

German climate policy measures in freight transport

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OUR RECENT TRANSPORT MINISTERS



Peter Ramsauer
CSU
2009-2013



Alexander Dobrindt
CSU
2013-2017



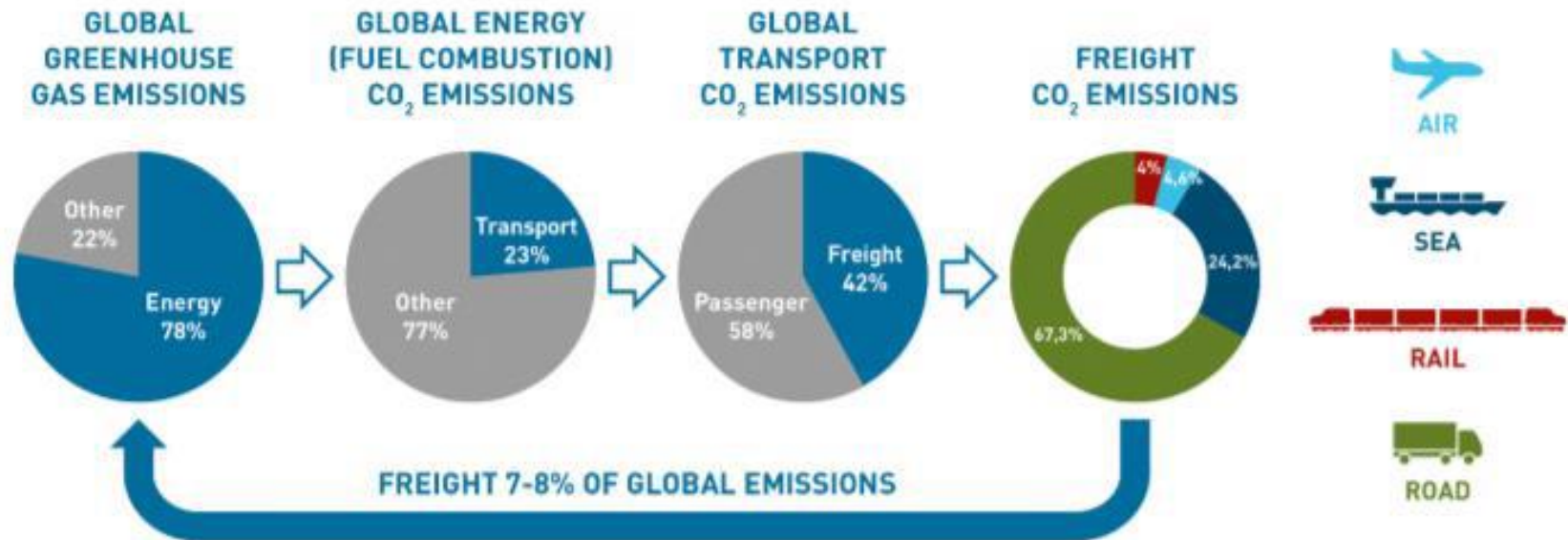
Andreas Scheuer
CSU
2018-2021



Volker Wissing
FDP
Since 2022

FREIGHT TRANSPORT CONTRIBUTES A SIGNIFICANT SHARE OF CO₂ EMISSIONS

Based on emissions 2015



LATEST FORECASTS FOR GERMANY

World Transport Report (2015/16)

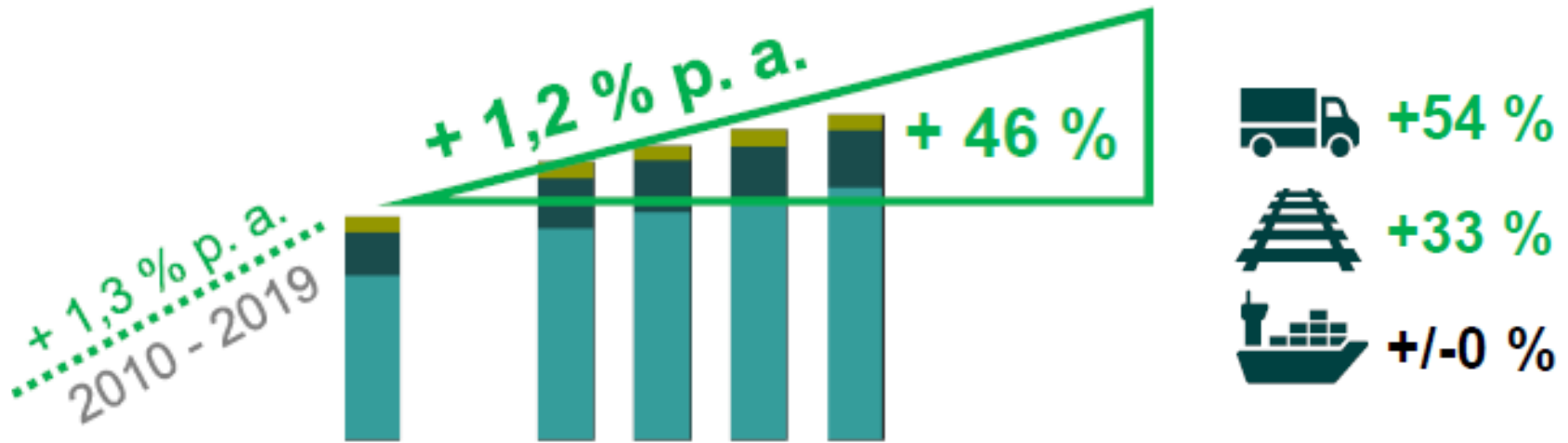
- Used data: GDP, Domestic consumption, Foreign Trade, Truck vehicle stock, Transport intensity (tkm/EUR GDP), indicators for main transport relations
- Prognosis freight transport growth 2010-2030
 - EU 27: 930 Bn. tkm (+39%)
 - Germany: 226 Bn. tkm (+36%)
- In EU 27 good transport between 2010 and 2030 will rise slightly faster as GDP
- Modal split in freight transport EU 15: Increase rail, decrease road

Rolling long-term forecast German ministry of transport (2023)

- Increase in transport volume by 30% (2019-2051)
- Increase in transport performance by 46% (2019-2051)
- Increase of average transport distance by 17%
(from 155 km in 2019 to 174 km in 2051)
- Decline of bulk (energy) goods (especially coal, oil)
- Only “conservative” scenario published

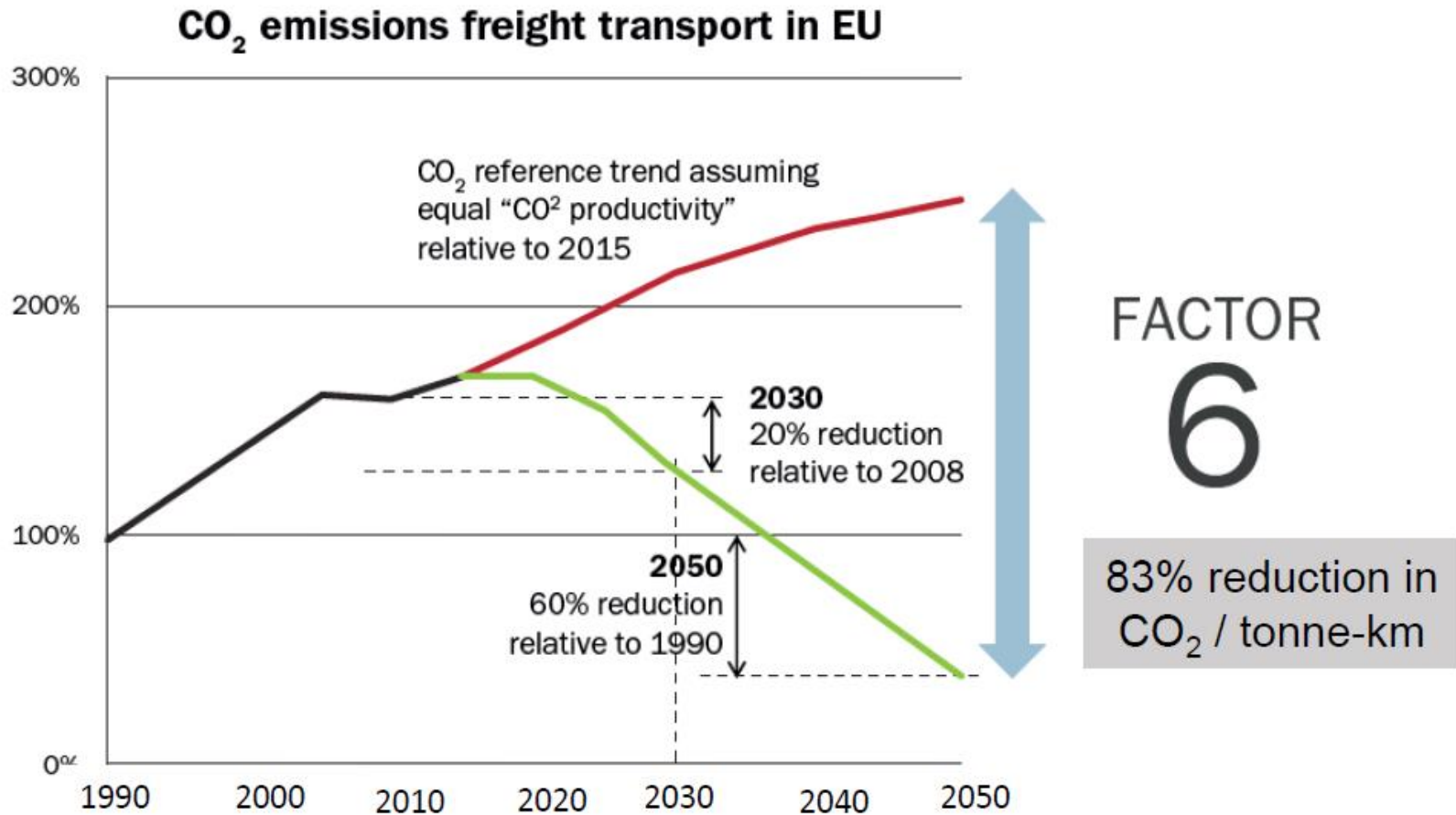
Source: World Transport Report (2012/13), BMDV https://bmdv.bund.de/SharedDocs/DE/Anlage/K/prognose-berichtgleitende-langfrist-verkehrsprognose.pdf?__blob=publicationFile

THE LATEST ROLLING LONGTERM FORECAST ASSUMES LOWER GROWTH FOR RAIL UNTIL 2051



Source: BMDV https://bmdv.bund.de/SharedDocs/DE/Anlage/K/prognose-berichtgleitende-langfrist-verkehrsprognose.pdf?__blob=publicationFile

REDUCING CO₂ EMISSIONS WHILE TRANSPORT ACTIVITY IS GROWING WILL BE CHALLENGING



Source: Smokers et al., Decarbonising Commercial Road Transport, Delft TNO, 2017

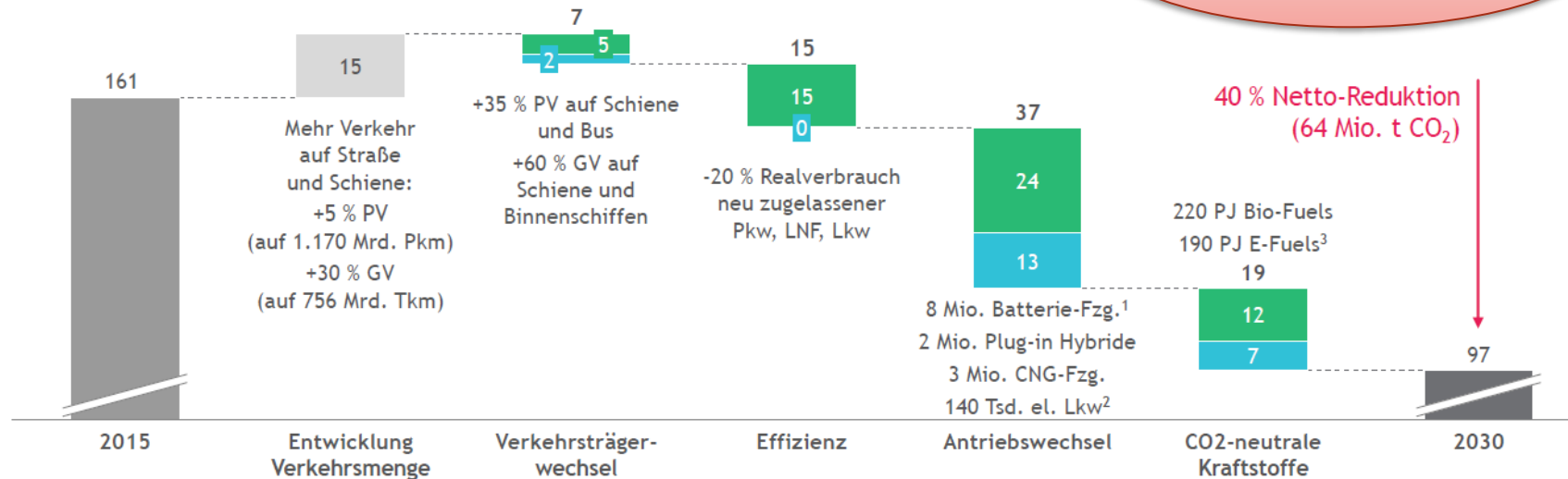
IN 2019 A STUDY FINANCED THE BDI WAS ASKING FOR CLEARER ACTION

Areas considered for freight transport:

- Increase of rail/inland waterway transport (+60%)
- Increase in energy efficiency (including platooning, long trucks and fuel economy)
- Switch of power train to CNG/electric trucks (incl. 2500 km e-Highway)
- Switch to carbon neutral fuel (incl. network of Bio Gas/H₂ gas stations)
- Additional CO₂ price impulse of up to 250 EUR/t (about 0.6EUR/liter fuel)

The study assumes "additional" costs of 115–126 Bn. EUR

THG-Einsparungen in Mio. t CO₂ nach Hebeln (Quellenbilanz)



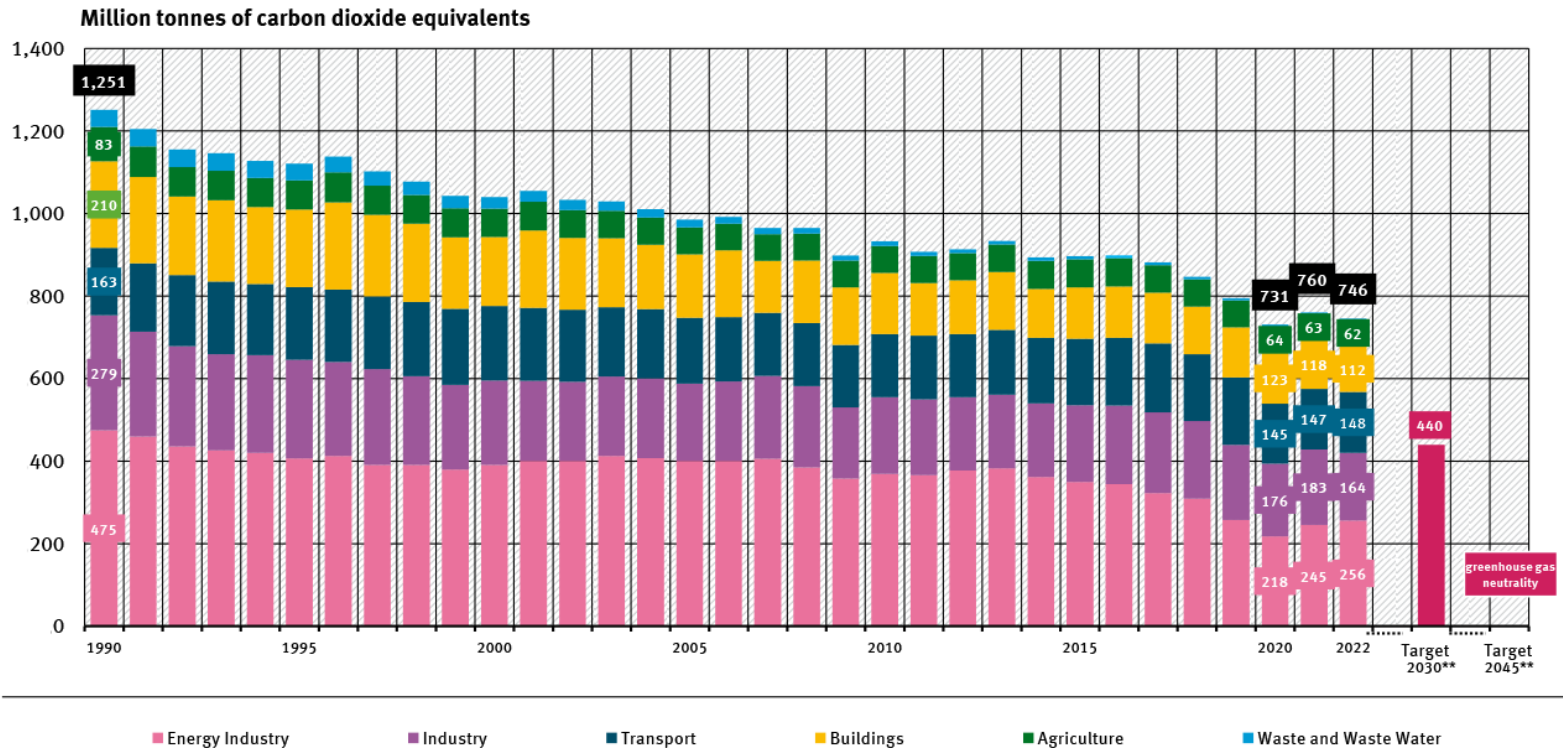
■ 95 %-Pfad aus Klimapfade-Studie ■ Zusätzlich erforderlich zur Erreichung des Sektorziels 2030

1. Pkw und leichte Nutzfahrzeuge 2. Oberleitungs-Hybride, Batterie-Lkw, Brennstoffzellen-Lkw 3. Davon ~140 PJ im nationalen Verkehr
Anmerkungen: Abkürzungen: PV = Personenverkehr, Pkm = Personenkilometer, GV = Güterverkehr, Tkm = Tonnenkilometer, LNF = leichte Nutzfahrzeuge, CNG = Compressed Natural Gas, PJ = Petajoule
Quelle: Prognos, BCG

Source: „Analyse Klimapfade Verkehr 2030“ BDI study provided by Prognos, BCG

GERMAN CO2 EMISSIONS BY SECTOR AND TARGETS (KLIMASCHUTZGESETZ)

Emission of greenhouse gases covered by the UN Framework Convention on Climate



Emissions by sector of the German Federal Climate Protection Act, excluding land use, land use change and forestry
* Adjusted Targets 2030 and 2045: according to the revision of the Federal Climate Protection Act (KSG) as of 12.05.2021, including annual adjustments

Source: German Environment Agency, National Greenhouse Gas Inventory 1990 to 2021 (as of 03/2023), for 2022 preliminary data (as of 15.03.2023)

SECTOR SPECIFIC TARGETS IN GERMANY – TRANSPORT FAILED 2021 AN 2022

Anlage 2 (zu § 4)

Zulässige Jahresemissionsmengen für die Jahre 2020 bis 2030

(Fundstelle: BGBl. I 2021, 3907)

Jahresemissionsmenge in Millionen Tonnen CO ₂ -Äquivalent	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Energiewirtschaft	280		257								108
Industrie	186	182	177	172	165	157	149	140	132	125	118
Gebäude	118	113	108	102	97	92	87	82	77	72	67
Verkehr	150	145	139	134	128	123	117	112	105	96	85
Landwirtschaft	70	68	67	66	65	63	62	61	59	57	56
Abfallwirtschaft und Sonstiges	9	9	8	8	7	7	6	6	5	5	4

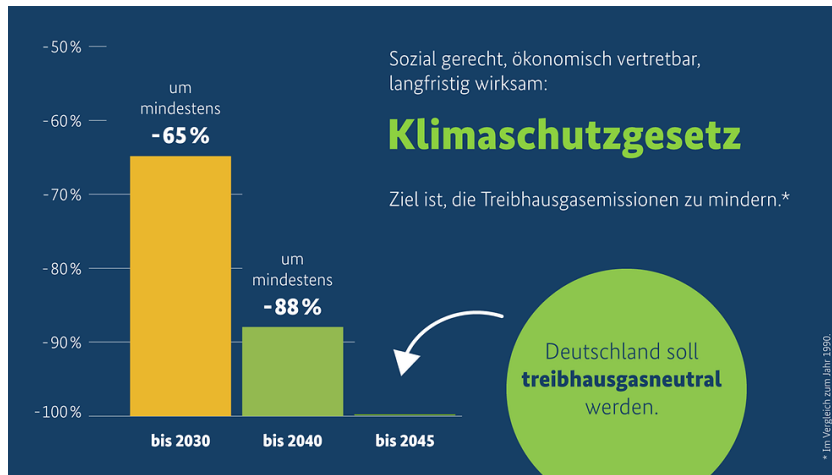
Actual Emissions in Transport:

- 2021 147 Mio. t
- 2022 148 Mio. t

Latest target for transport for 2030 (in the Klimaschutzgesetz 2019) was about 52% compared to 1990 emissions (163 Mio. t) – this is „only“ a 48% reduction

UPDATE OF THE KLIMASCHUTZGESETZ JUNE 2023

Targets (stay the same):



- Focus on overall German targets (independent of the sector to be more flexible and more effective)
- Full transparency on individual sectors will be kept
- Forward perspective (rather oriented at prognosis of future emissions)
- Further empowerment of the expert council (will now validate prognosis and will be able to propose additional actions)

LATEST „KLIMASCHUTZPROGRAMM“ – FREIGHT TRANSPORT RELATED ACTIONS (1/2)

Rail Transport

- Covering needed invests in rail infrastructure of 45 Bn. EUR until 2027 (if financially possible, using i.e. new CO2 component in truck toll)
- Strengthening and digitalization of existing network
- Reaching 25% market share for rail freight transport in 2030 (in 2020: 18.3%)
 - Continuation of reduced prices for the use of infrastructure
 - Incentives for digitization
 - Strengthening automatization and vehicle technology
 - Reducing charges for using marshaling yards to support single wagon transport
- Digitalization rail system:
 - Digital capacity management for infrastructure
 - ETCS for rail vehicles
 - Technologies for the “Digitales Bahnsystem”
- Strengthening of terminals in intermodal transport (beyond the actual infrastructure master plan)
- Alternative vehicle powertrains and charging infrastructure

Synthetic Fuels (e-fuels)

- Approving (pure) e-fuels
- E-Fuels-Dialog with industry and e-fuels strategy
- New e-fuel vehicles also after 2035 in EU
- Funding for additional research in e-fuels and development of international partner countries (i.e. in Africa and South America) for production

Source: <https://www.bmwk.de/Redaktion/DE/Downloads/klimaschutz/entwurf-eines-klimaschutzprogramms-2023-der-bundesregierung.html>

GERMANY RAIL NETWORK HAS MAJOR CAPACITY BOTTLENECKS – ALREADY NOW

Kapazitätsengpässe im Schienennetz

Vor allem acht Engpässe in ihrer Infrastruktur machen der Deutschen Bahn zu schaffen. Die Strecken sind stark überlastet. Kleinste Störungen wirken sich folgenreich auf die Pünktlichkeit aus und setzen sich als Dominoeffekt im gesamten Netz fort.



Das große Investitionsprogramm für Mobilität und Klimawende.

- A** Knoten Hamburg (– Hannover)
- B** NRW: Dortmund – Duisburg – Düsseldorf – Köln
- C** Mittelrheintal
- D** Knoten Frankfurt
- E** Knoten Stuttgart
- F** Oberrhein: Mannheim – Karlsruhe – Basel
- G** Würzburg – Nürnberg
- H** Knoten München

-  Korridore mit höchster Auslastung
-  Unmittelbare Auswirkungen



Stand: Mai 2022



SINCE 2002 GERMANY SUBSIDIESED NEW INTERMODAL FREIGHT TERMINALS

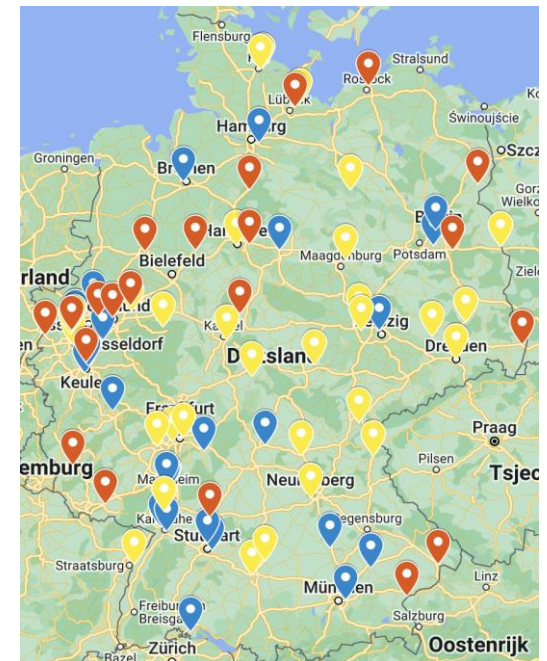
Up to 80% of the construction costs.



Situation before 2002
28 terminals built



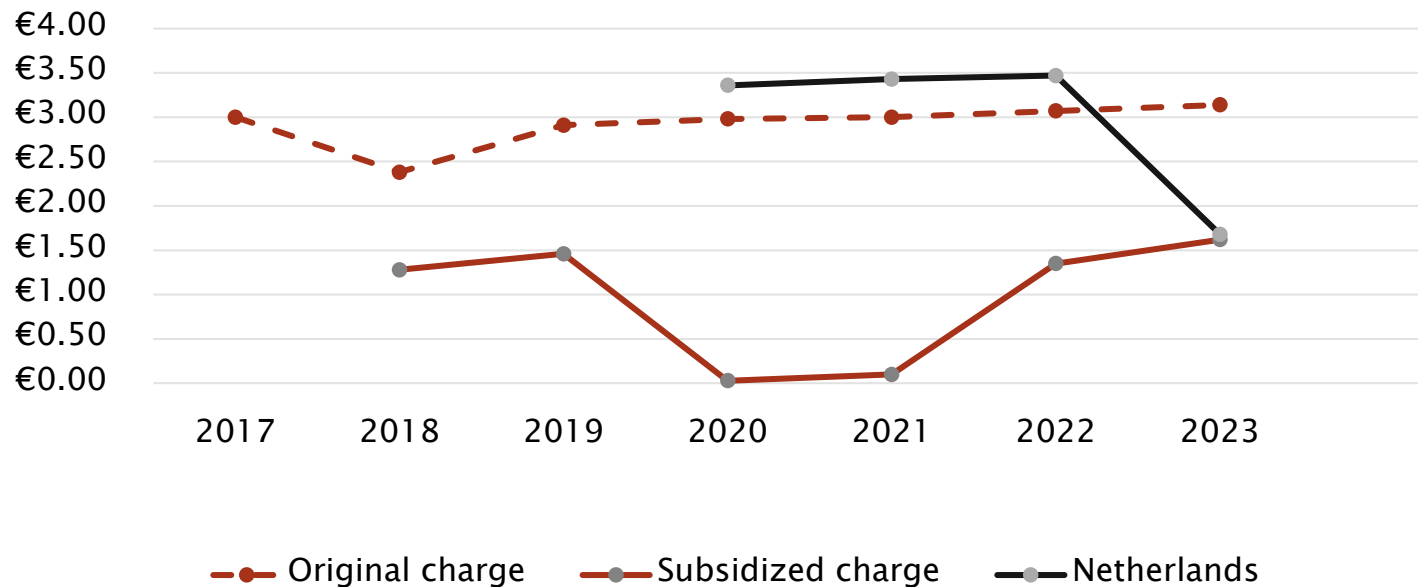
Development between
2002 and 2011
31 terminals built



Development between
2012 until 2022
21 terminals built

SINCE 2018 GERMANY REDUCED THE RAIL INFRASTRUCTURE ACCESS CHARGES

EUR per km for a standard freight train



Source: DB Netz, Prorail 2023

LATEST „KLIMASCHUTZPROGRAMM“ – FREIGHT TRANSPORT RELATED ACTIONS (2/2)

Maritime and air transport

- Subsidies for land power infrastructure in harbors (i.e. Hamburg, Bremen, along Rhine)
- Continuation of air Research program for CO2 free airplane engines until 2026 (to use in regional airplanes until 2028)
- Subsidies for electric charging infrastructure at airports
- Continuation of maritime research program for climate neutral ships

Road

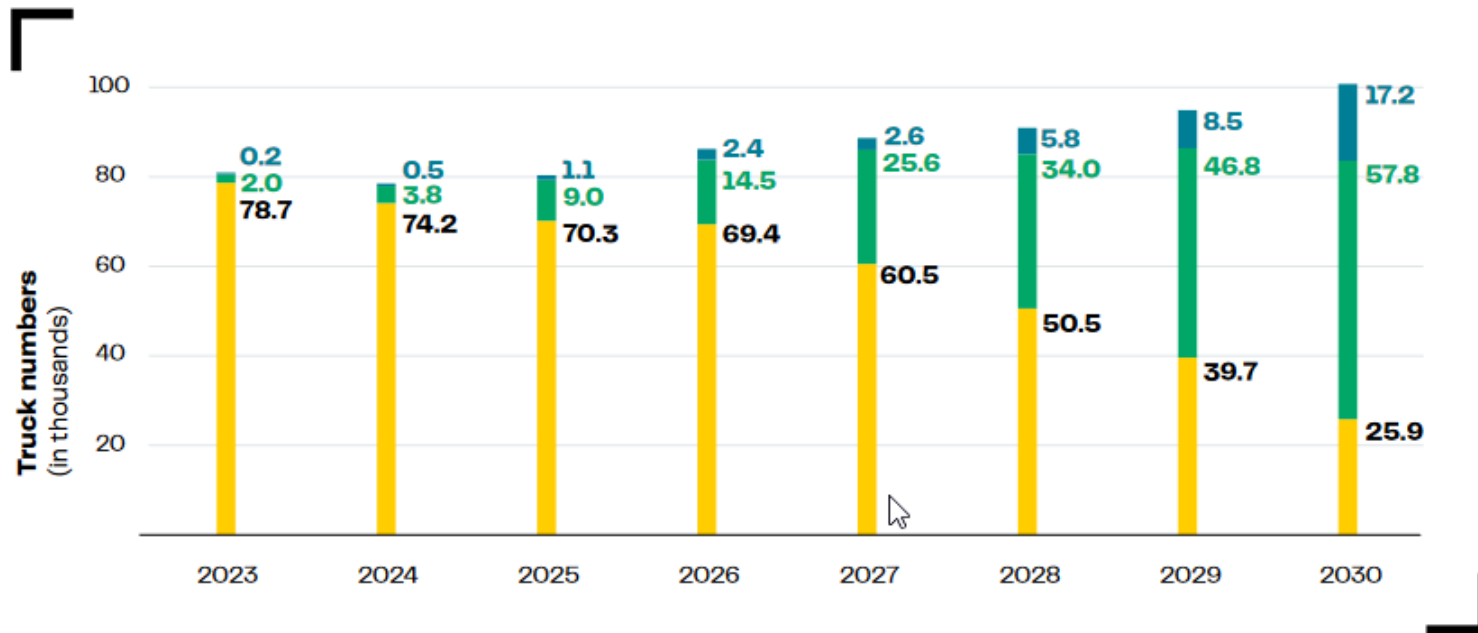
- Truck toll (as of 1/2024)
 - New (additional) CO2 component for truck: toll 200 EUR per t of CO2
 - No truck toll for emission free trucks until 2025 – afterwards only 25%
 - Including trucks of more than 3.5 t
- Charging infrastructure network for electric and hydrogen trucks until 2025 along highways
- Funding for infrastructure (electric and hydrogen) at depots, hubs and company sites
- Support of ambitious EU directive for development of infrastructure for alternative fuel (AFIR) including fixed targets
- Support for more ambitious CO2 fleet targets for 2030 and 2035 on EU level
- Continuation of subsidies for truck with alternative powertrains until 2028
- Funding program for more (CO2) efficient trailers
- Strengthening of innovation clusters to test alternative power train technologies (i.e. stationary and dynamic charging and hydrogen/fuel cells)
- Realization of efficiency gains through autonomous vehicles level 2–4 (after having established the regulation base recently)

Source: <https://www.bmwk.de/Redaktion/DE/Downloads/klimaschutz/entwurf-eines-klimaschutzprogramms-2023-der-bundesregierung.html>

AMBITIOUS EXPECTATIONS FOR NEW VEHICLE TECHNOLOGIES EXIST

Forecast sales figures for heavy-duty vehicles (N3/> 12 t)

In Germany according to manufacturer data



Notes on uncertainty due to incomplete market coverage:

- Data is not available for all drivetrain types, manufacturers and years.
- For the second half of the decade, the response rate in terms of current market shares is 95%.
- For fossil fuel-based drivetrains, the response rate was between 70% and 90% by 2025.

■ H₂ fuel cell
■ Battery
■ Diesel


For better readability, the low sales figures for PHEVs, H₂ combustion engines and natural gas (CNG/LNG) are not listed.

Source: https://www.klimafreundliche-nutzfahrzeuge.de/wp-content/uploads/2023/05/BroschuereNOWCleanroom_ENG_web.pdf

THERE IS A MASTER PLAN AND A NUMBER OF TASK FORCES FOR CHARGING INFRASTRUCTURE




Task-Forces




Task-Force „Depotladen“ – ein besseres Verständnis für die räumlichen, technischen, energetischen, organisatorischen und rechtlichen Rahmenbedingungen für das Laden von schweren Nutzfahrzeugen am Depot gewinnen

Hintergrund Für den Betrieb von elektrischen Nutzfahrzeugen ist das Laden am Depot zentral. Angesichts der...



Ad-hoc-Task-Force zum dynamischen und stationären Laden mithilfe der Oberleitungstechnologie

Hintergrund der Ad-hoc-Task-Force Die Begriffe eHighway oder auch Electric Road System (ERS) beschreiben die Elektrifizierung...



Task-Force „Backcasting – Ladeinfrastruktur für schwere Nutzfahrzeuge“ legt erste wichtige Grundlage für den öffentlichen Ladeinfrastrukturaufbau für E-Lkw

Hintergrund Die Herausforderungen beim Aufbau von Ladeinfrastruktur für schwere, batterieelektrische Nutzfahrzeuge sind zahlreich. In der...



Ad-hoc-Task-Force Ausbau von Wasserstoff-Tankinfrastruktur

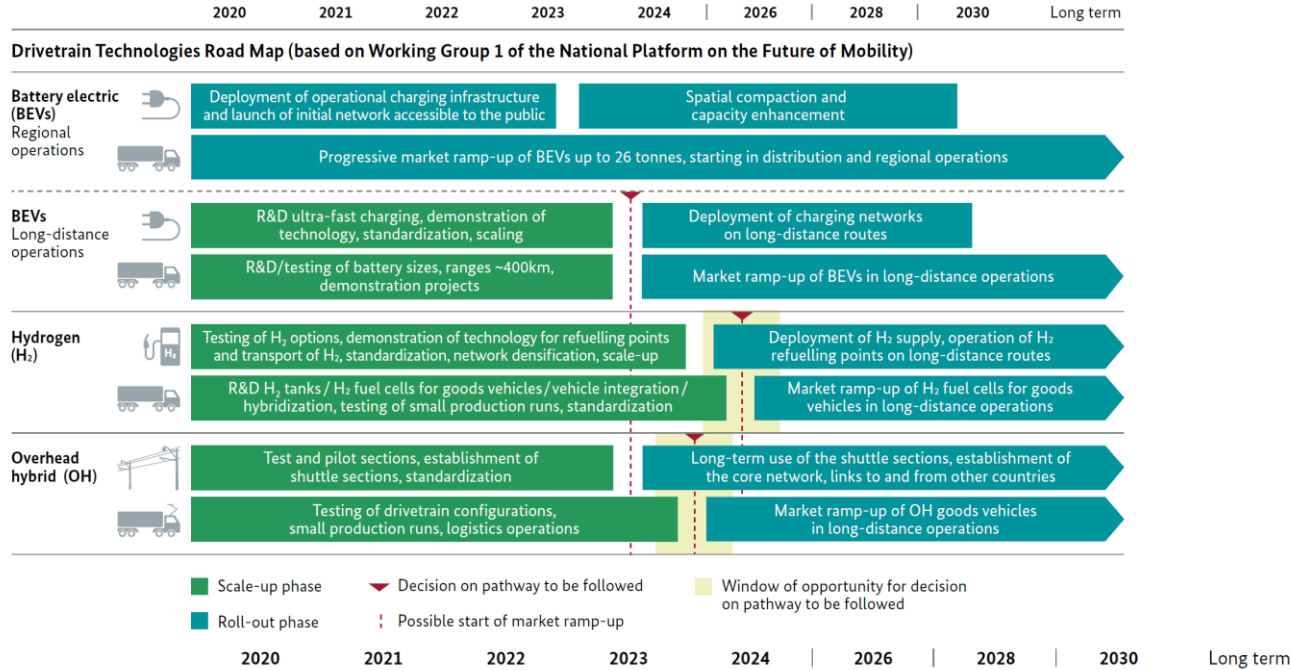
Wasserstoff-Brennstoffzellenantriebe stellen vor allem für Nutzfahrzeuge mit hohen Reichweiten eine vielversprechende Antriebsoption dar. Zum Hochlauf...



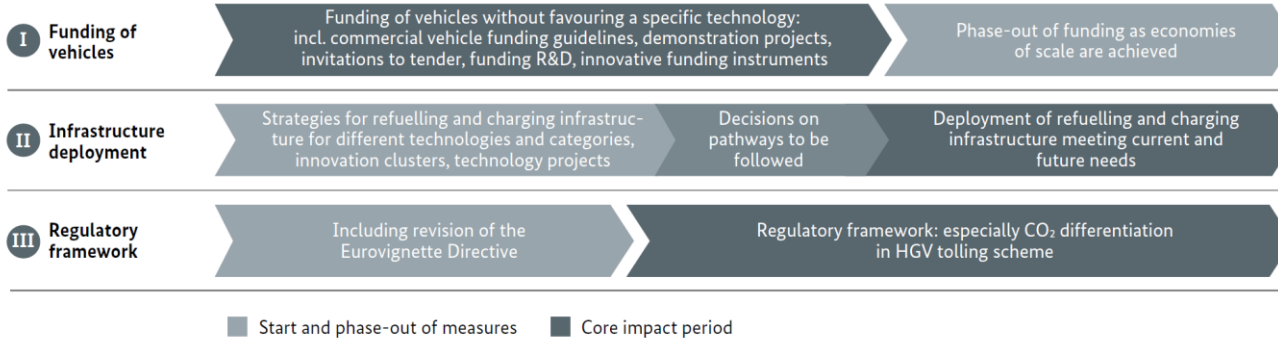
Ad-hoc-Task-Force zu Mindeststandards bei der Umrüstung von konventionellen Nutzfahrzeugen auf alternative Antriebe

Mit Akteuren aus der Umrüstungsbranche wurde ein Kriterienkatalog mit praxisbewährten Standards erarbeitet. Es muss nicht...

ALREADY IN 2020 A ROADMAP WAS DEFINED



Federal Ministry of Transport and Digital Infrastructure's Road Map of Measures



Source: <https://www.klimafreundliche-nutzfahrzeuge.de/>

OPEN QUESTION FOR ROAD DECARBONIZATION: HOW TO HANDLE LONG DISTANCE TRANSPORT

- Electrification of short distance road transport already well on the way
- Possible alternatives for long distance trucks:
 - Full Battery Truck (or hybrid trucks)
(main problem: *weight of batteries*)
 - Electrified highway (for example e-Highway or OLEV)
(main problem: *high infrastructure investment*)
 - Hydrogen
(main problems: *high energy losses, lack of refueling network, low availability of green hydrogen*)
 - Biofuels
(main problems: *high life-cycle emissions, competition with food production*)
- Challenges/Criteria
 - Costs
 - Infrastructure
 - Fueling/Charging
 - Road
 - Vehicle equipment
 - Charging time
 - Weight of batteries
 - Energy efficiency

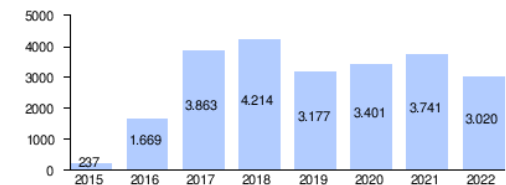
Probably only partial contribution for 2030 climate targets, since:

- Solution still unclear
- Time consuming Infrastructure development
- Energy Mix 2030

LIGHT ELECTRIC TRUCK ARE ALREADY IN USE: THE STORY OF STREET SCOOTER



- Founded in 2010 by a Professor of of RWTH Aachen
- Bought by DHL in 2014 to produce small electric trucks, reason: no vehicle producer was willing to offer electric trucks at that point
- First serial production in 2016
- In 2022 sold to investors due to high losses – (Company name now: B-ON)
- Registered new vehicles in Germany:



- Today most vehicle producers offer electric truck of that size

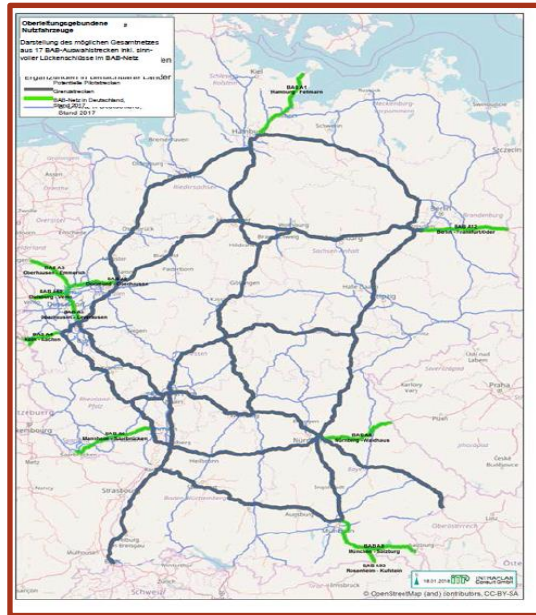
SIEMENS E-HIGHWAY



Source: <https://www.siemens.com/global/de/home/produkte/mobilitaet/strassenverkehr/elektromobilitaet/ehighway.html>

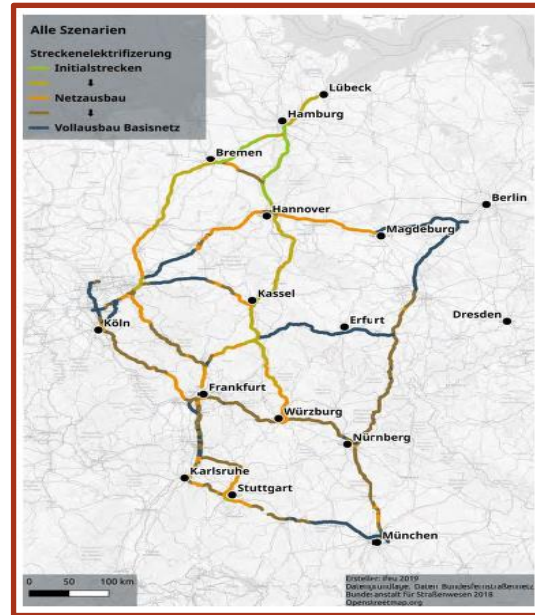
DIFFERENT PROPOSALS ALREADY EXIST – BUT ARE THEY GOOD?

StratON
Öko-Institut, HHN,
Frauenhofer, ITP
Hacker et al (2020)



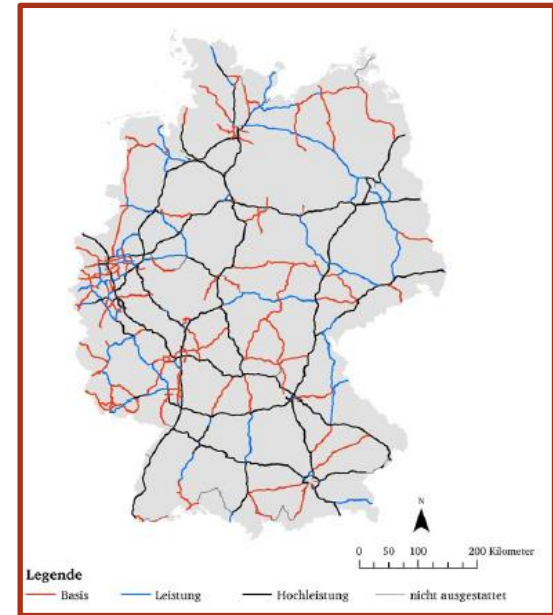
- Max. CO2 savings: 6 Mio t
- Max. Length: 4.000km
- Max. Investments: 12,2 Bn EUR

Roadmap OH-LKW
Frauenhofer, PTV, ifeu
Jöhrens et al (2020)



- Max. CO2 savings: 3,6 Mio t
- Max. Length: max. 3.200km
- Max. Investment: 15,6 Bn EUR

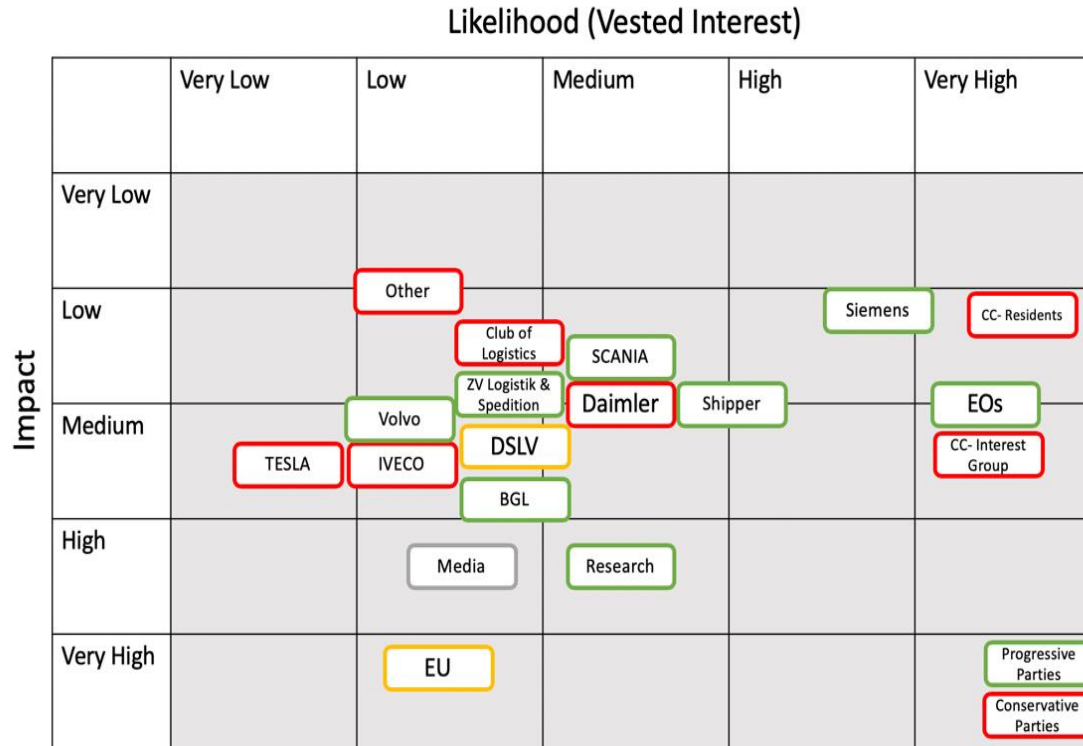
Dissertation TU Darmstadt
Kevin Rolko (2020)



- Max. CO2 savings: 5,4 Mio t
- Max. Length: 13.000 km
- Max. Investment: 31,2 Bn EUR

- Is one of these these solutions optimal?
- Are the results comparable?

RESULTS OF A STAKEHOLDER IMPACT ANALYSIS ON THE SIEMENS E-HIGHWAY

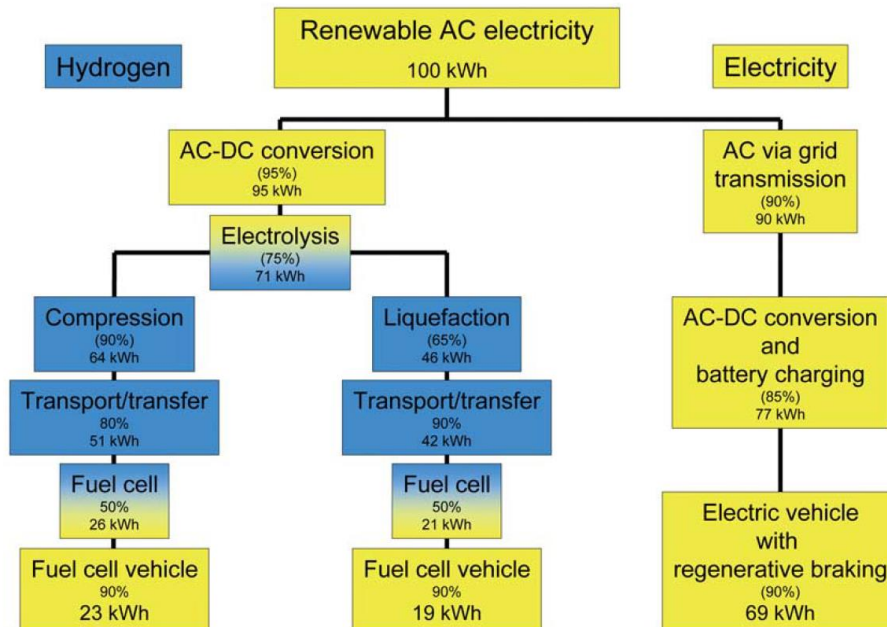


- Vested interest describes the probability that a stakeholder takes action (influences a decision)
- Impact represents the level of influence a stakeholder has on the decision
- Coloring:
 - Green - for the eHighway
 - Red - against the eHighway
 - Yellow- neutral

Source: Bachelor Theis Olivia Cardenal (KLU), 2019

DISADVANTAGE OF HYDROGEN: ENERGY LOSSES

Useful transport energy derived from renewable electricity (Bossel (2006)):



But there are scientific advances:

nature energy

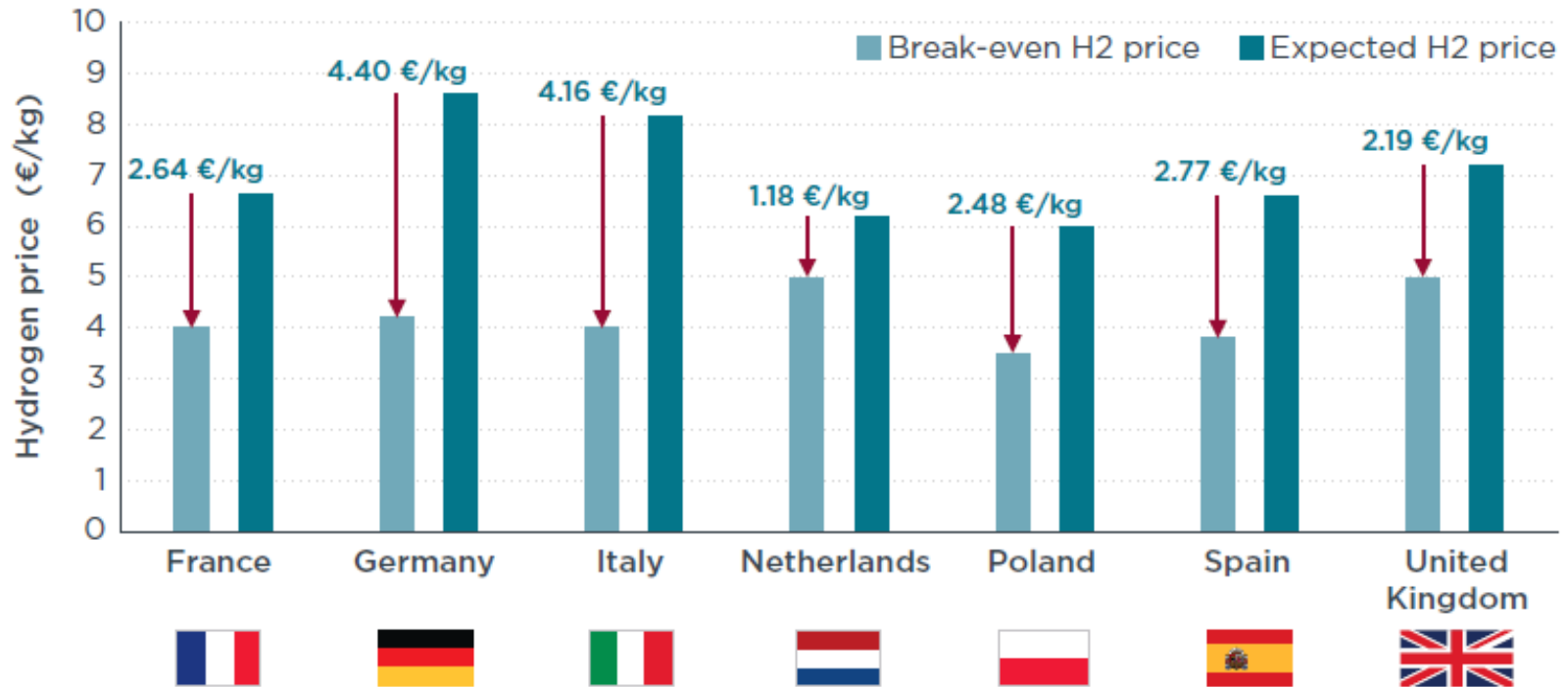
Article | Published: 11 March 2019

Highly efficient reversible protonic ceramic electrochemical cells for power generation and fuel production

Chuancheng Duan, Robert Kee, Huayang Zhu, Neal Sullivan, Liangzhu Zhu, Liuzhen Bian, Dylan Jennings & Ryan O'Hayre

Nature Energy 4, 230–240 (2019) | Download Citation

BREAK-EVEN AND EXPECTED H2 PRICE TO MAKE H2 TRUCKS COMPATIBLE (TCO IN 2030)



CONCLUSIONS

- Solutions (technologies) exist but often are expensive
- The German transport ministry wants to keep technology openness (recently even supporting e-fuels)
- This is slowing down the transition, but missed sectoral targets increase the pressure to act
- Finally, first concrete measures are proposed (especially massive rail infrastructure investments and a CO2 component for truck toll)
- Plans are being developed, decisions have to be taken soon

THANK YOU FOR LISTENING!
TAK FOR AT LYTTE / TAKK FOR AT DU LYTTET!

Norway's and Denmark's northeast freight train operations



Nordic Rail Express leaves the Narvik terminal onwards to Oslo Alnabru



Danish history: the Fiskemeltog upon arriving on its final destination Skagen