Towards Climate Neutrality and Circularity

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The Case of e-Trucks in Austria 2040+

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JOANNEUM RESEARCH LIFE

hevtcp

Task 46:
LCA of Electric Trucks, Buses, Two-wheelers and Other Vehicles

Austrian participation financed by

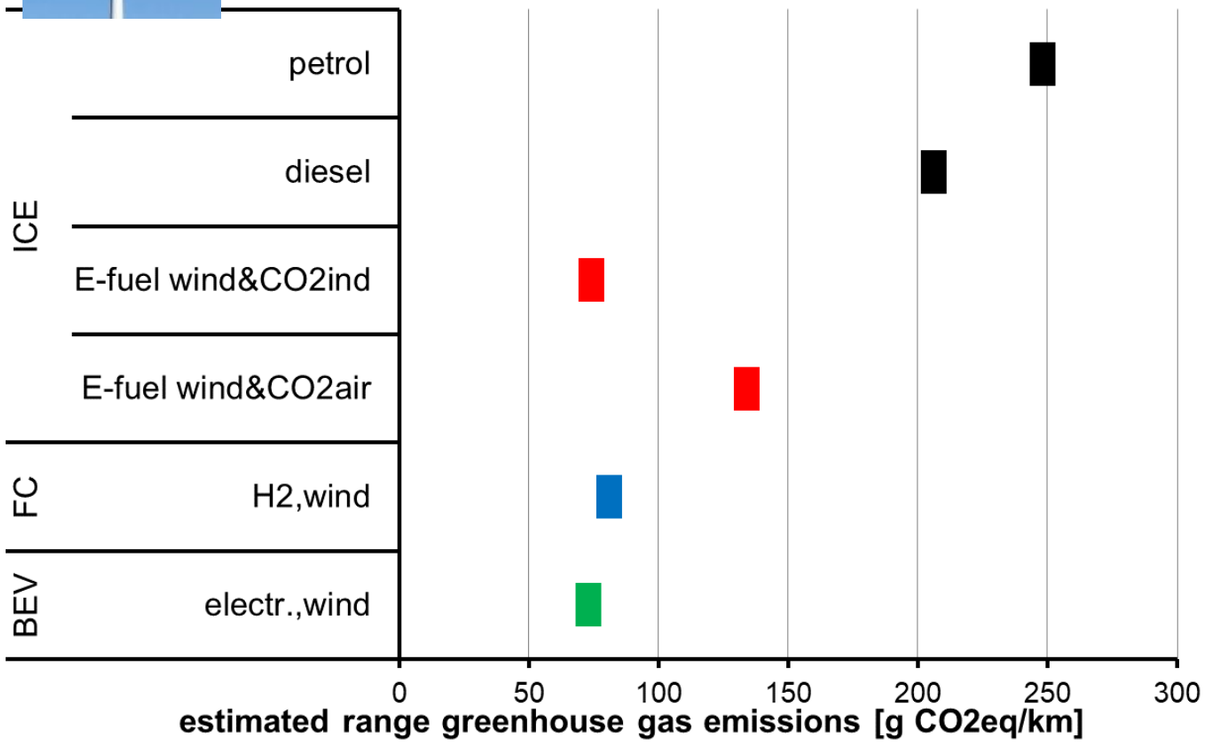
klima+ energie fonds

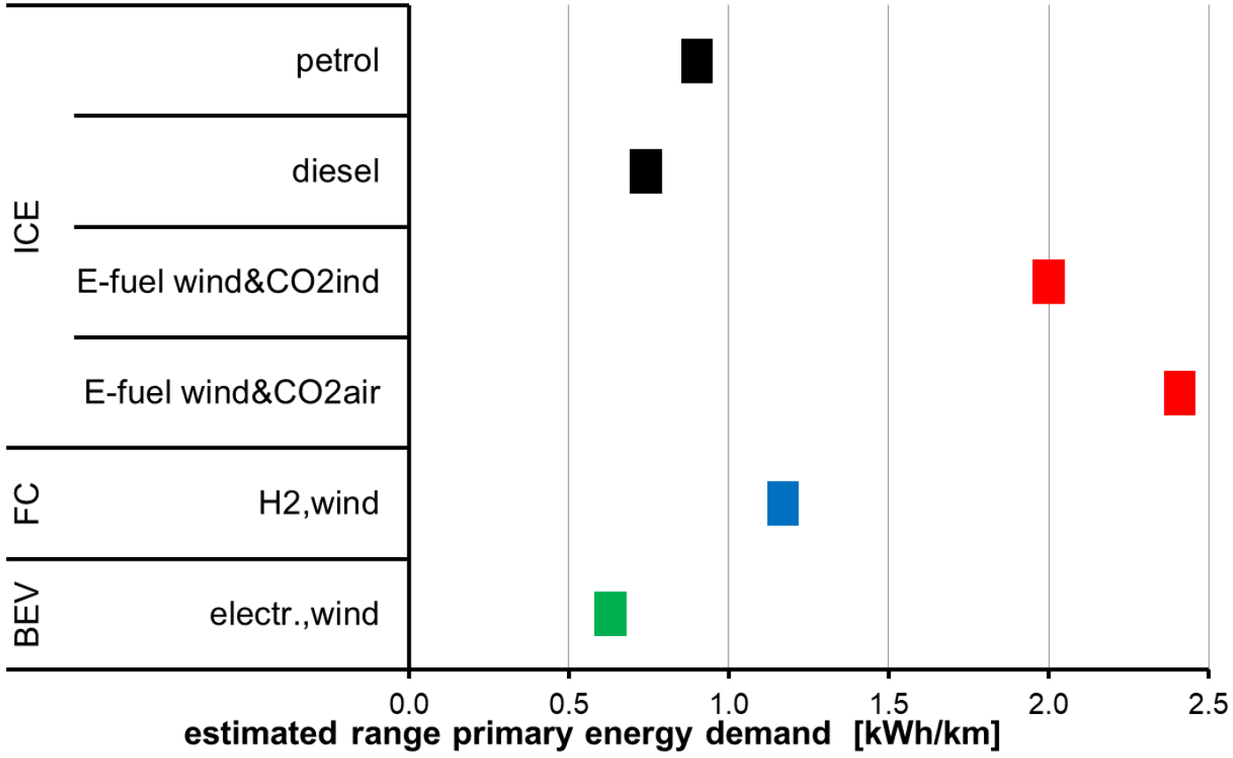
FFG

Comparing GHG Emissions is not enough!

Example:
Using Wind Energy for H_2-FCV, E-fuel and BEV passenger vehicle

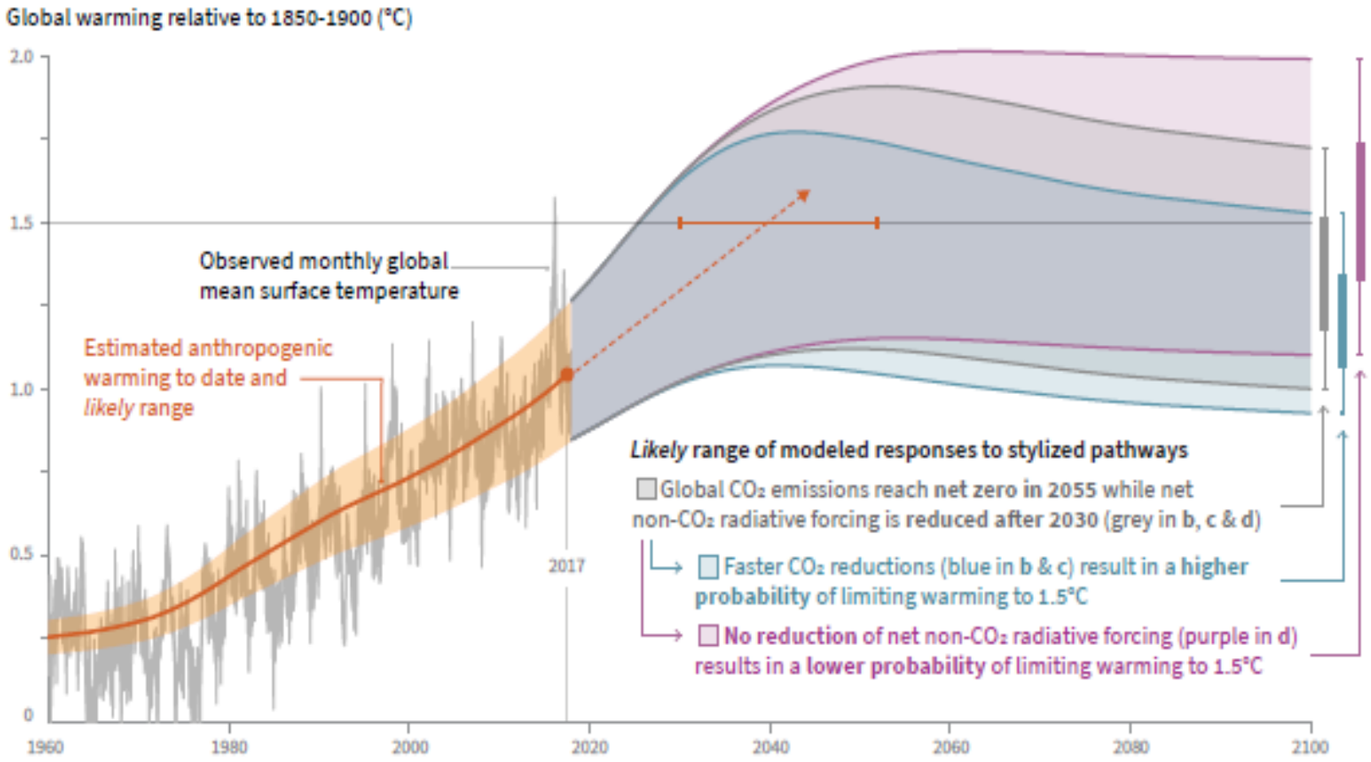
Primary energy demand is essential!





The Challenges

Climate Neutrality

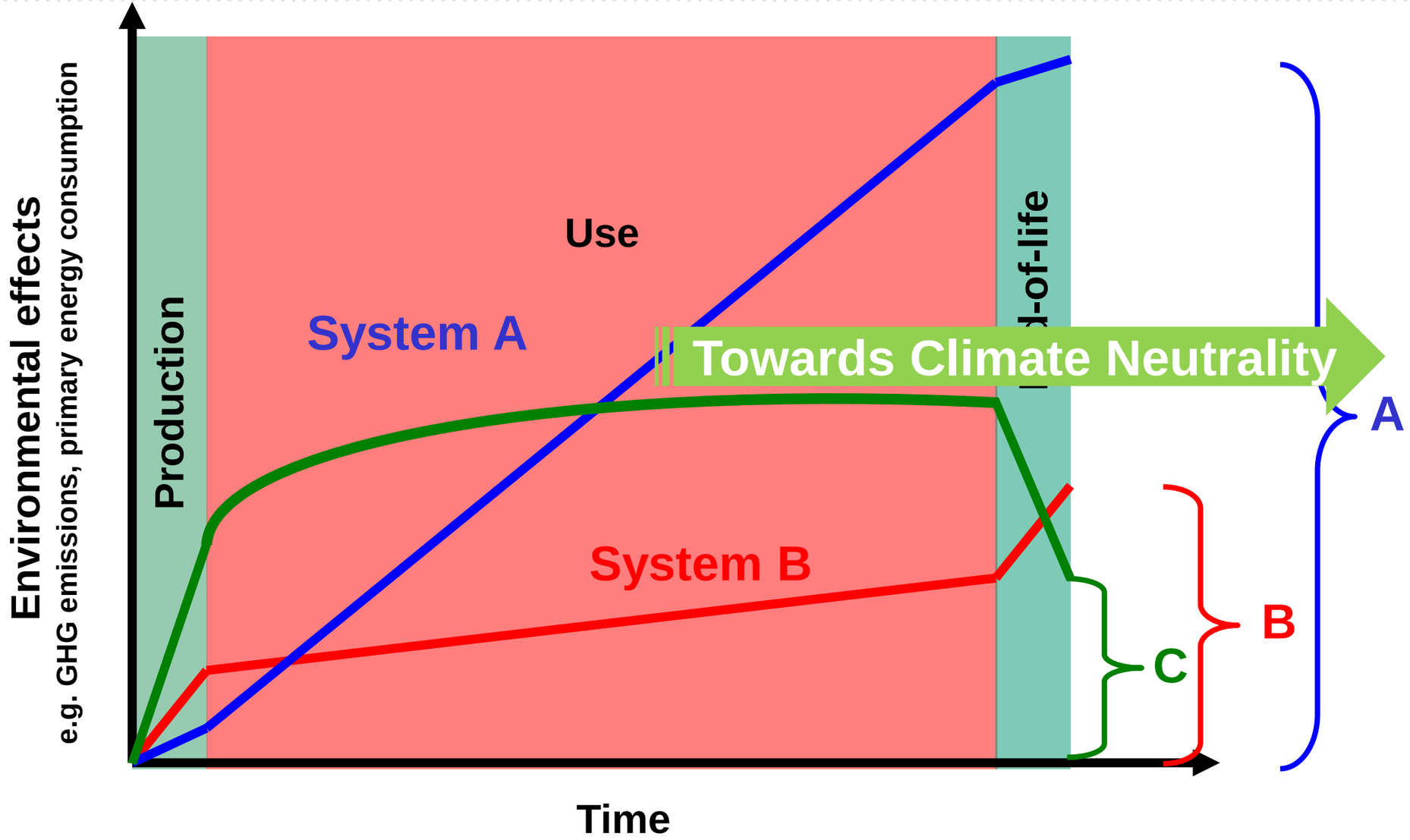


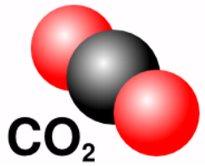
Circularity

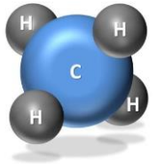
Quellen: www.ipcc.ch, www.europarl.europa.eu/news/de

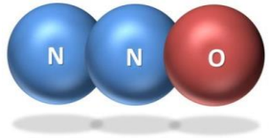
The three Phases of a Life Cycle

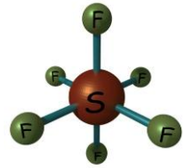
Dynamic LCA considers time of environmental effects

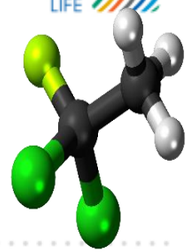










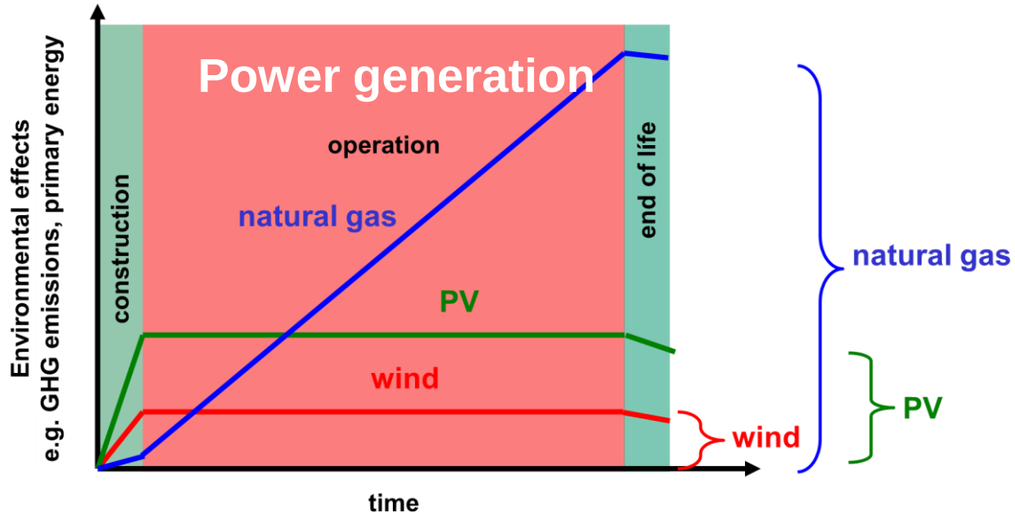


Climate Neutrality – An Initial Definition

- Climate Neutrality = human activities cause **no changes** of global temperature
- Products/services are „climate neutral“, if in the total life cycle **no GHG emissions** (CO_2, CH_4, N_2O, SF_6, FCKW, etc.) occur
- Or the remaining/unavoidable GHG emissions **are compensated permanently** („Net-Zero“), e.g. CO_2-fixation and CO_2-storage by CCS and/or CCU
- the **timing** of the GHG emissions is essential and must be considered

→ only method of dynamic LCA

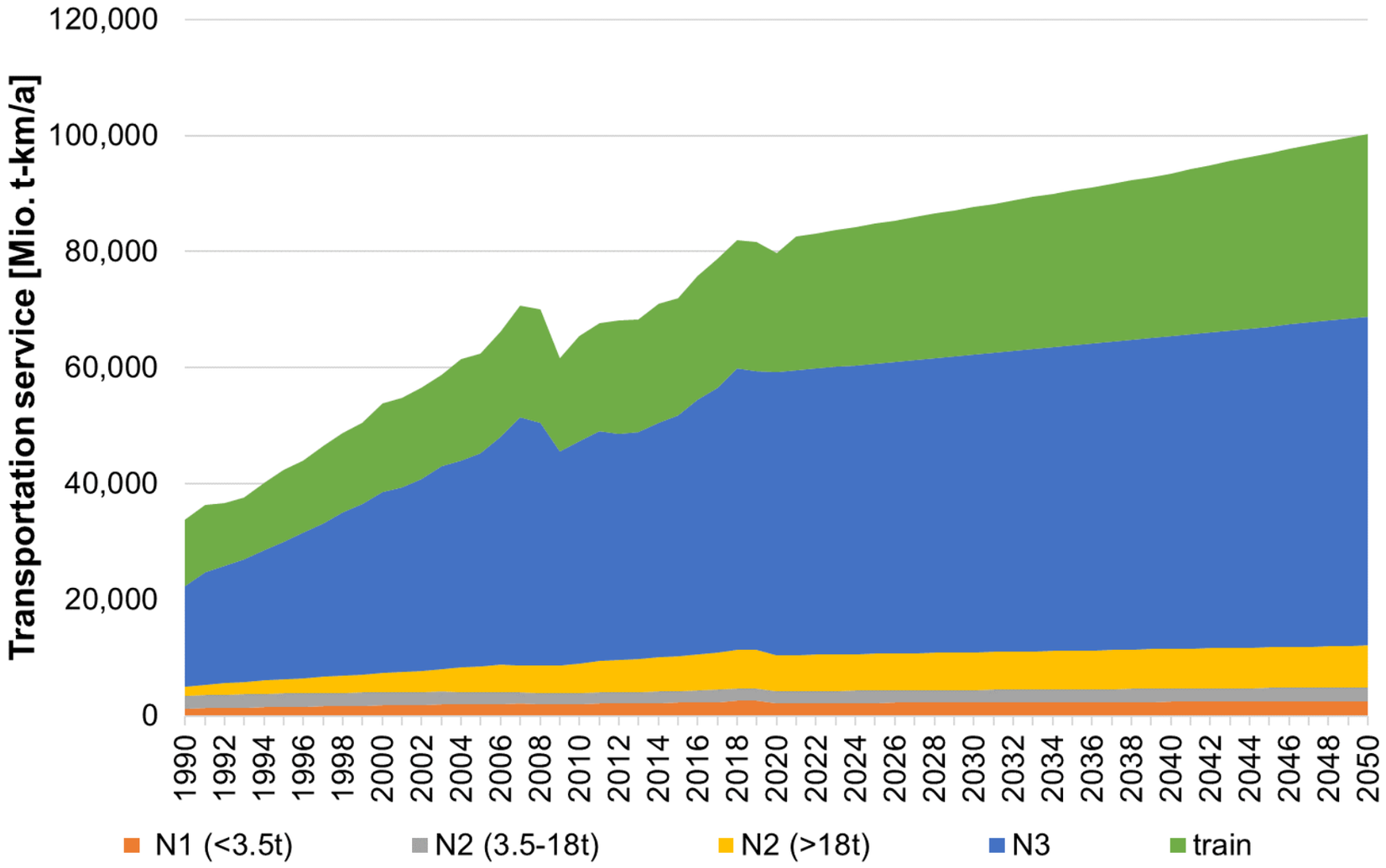
able to adresses climate neutrality



Scenarios for a Climate Neutral Truck-Fleet in Austria 2040+

- **GHG reduction goals**
  - 2030: Austria about 48% reduction (based on 2005)
  - 2040: Austria „climate neutral“ transportation sector
  - 2050: EU and USA climate neutral
  - 2060: Rest of the world climate neutral
- **Fleet modelling** with NEMO (Network Emission Model) used for OLI (Österreichische Luftschadstoff-Inventur)
  - **Different shares of new registrations** since 2021: BEV, HFC and ICE/PHEV
  - 3 Types of trucks: N1, N2 and N3
  - Only **domestic trucks** (without „tank tourism“)
  - **Vehicle fleet:** constant since 2019
  - **Total annual kilometres:** constant since 2019
- **Renewable electricity** for BEV, H_2 & e-fuel generated in **new power plants** in Austria/abroad integrated in existing renewable electricity mix
- CO_2-sources for **e-Fuels**:
  - 50 – 100 kt/a from biomass (e.g. fermentation, combustion)
  - > 100 kt/a from air
- **Amount of biofuels** for passenger vehicles remain constant since 2020 (about 250 kt)
- Highway **catenary lines** for e-trucks
- **Cooperation**
  - JOANNEUM RESEARCH (LCA & modelling)
  - Graz University of Technology (vehicle fleet)
  - IEA HEV Task 30 (methodology)

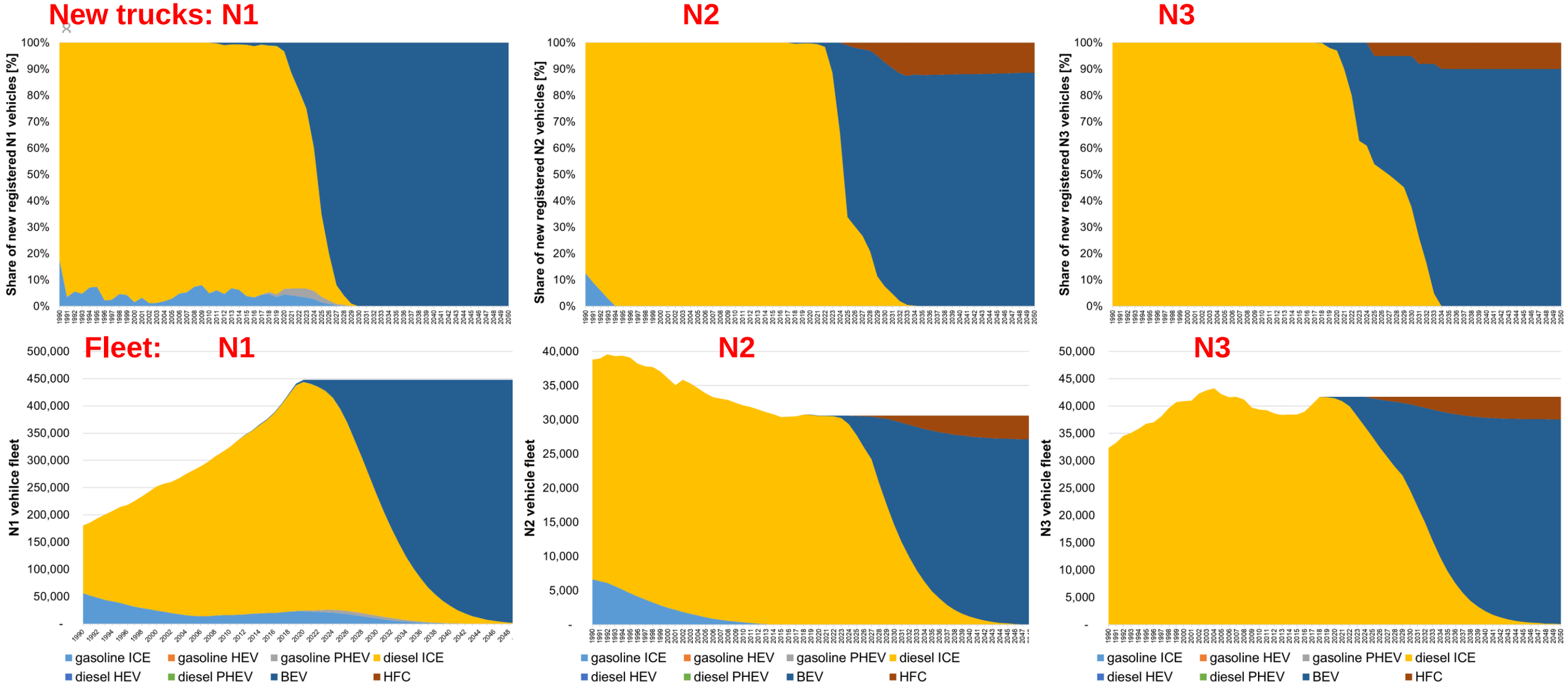
Development of Good Transportation Services



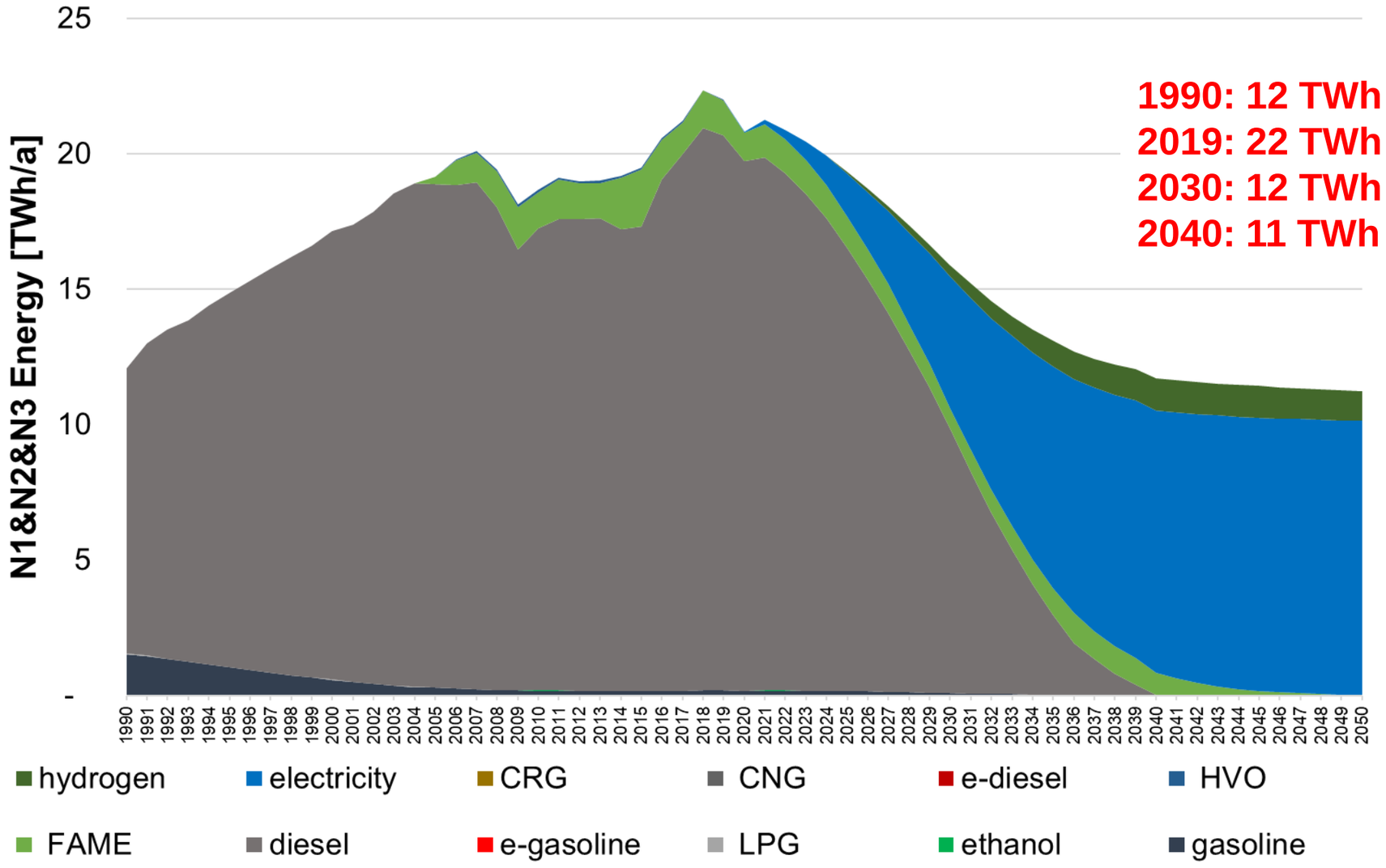
Scenario assumptions

- *Same transportation service in all scenarios*
- *Occupation good transport: annual increase 0.5% starting in 2021*
- *Annual kilometres and number of vehicles stays constant after 2019 (except public transport)*
- *Population grows: 8.9 to 9.6 Mio. (2019 – 2050)*

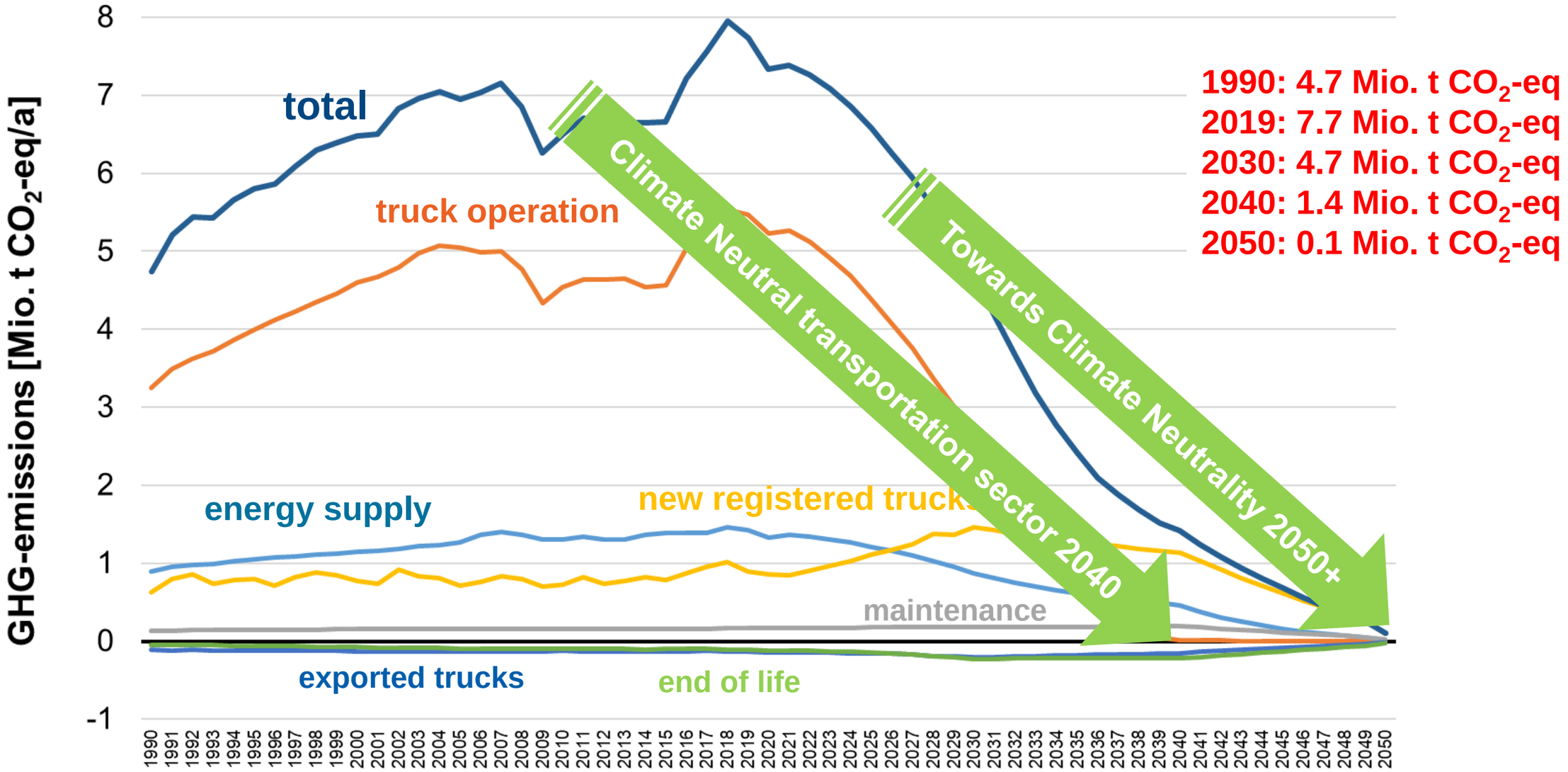
Development of Truck Fleet for Climate Neutrality 2050



Development Energy Demand of Truck Fleet



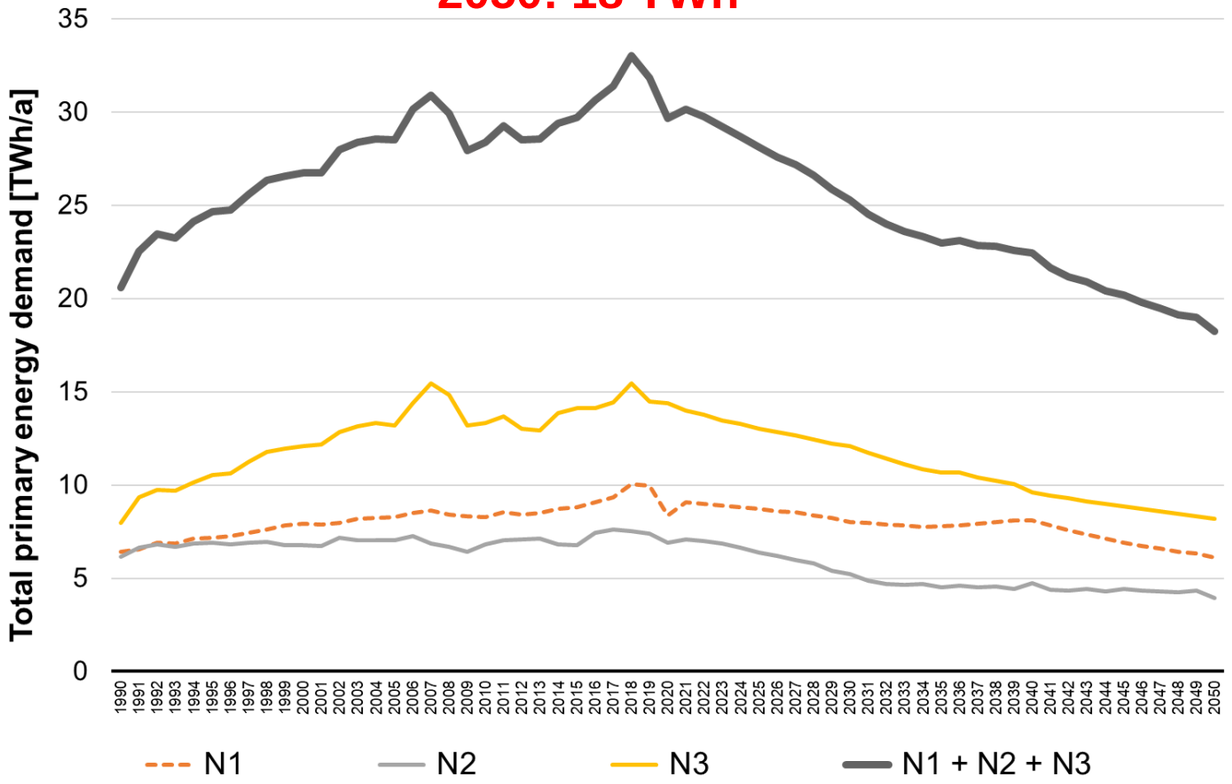
Development of Contributions of GHG-emissions of Truck Fleet for Climate Neutrality 2050



Development of Primary Energy Demand of Truck Fleet for Climate Neutrality 2050

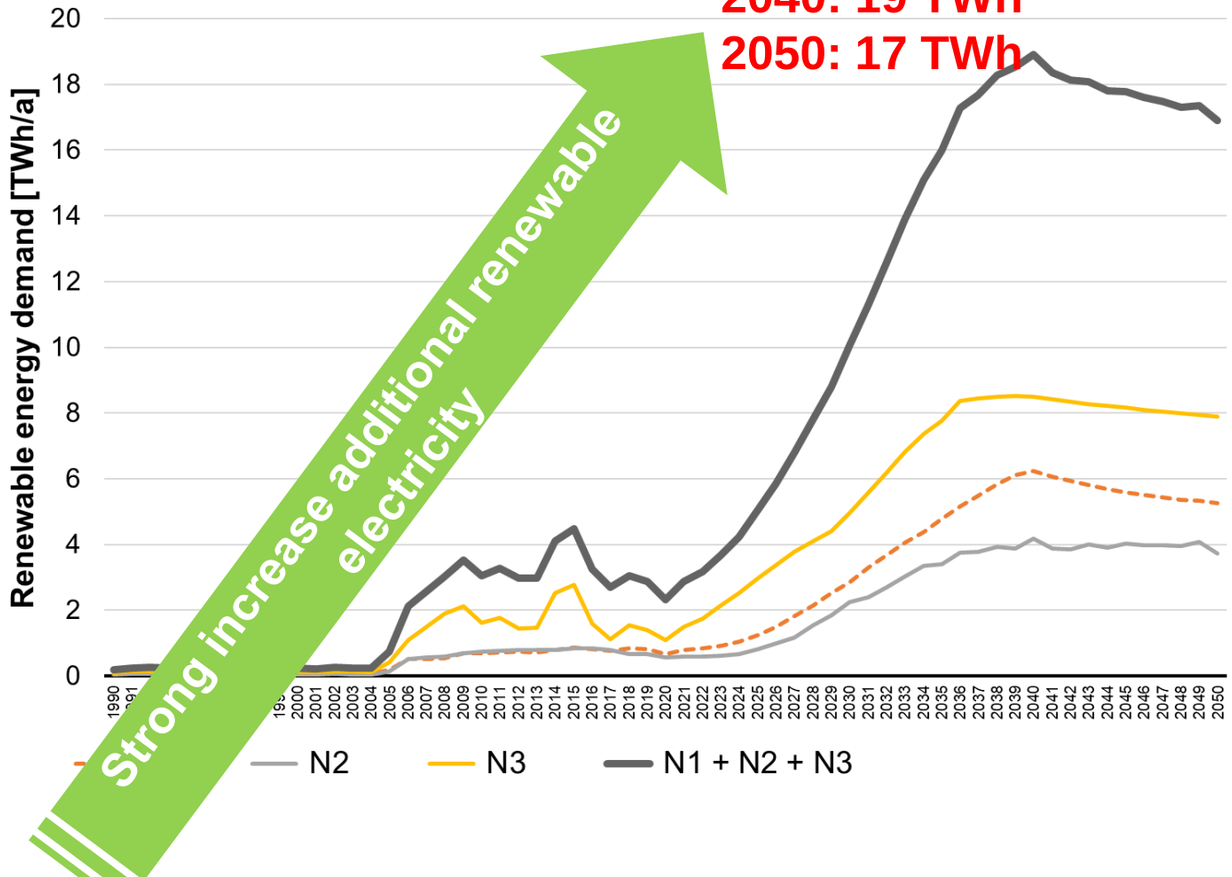
Total:

1990: 21 TWh
2019: 31 TWh
2030: 25 TWh
2040: 22 TWh
2050: 18 TWh



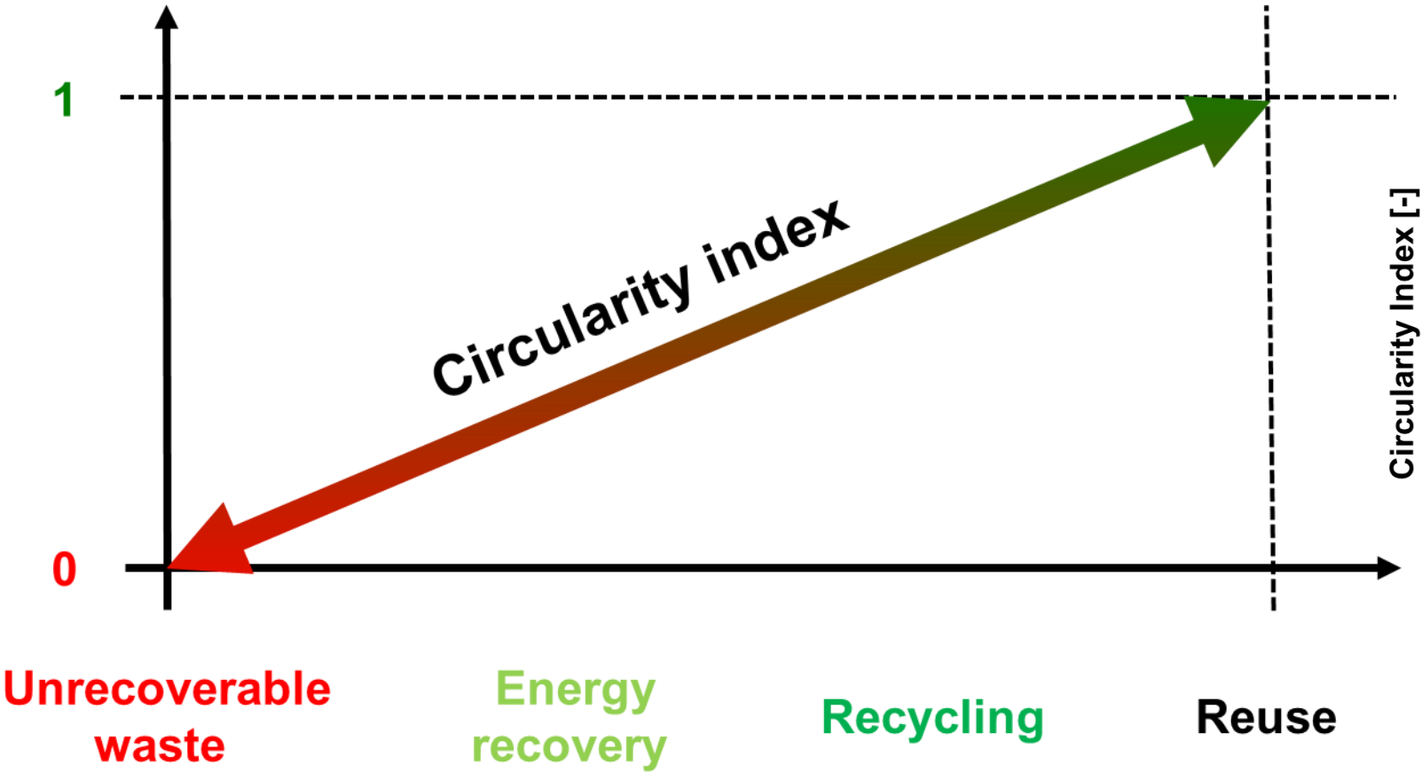
Renewable:

1990: 0.2 TWh
2019: 2.9 TWh
2030: 10 TWh
2040: 19 TWh
2050: 17 TWh

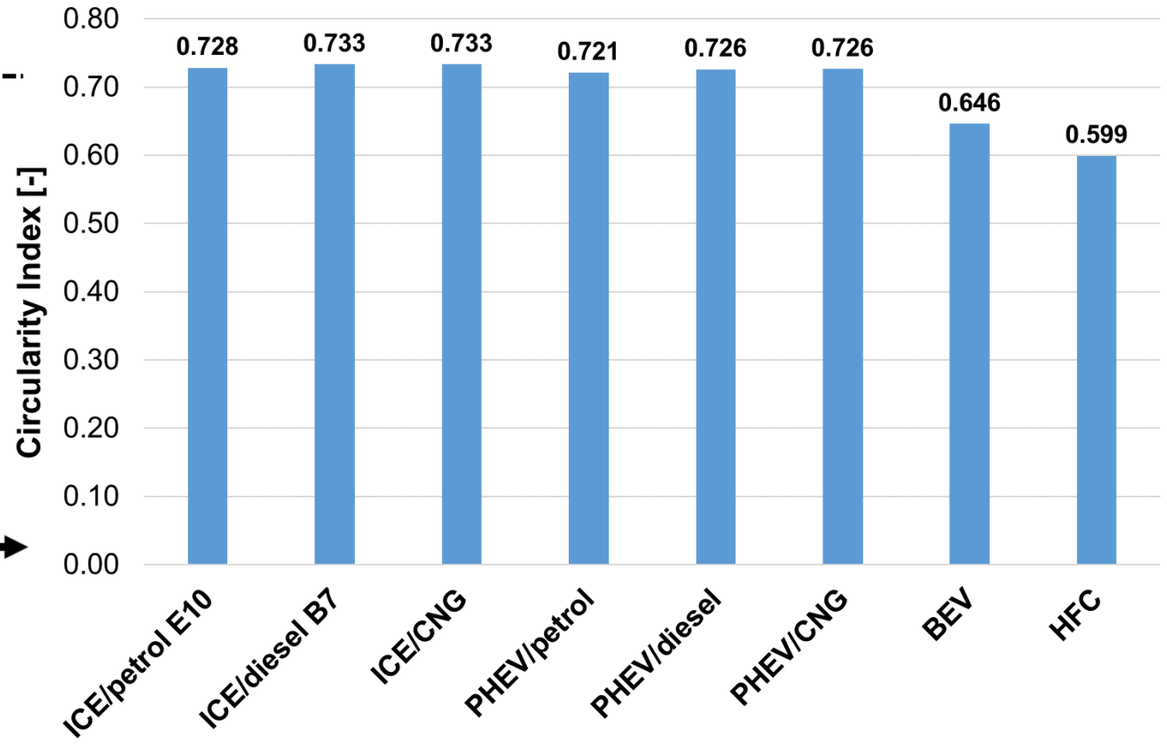


Development of Circularity Index for End of Life

Concept of Circularity Index



Example: passenger vehicles



Method for Environmental Assessment

There is an international agreement

that environmental effects of

products and services

can only be assessed based on

Life Cycle Assessment (LCA)

taking production, use and end-of-life phase into account

Additional §:

„**Climate Neutrality**“
and
„**Circularity**“

are only adressed by a

Dynamic Life Cycle Assessment

considering the timing of
GHG emissions and
raw material extraction and recycling.

Thank you!

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