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Decarbonising road (freight) transport

Insight from linking of transport and energy system models

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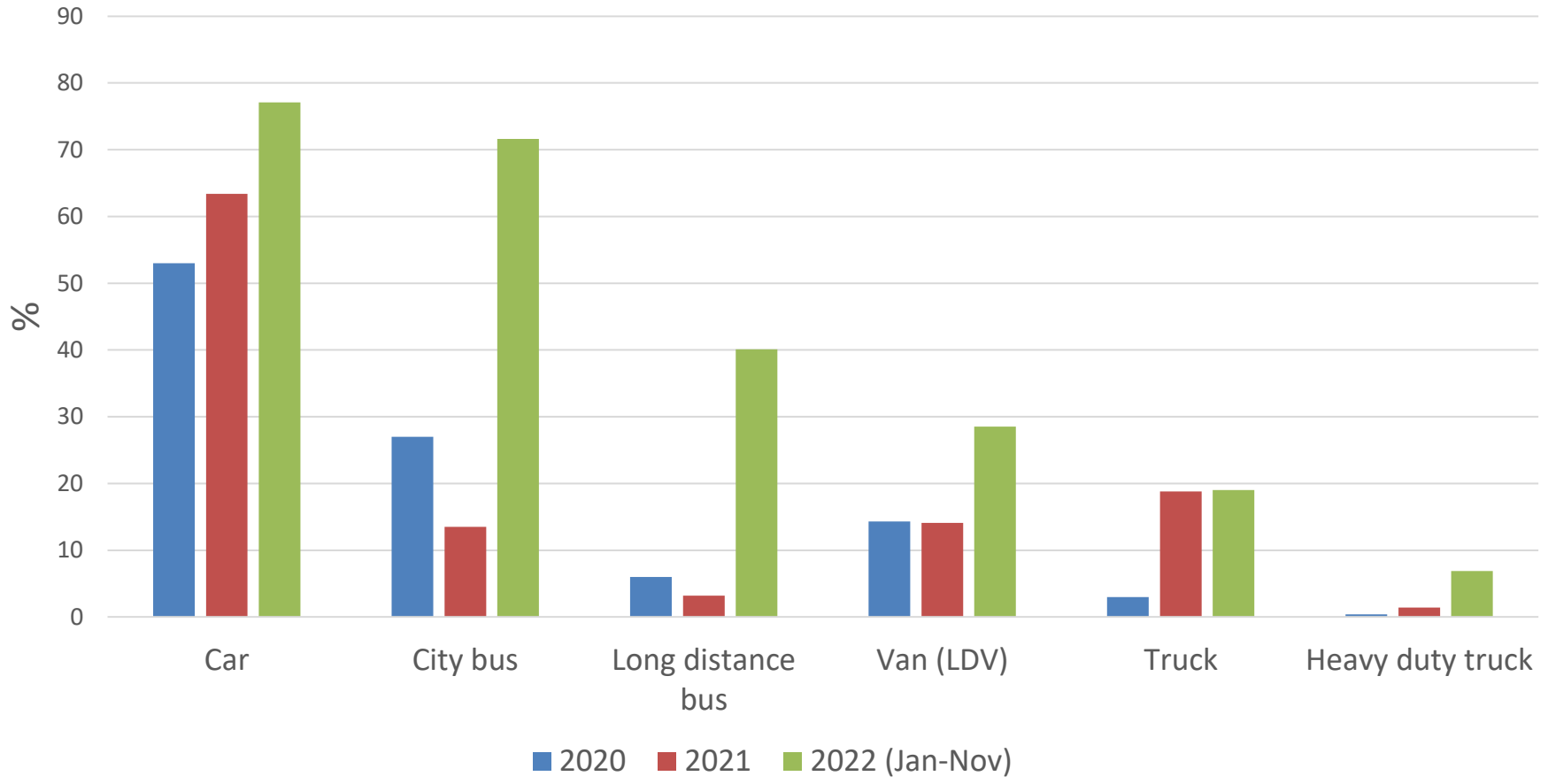
What is the situation today?

Shares of electric vehicles of new vehicles sold in Norway



Source: Oppdatert status på nullutslippskjøretøy | Statens vegvesen

Important assumptions for the analysis

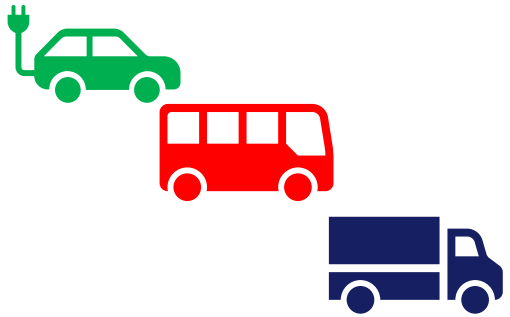
Transport demand
- Based on NTP 2022-2033

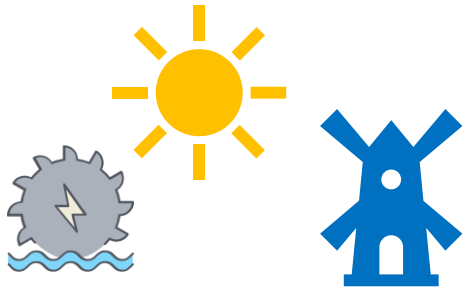
Vehicle technologies
- Investment costs
- O&M costs
- Efficiencies
- EU-regulation 2019/1242: New heavy vehicles

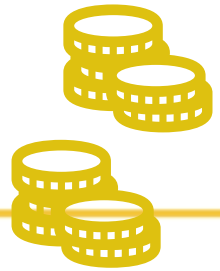
Infrastructure (energy and transport):
- Investment costs
- O&M costs
- Availability and flexibility options

Energy:
- Import/export prices
- Market/trade prices for global energy resources

Policy:
- Economic incentives (CO2-tax, other taxes, subsidies..)







Analysed to main scenarios: Trend and Policy

General

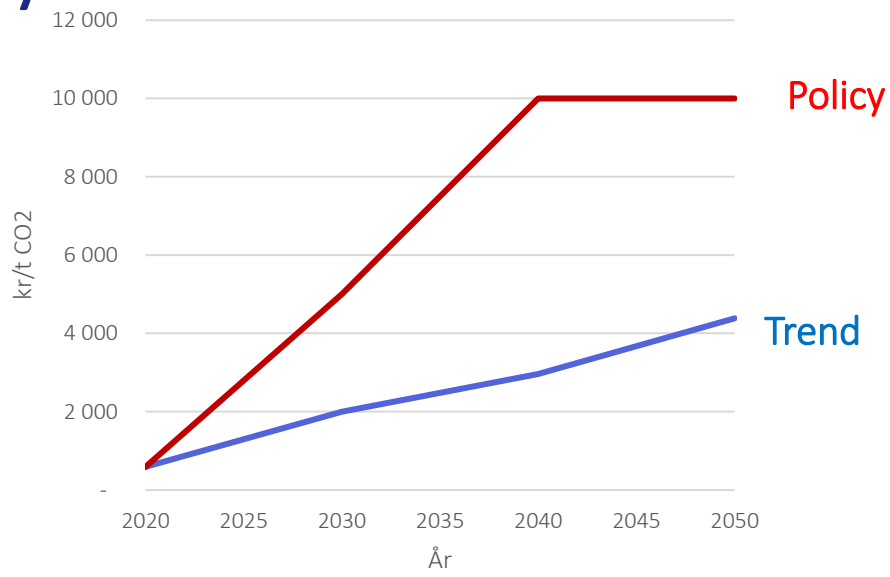
- Technology learning
- Financial support to zero emission trucks until 2030
- Large trucks driving >300 km pr day cannot be BAT

Trend (Reference)

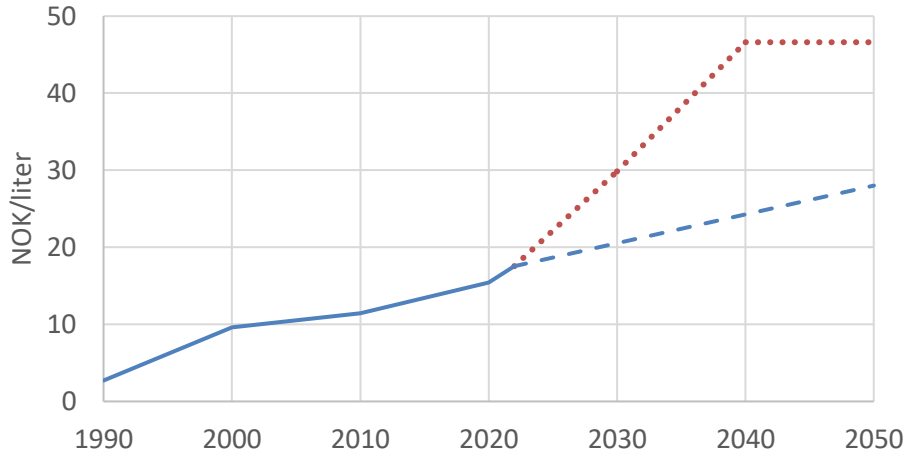
- CO2-tax: 2000 NOK/ton in 2030, followed by 4% yearly increase
- No road toll from 2030 an onwards
- No requirements on new heavy vehicles (EU-regulation)

Policy measures

- CO2-tax: 5000 NOK/ton in 2030, 10000 NOK/ton in 2050
- Road toll: constant on today's level
- EU regulation 2019/1242: heavy duty vehicles
  - CO2 emission pr ton-km in new heavy trucks
  - 15% reduction in 2025, and an additional 15% reduction in 2030 (compared to 2019)

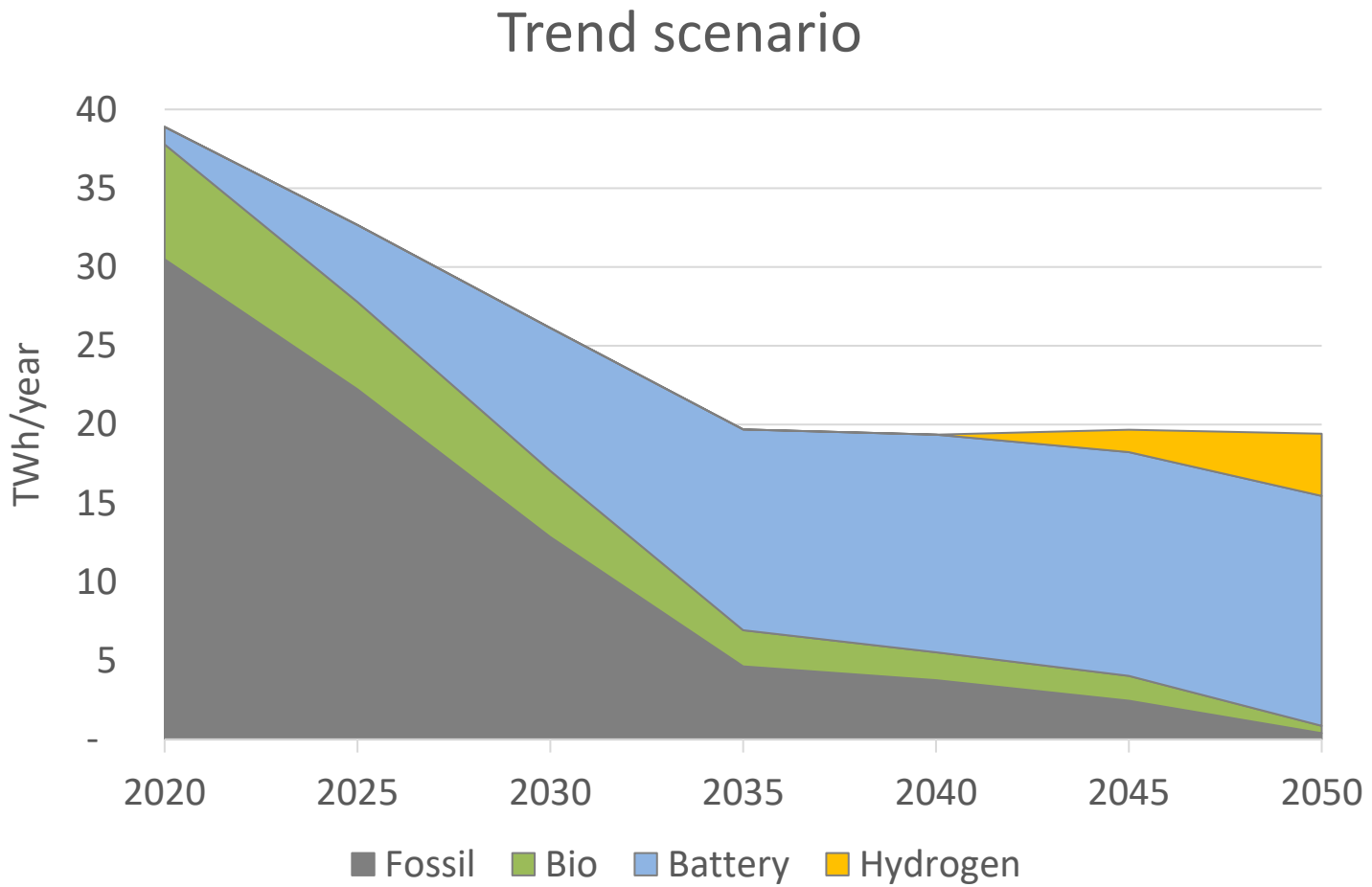


Diesel price incl. VAT



Energy use in road transport will be halved towards 2050

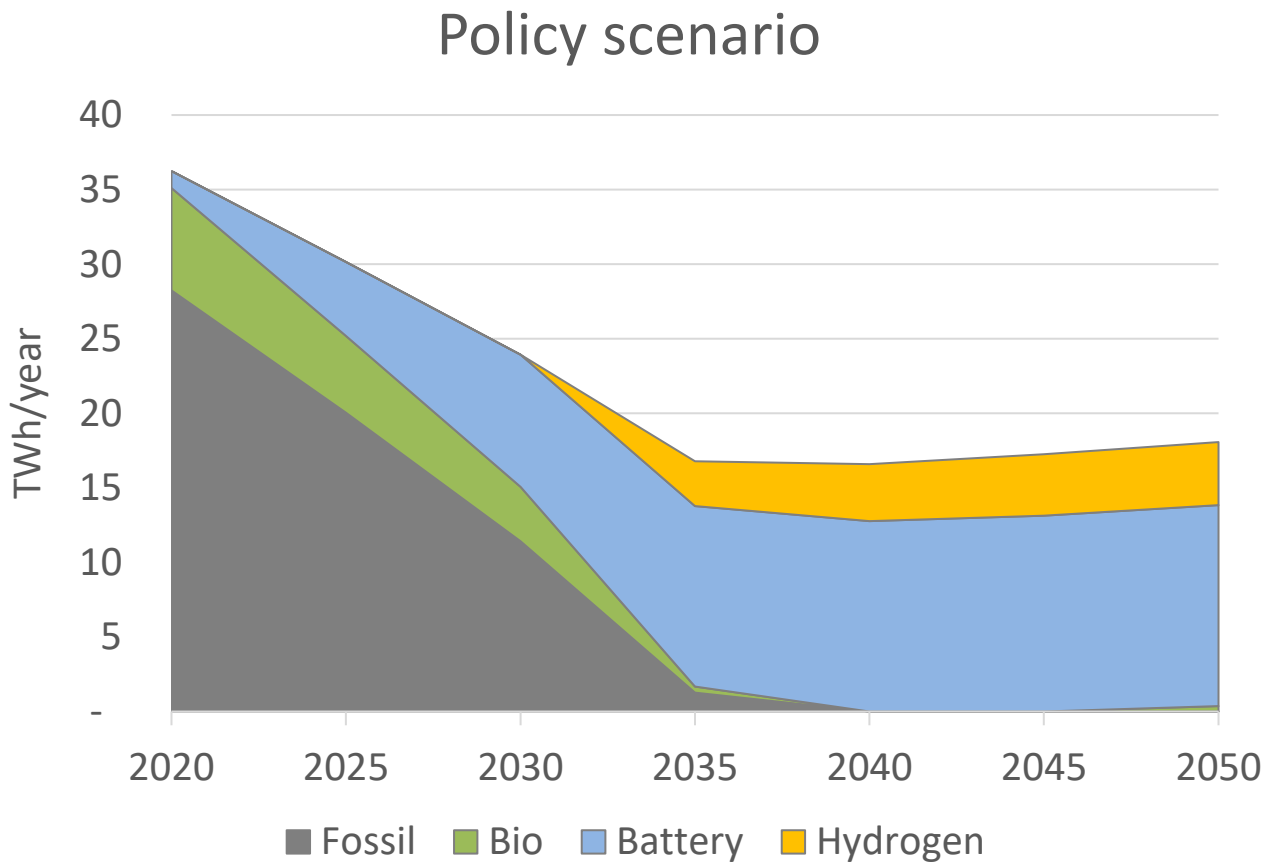
- at the same time as demand increases significantly



Still use of fossil fuels

Hydrogen: from 2040

Energy use in road transport will be further decreased in the Policy scenario

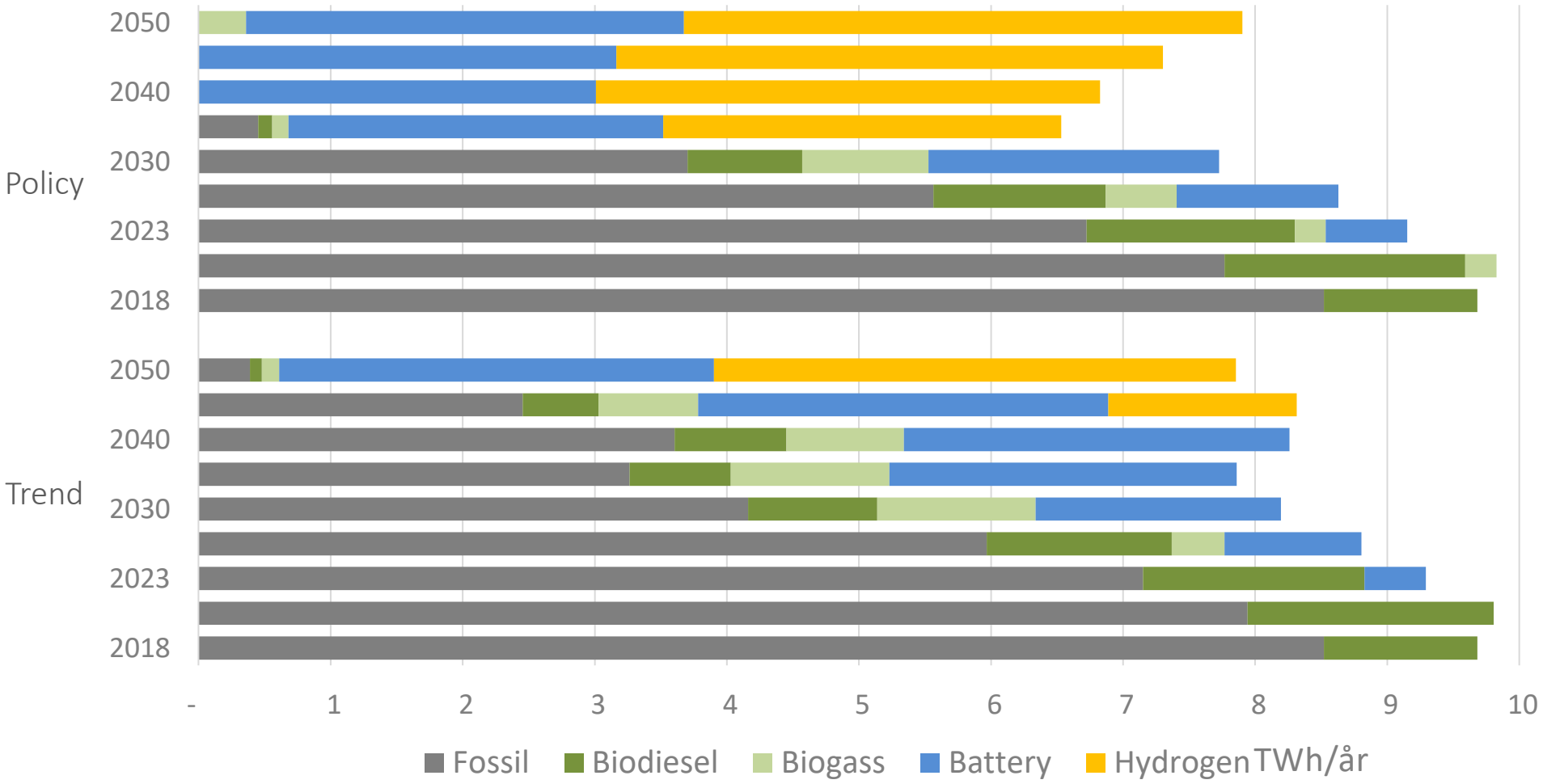


Compared to the Trend scenario:

- Faster phase-out of fossils
- Earlier introduction of hydrogen
- More use of hydrogen
- Lower energy demand

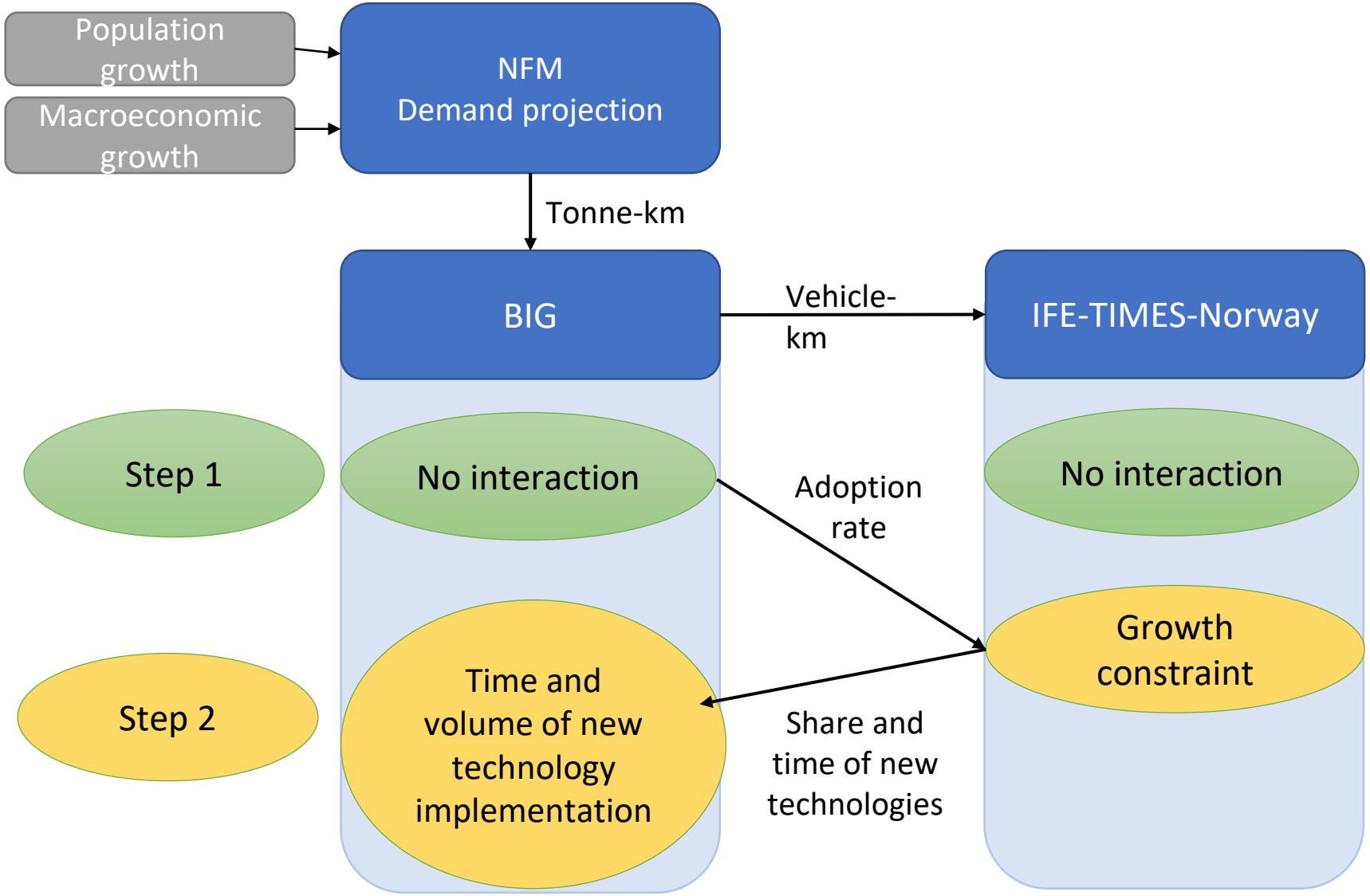
Modelling results

Energy demand in trucks

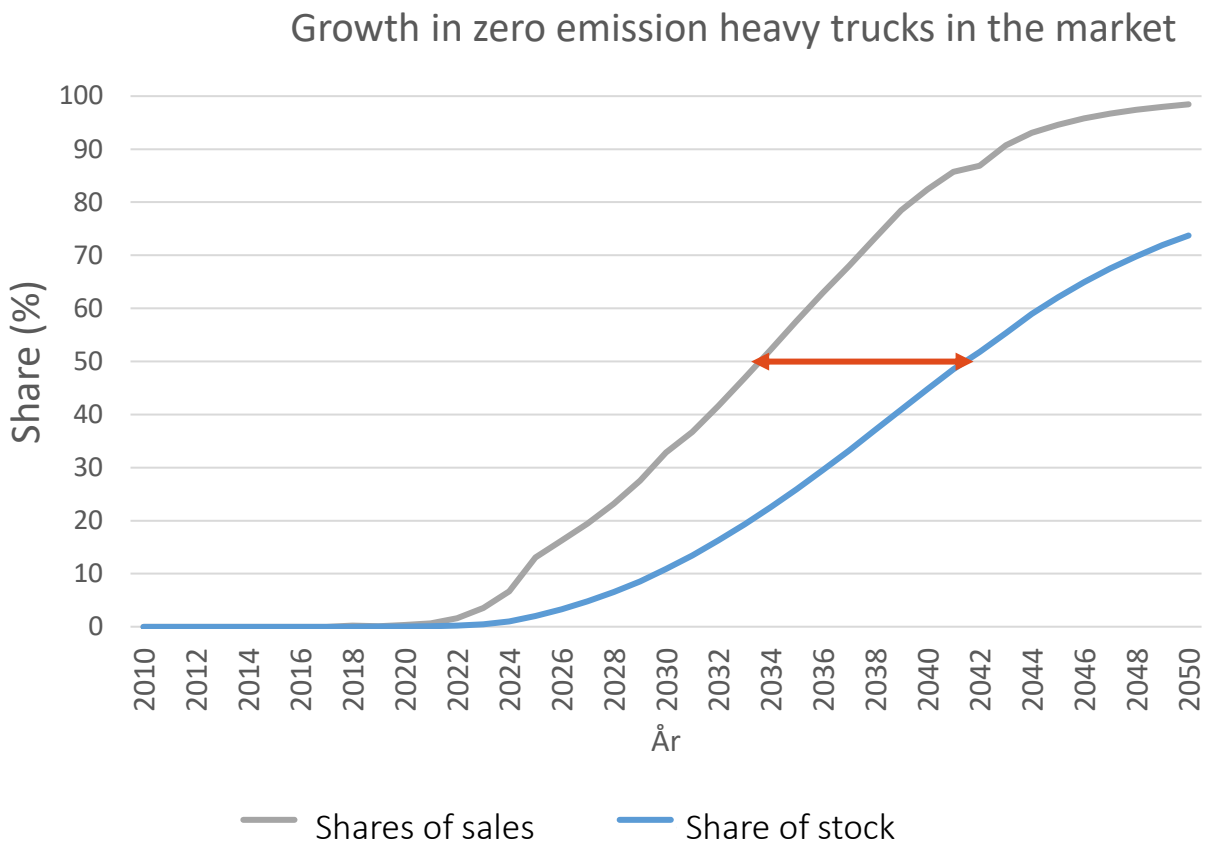


- Zero emission trucks are introduced faster in the Policy scenario
- Energy demand are reduced, despite a significant growth in road freight demand

Linking of transport- and energy models



It takes years from innovation to penetration

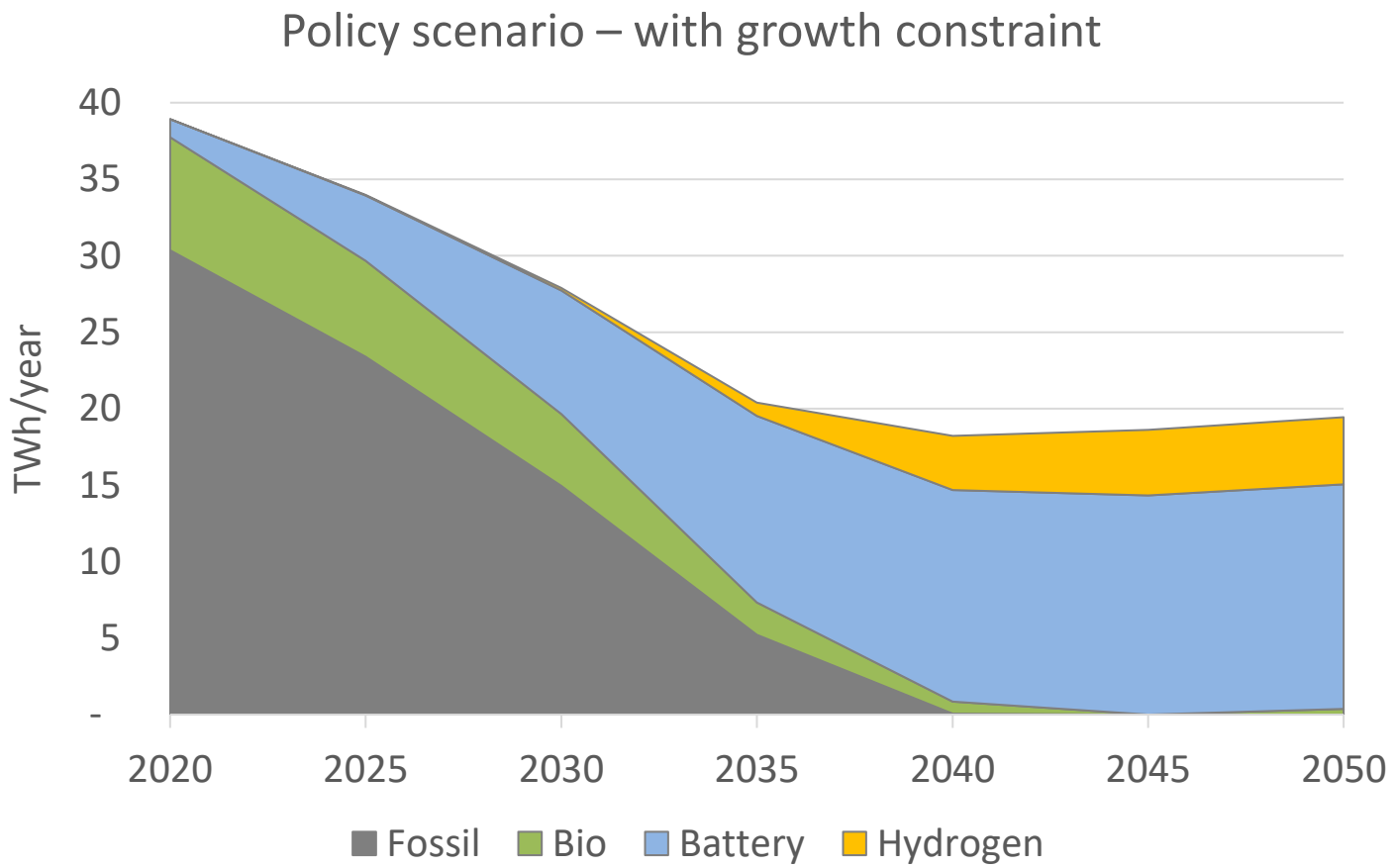


Replacement of heavy duty trucks :

- It takes approx. 8 years from half of all new trucks are zero emission to the time when half of the stock of trucks are zero emission

- The growth rate constraint is used in the energy system model to restrict the implementation rate of new trucks

Energy use in road transport when introduction of new vehicles are constrained

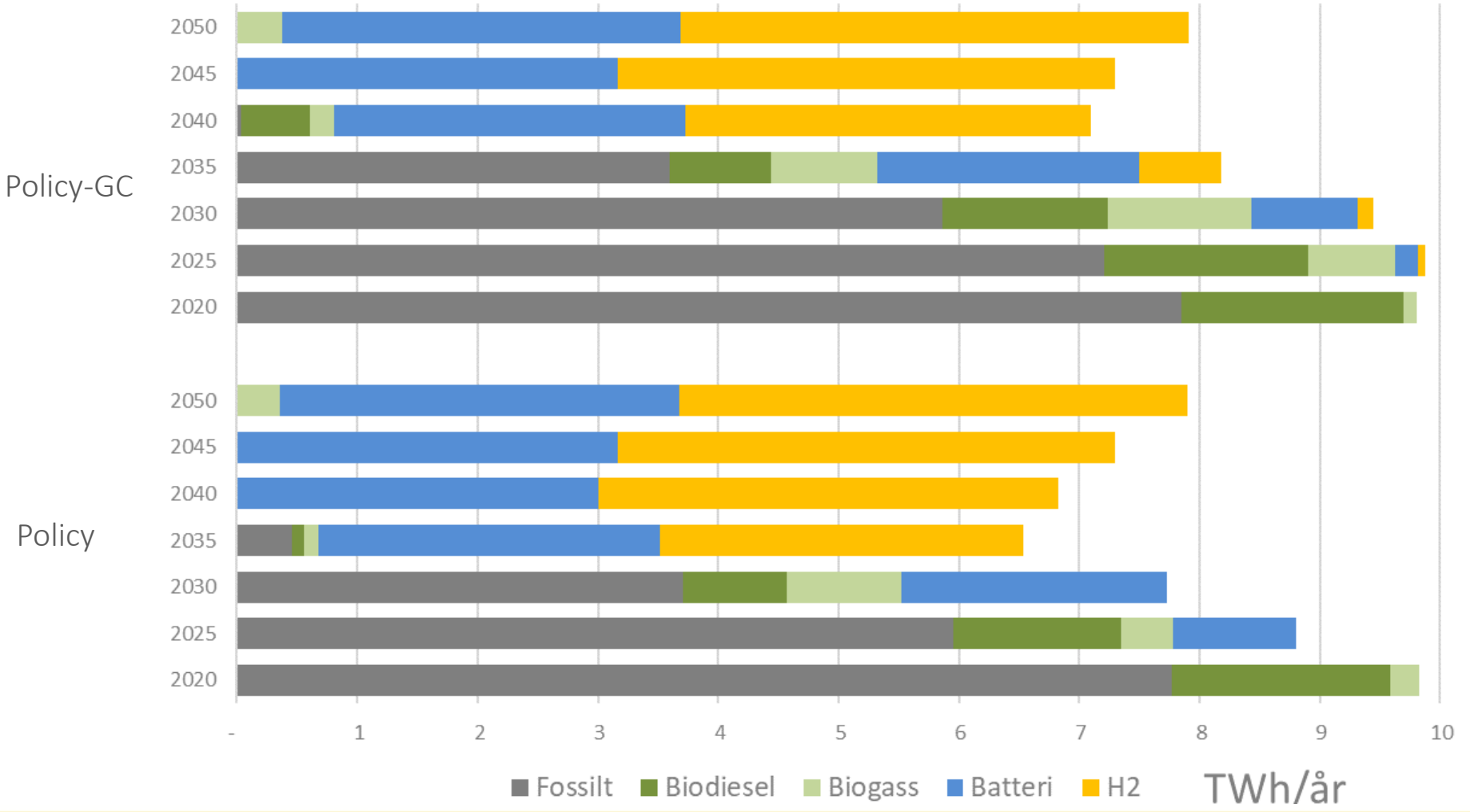


Compared to the Policy scenario:

- more use of fossil fuels

Linking TØI-BIG and IFE-TIMES-Norway

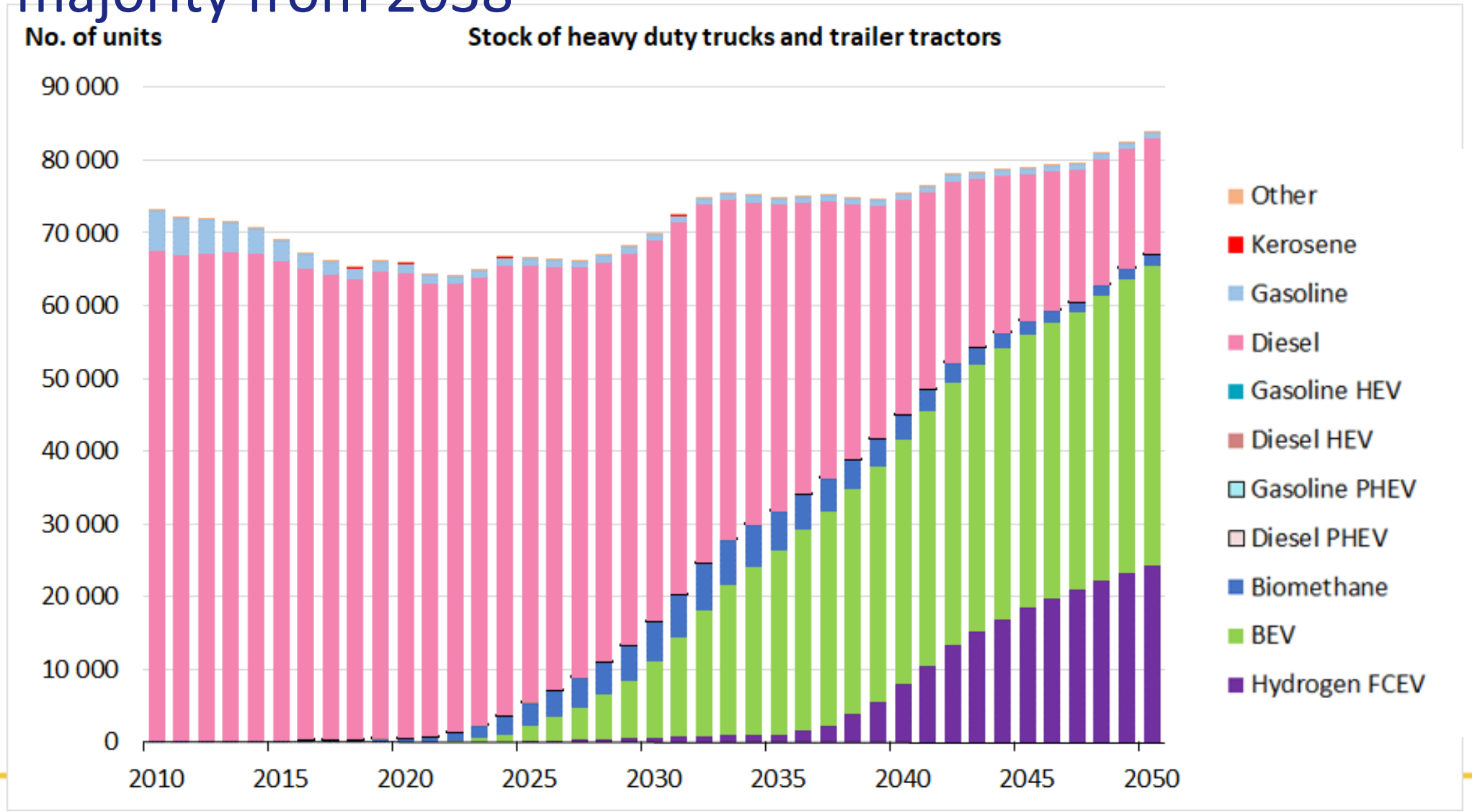
Energy us in trucks: with and without growth constrain



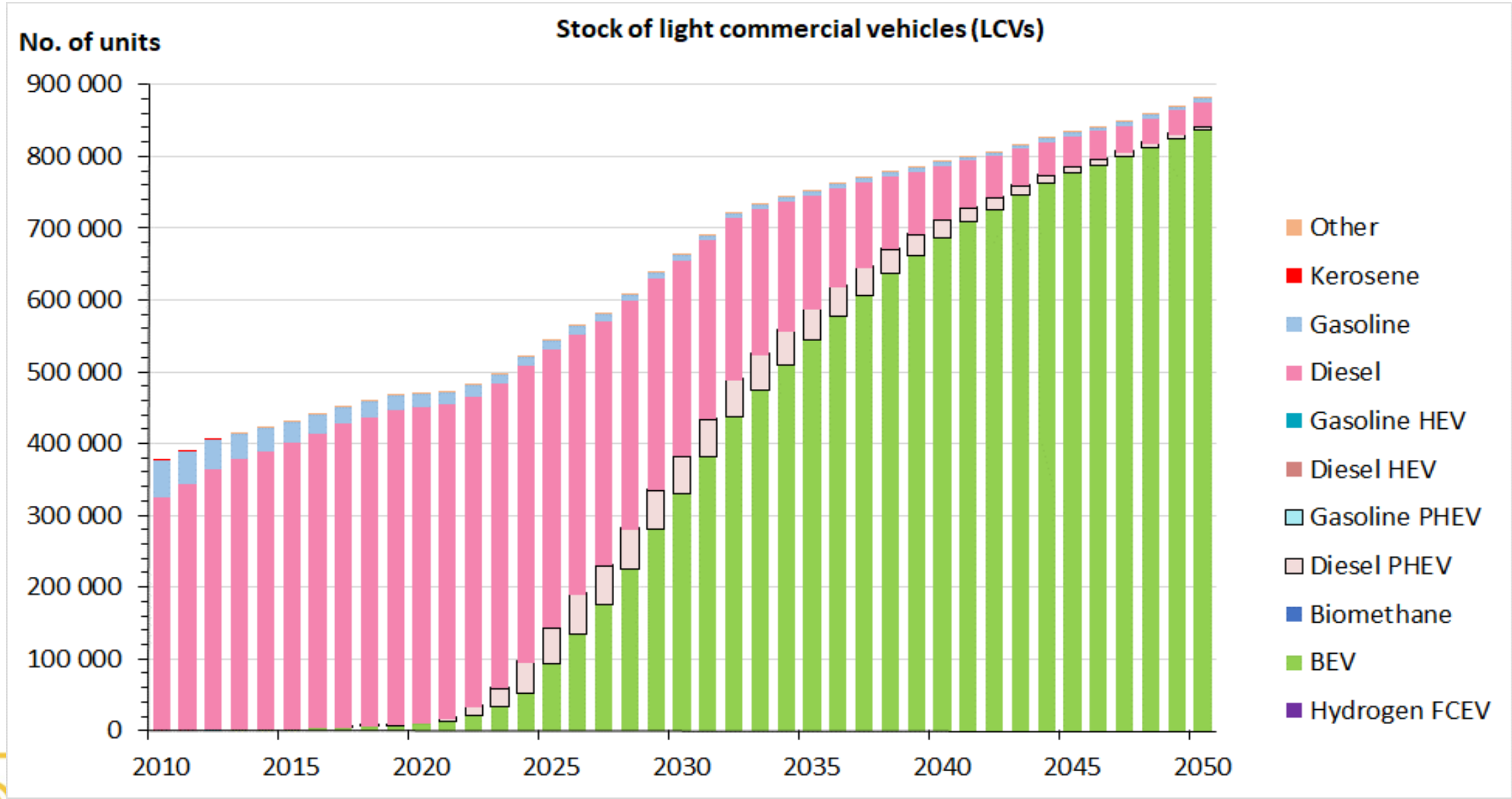
With growth constraint:

- Phasing out of ICE is delayed
- 2035 still a large share of diesel (45 %)
- Implementation of battery- and fuel cell electric trucks go slower
- However, from 2045 the two scenarios gives same results

Gradually more zero emission heavy-duty trucks in fleet - in majority from 2038



Zero emission LDVs (vans) are in majority from 2031



Major takeaway

- Transport technology and the energy system are interdependent
- Energy transition and decarbonization takes time, determined by the velocity of turnover of durable assets
- Heavy-duty long-haul freight transport is most likely niche for fuel cell electric trucks
- Battery electric technology is likely to dominate in other segments
- To circumvent chicken-and-egg problem and trigger hydrogen market, technology neutrality may have to be sacrificed.

Takk

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Total cost of ownership (TCO)