

Climate Thursdays 06. October 2022



Transportation

– Strategies for climate change mitigation

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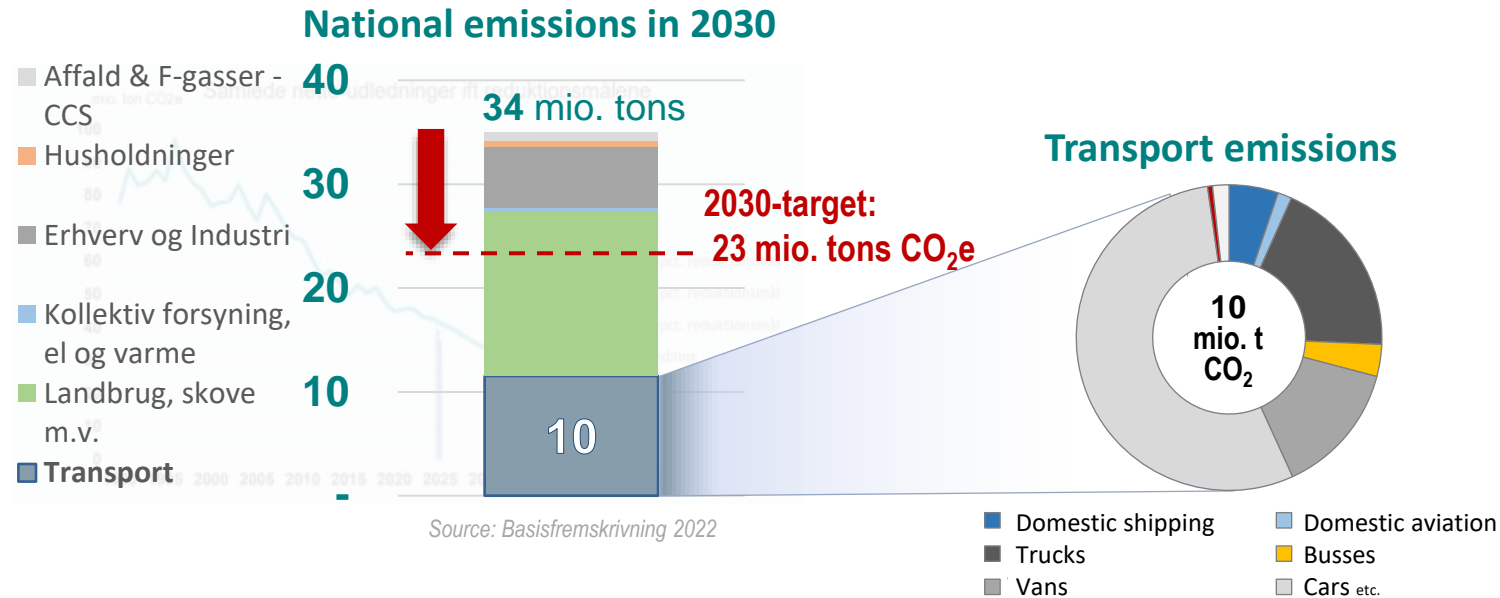
tøi : Transportøkonomisk institutt
: Stiftelsen Norsk senter for samferdselsforskning

Klimarådet.



Denmark's CO₂-emissions and the national 70%-target in 2030

in comparison with 1990-level*



Achieve climate neutrality no later than 2050*

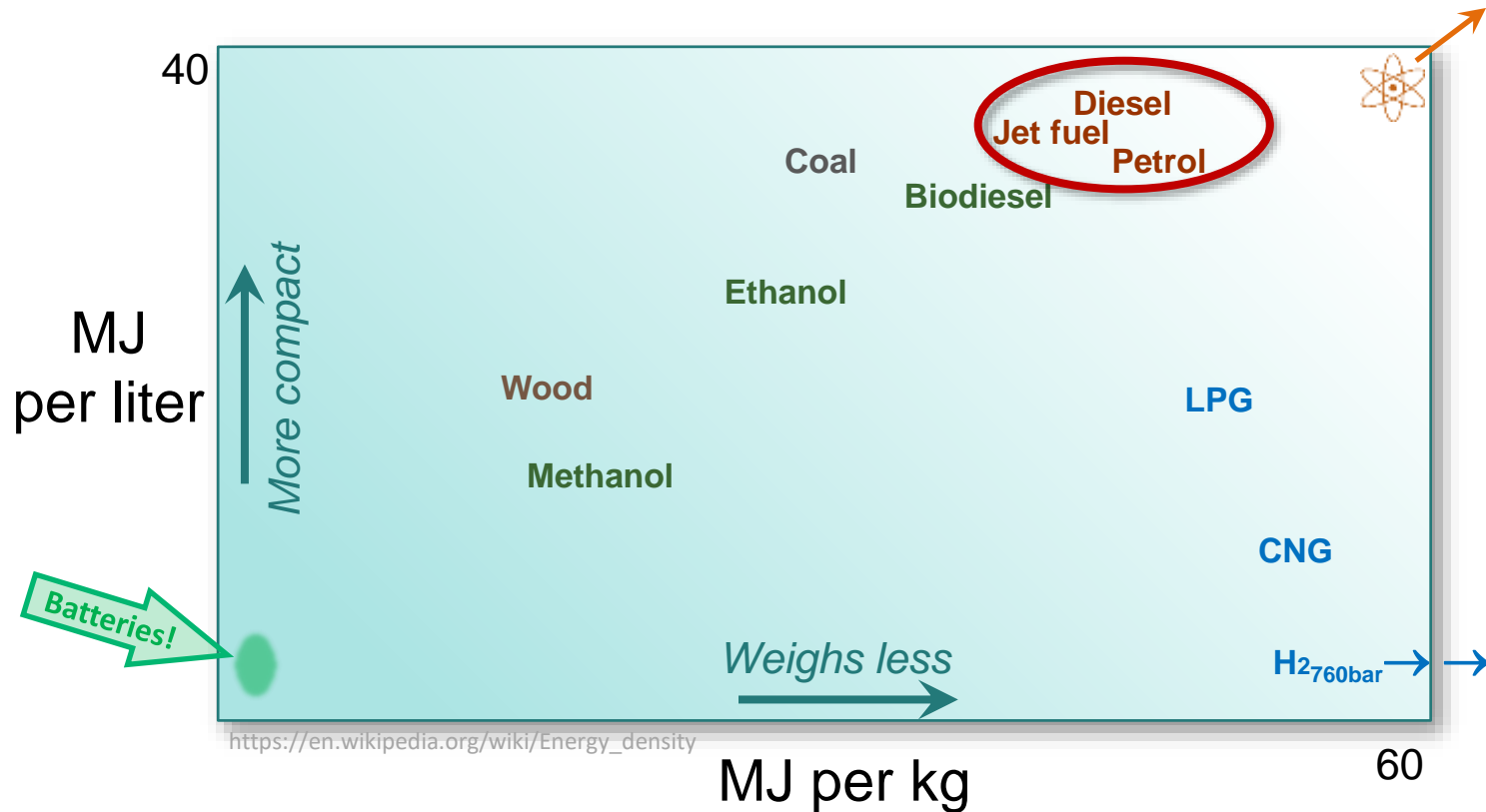
(* the Danish Climate Law of 26 June 2020)

Oil addiction ...



Fossil fuels are very energy dense

- convenient for mobile applications



CO₂-emissions from fossil energy (ton CO₂)

Transport volumes
(pkm and tkm)

x

Energy efficiency
(MJ per tkm and pkm)

x

CO₂ intensity
(g CO₂ per MJ)

CH₄; NO₂

Behaviour



- Lower wealth (GDP)
- Restrict mobility
(increase price, skip infrastructure improvements)



DSB

- More energy efficient modes of transport
- Better capacity utilisation (or larger vehicles)
- Energy improvements of cars, trains, ships and aircraft



- Greener fuels
(LPG, CNG, Biofuels)
- Zero emission technologies
(Electrification, P-t-L, H₂, CCS)

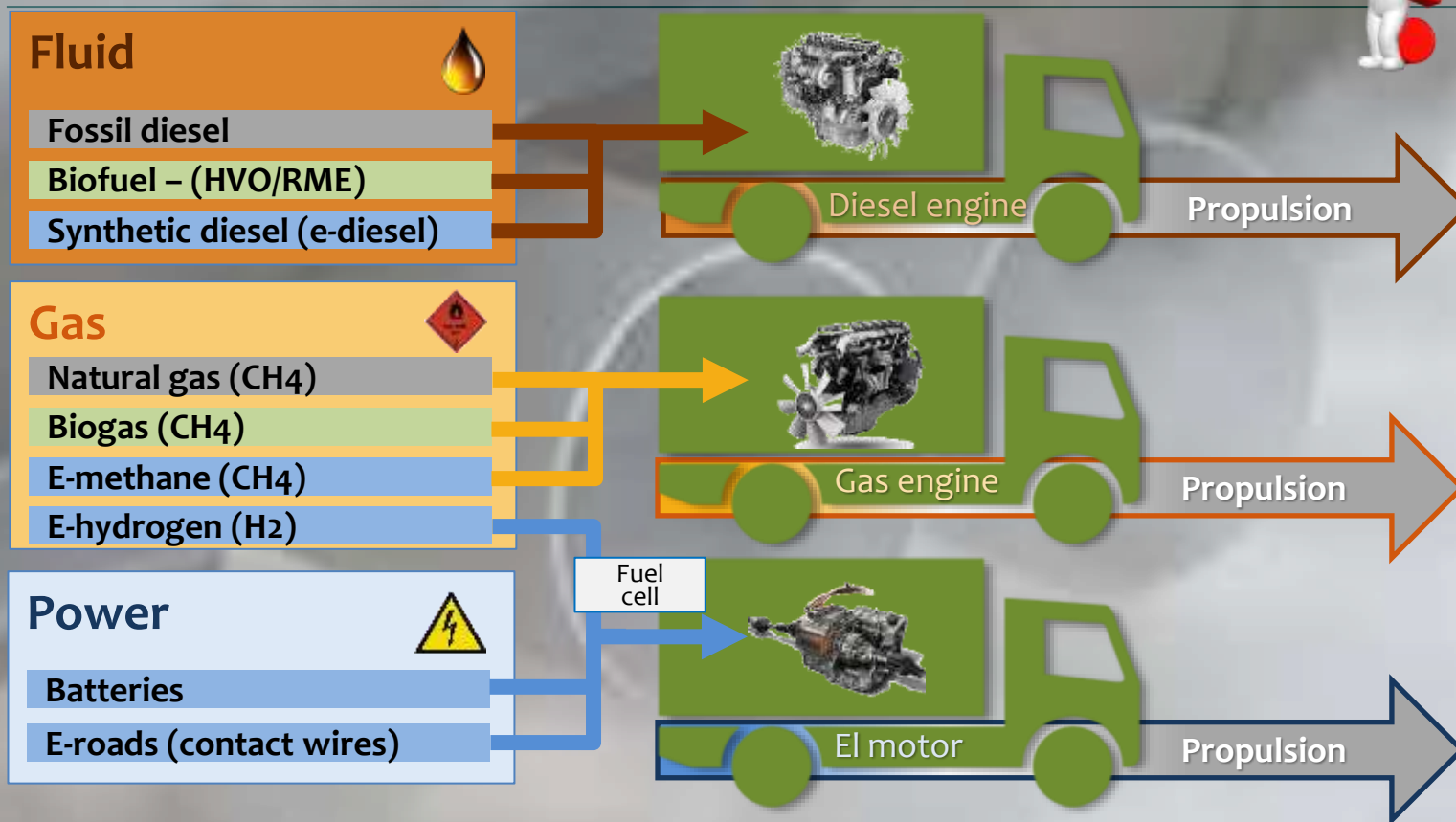
Technology

Time perspective increases

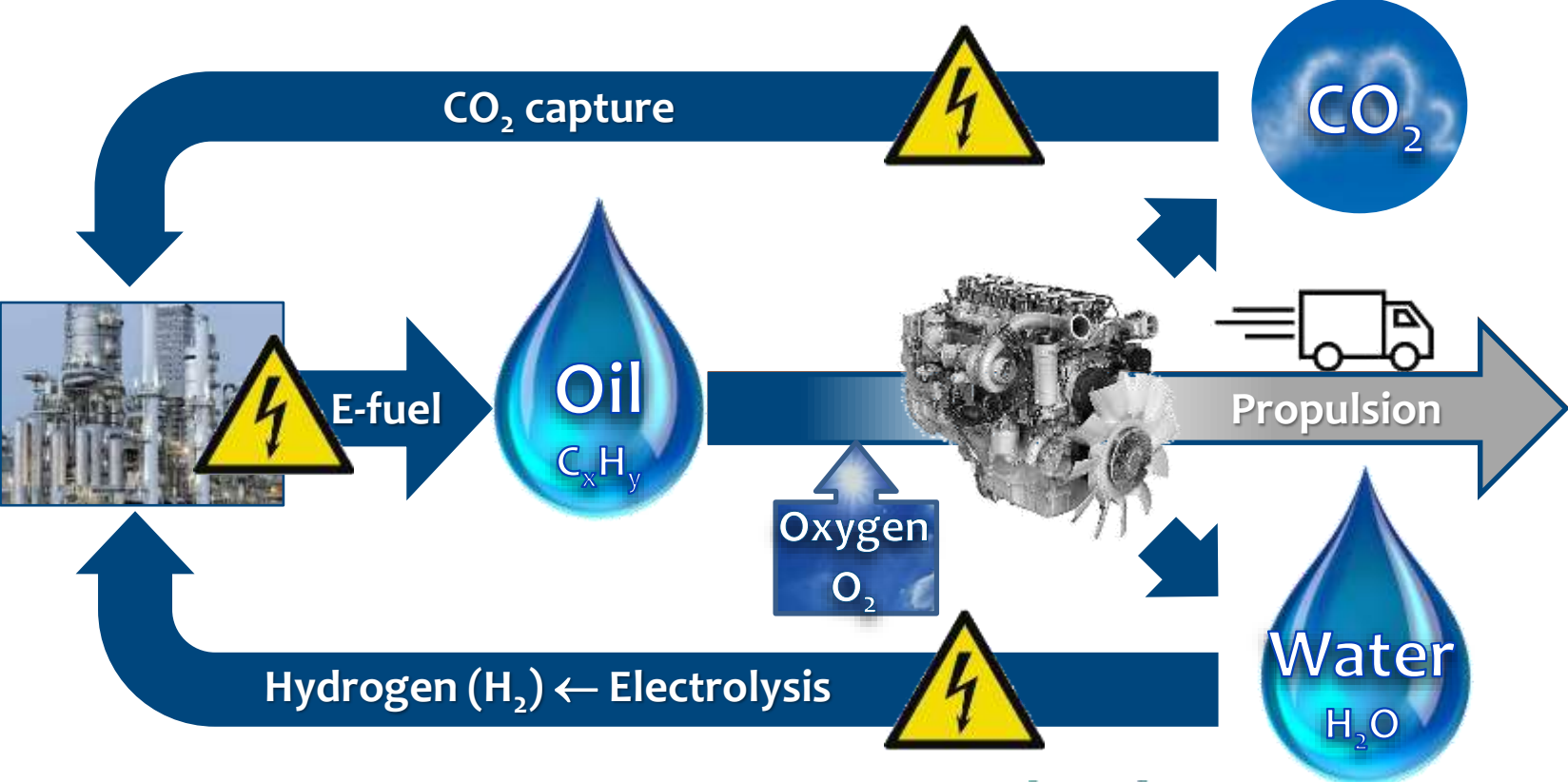
We must transform all road transport
to renewable energy



What are the options?



Power-to-Liquid



Power-to-L (liquid)



Power-to-B (battery)

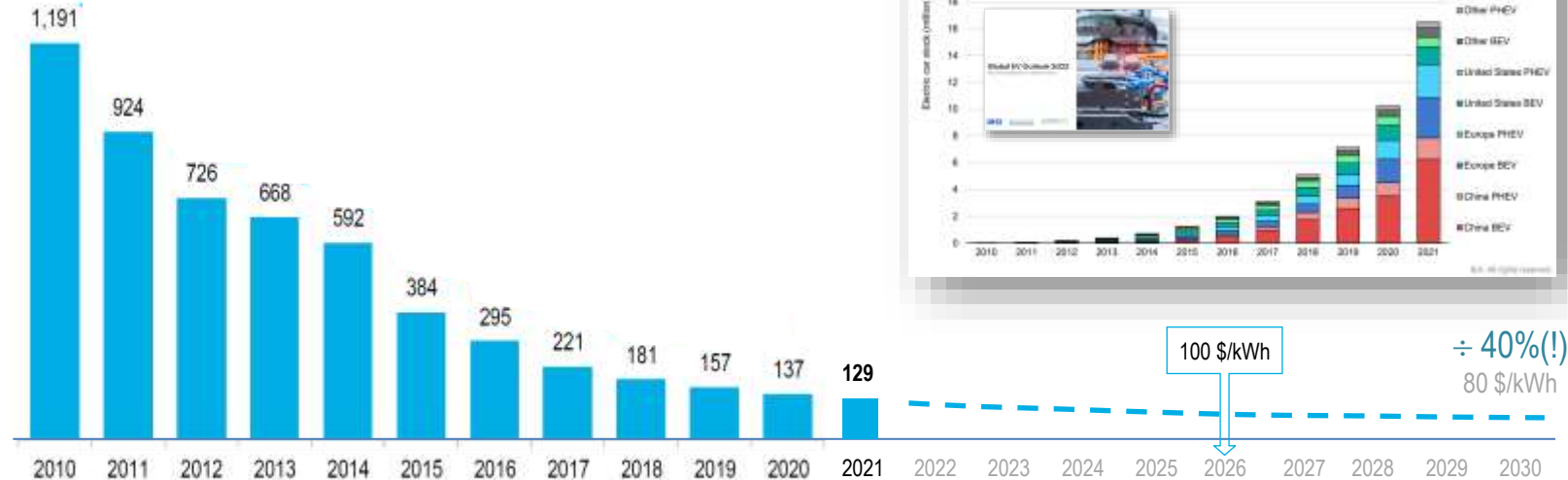


Source for energiefficiencies: Klimarådet: Baggrundsnotat om sektorvurderinger, 2021.

Potentialet for eldrift er stort

Battery price has plummeted ... – and is expected to continue to fall!

Battery pack price (real 2020 \$/kWh)



Source: BloombergNEF 2020 Electric Vehicle Outlook and 2021 Lithium-ion Battery Price Survey

Cars and vans will become electric vehicles



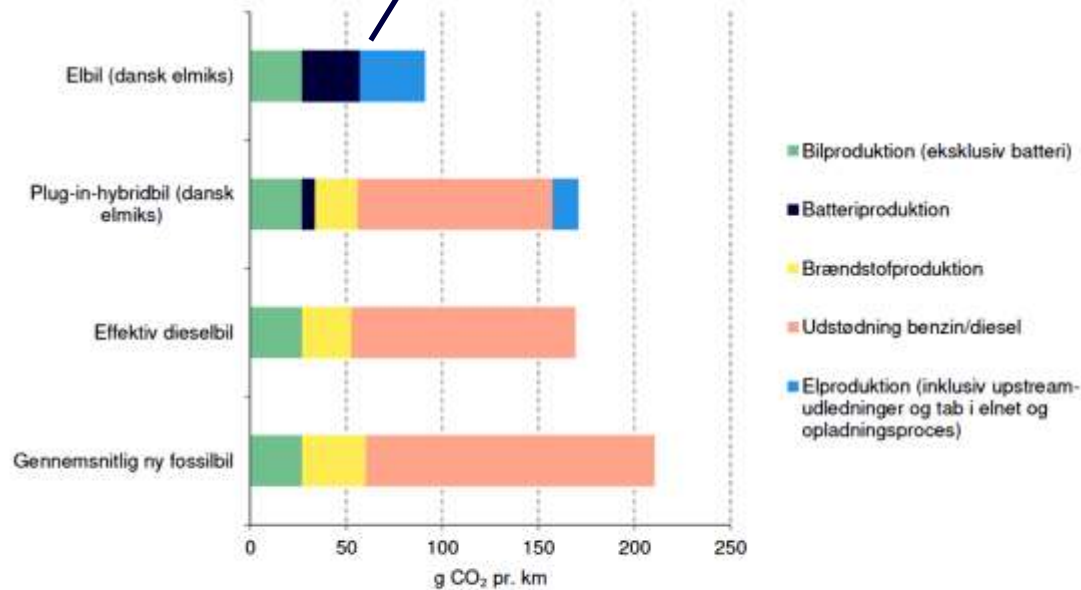
Zero emissions



Life cycle analyses for EVs

Klimarådet.

CO₂-emissions from battery production is compensated after about 50.000 km



Figur 1: Global CO₂-udledning pr. km over bilens levetid

Local and regional distribution can also be handled by battery trucks

Volvo FL Electric

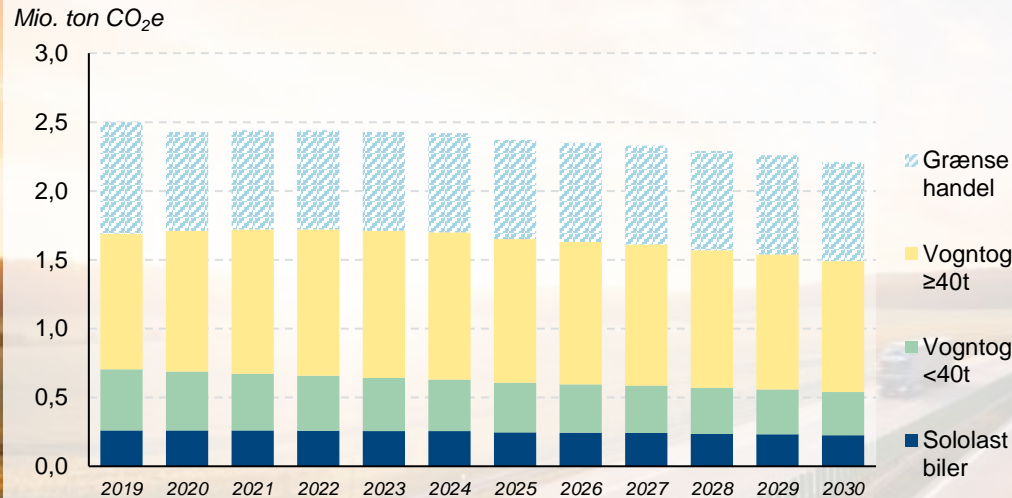
Size: up to 16,7 ton

Range: up to 300 km

Charging: 2 – 11 hours



... but longhaul trucks are responsible for the majority of emissions



Anm. 1: Som i klimafremskrivningen er det antaget, at 90 pct. af den samlede grænsehandel af diesel tilskrives lastbiler. Udledningerne forbundet med grænsehandelen er ikke udspecificeret på vægtklasser.

Anm. 2: Kategorierne 'Vogntog ≥ 40t' og 'Vogntog < 40t' dækker over både sættevognstog og lastbiler med påhængsvogne med tilladt totalvægt på henholdsvis over og under 40 ton.

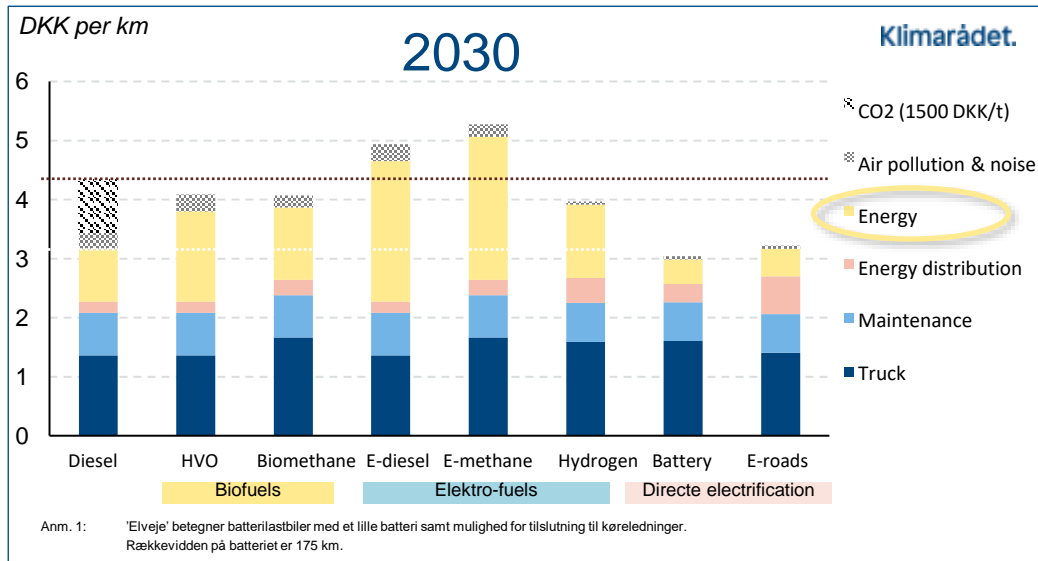
Kilde: Energistyrelsen.



Heavy long haul ... Sustainable fuels?



Total social cost per km for a new truck in 2030



In line with strategic announcements from major truck producers in Europe

THE TRANSITION TO ZEV

High potential variability in timing – but we are ready for any outcome



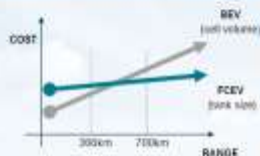
ZEV TECHNOLOGY: BOTH BEV AND HYDROGEN WILL BE NEEDED

Three key factors drive our dual strategy

COST PER RANGE:
"THESE LINES MUST CROSS"

ENERGY DENSITY/CHARGING:
"THESE LINES NEVER CROSS"

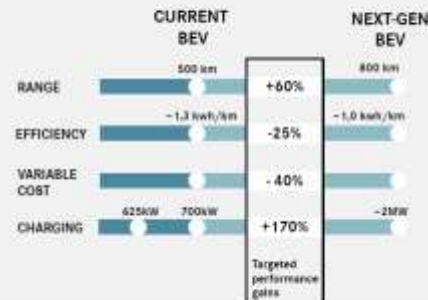
GLOBAL ENERGY ECOSYSTEM:
"WILL BE ESTABLISHED ANYWAY"



FCEV AND BEV
BOTH WIN
DEPENDENT ON RANGE

BEV TECHNOLOGY – READY TO GO

New BEV trucks about to hit the market; next-gen technology will leap further



In line with strategic announcements from major truck producers in Europe

Focus on Battery Electric and Fuel Cell Electric Vehicles



- Battery Electric Vehicles will be optimized for distribution / city applications and regional haul.
- Fuel Cell Electric Vehicles will be optimized for demanding long haul.



JOINING FORCES FOR HYDROGEN-POWERED CO₂-NEUTRAL TRANSPORTATION

cellcentric
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DAIMLER
Daimler Truck

VOLVO
VOLVO GROUP

Technology leadership | Economy of scale | Society push | Infrastructure roll-out

Press release 16.March-22

Press release / Presse Info / Comunicado de imprensa / 新聞稿 / プレスリリース / Comunicado de prensa / Communiqué de presse / Informacja prasowa

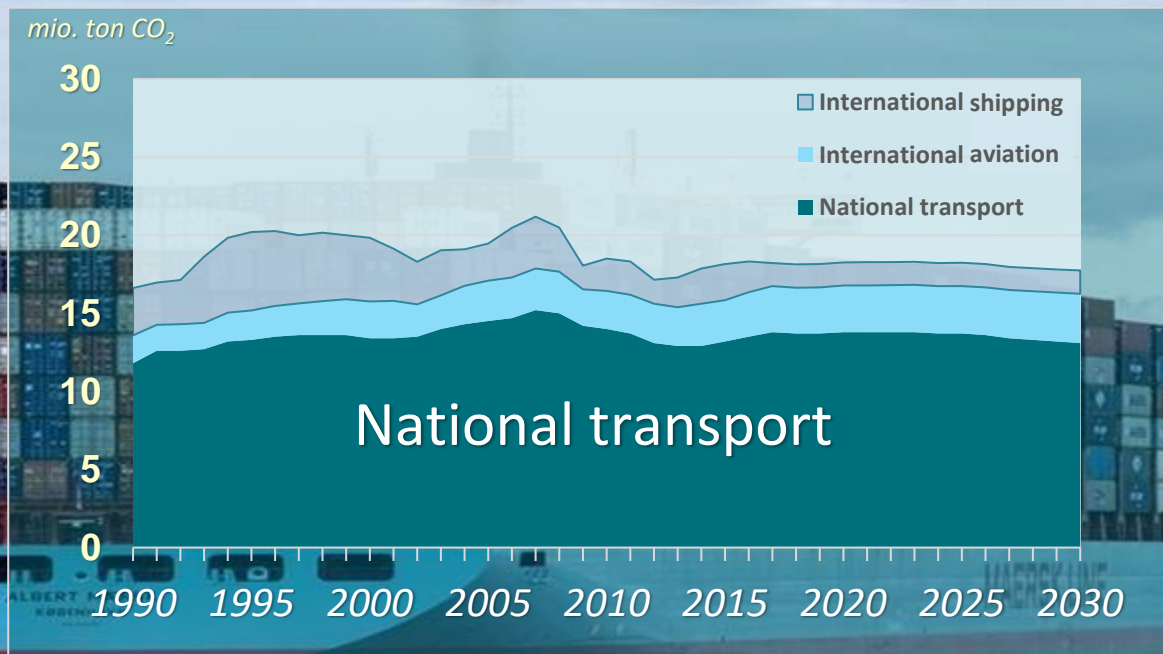
TRATON GROUP to invest a total of €2.6 billion in e-mobility research and development by 2026

- Previously, the e-mobility budget had been €1.6 billion by 2025
- The share of conventional drives in the product development budget will be scaled back accordingly
- Clear focus on battery electric drives, including in long-haul transportation
- Hydrogen drives may have their advantages in individual applications





International aviation and shipping are not comprised by national targets



Green fuels (P-t-L) for long distances



Eviation's all-electric Alice aircraft makes its maiden flight 27.Sep-2022

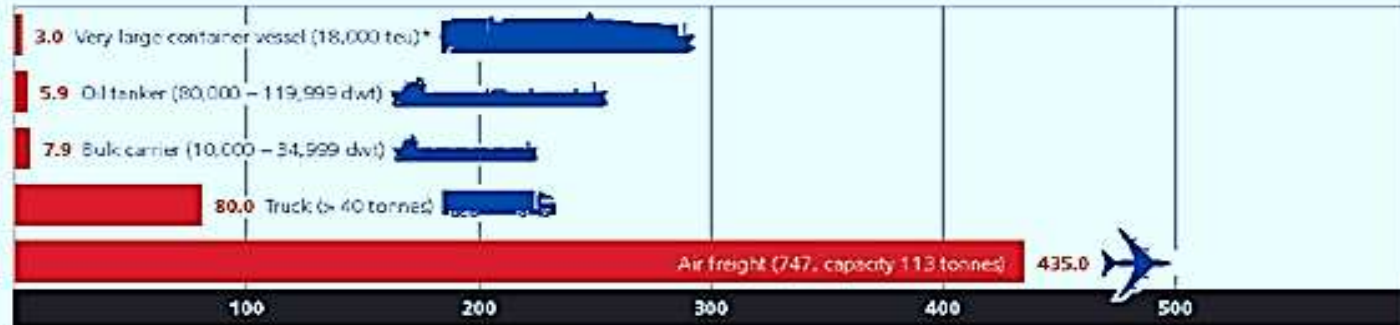


Source: TechCrunch 28.Sep-2022

Produce and buy locally?

COMPARISON OF TYPICAL CO₂ EMISSIONS BETWEEN MODES OF TRANSPORT


Grams per tonne-km



Source: IMO GHG Study: 2009 (*AP Moller-Maersk, 2014)

Concluding remarks about the role of regulation

- Demand reduction and mode shift measures can be highly recommendable for many reasons
 - Will contribute to emission reductions
 - but cannot solve the climate change challenge
- The driving force: Incentives to technological development and adoption
 - First of all EU: Emission standards, ETC etc.
 - By national policies Denmark can be a front runner in implementing the necessary green technologies



Thank you for your attention

*Perito Moreno in Los Glaciares National Park, Argentina
– one of the world's very few non-retreating glaciers ...*

Photo: © Niels Buus Kristensen

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Transparitøkonomisk institutt
Stiftelsen Norsk senter for samferdselsforskning

Klimarådet.