

Climate Thursdays 12. October 2023

Transportation

– Road transport and aviation

Niels Buus Kristensen

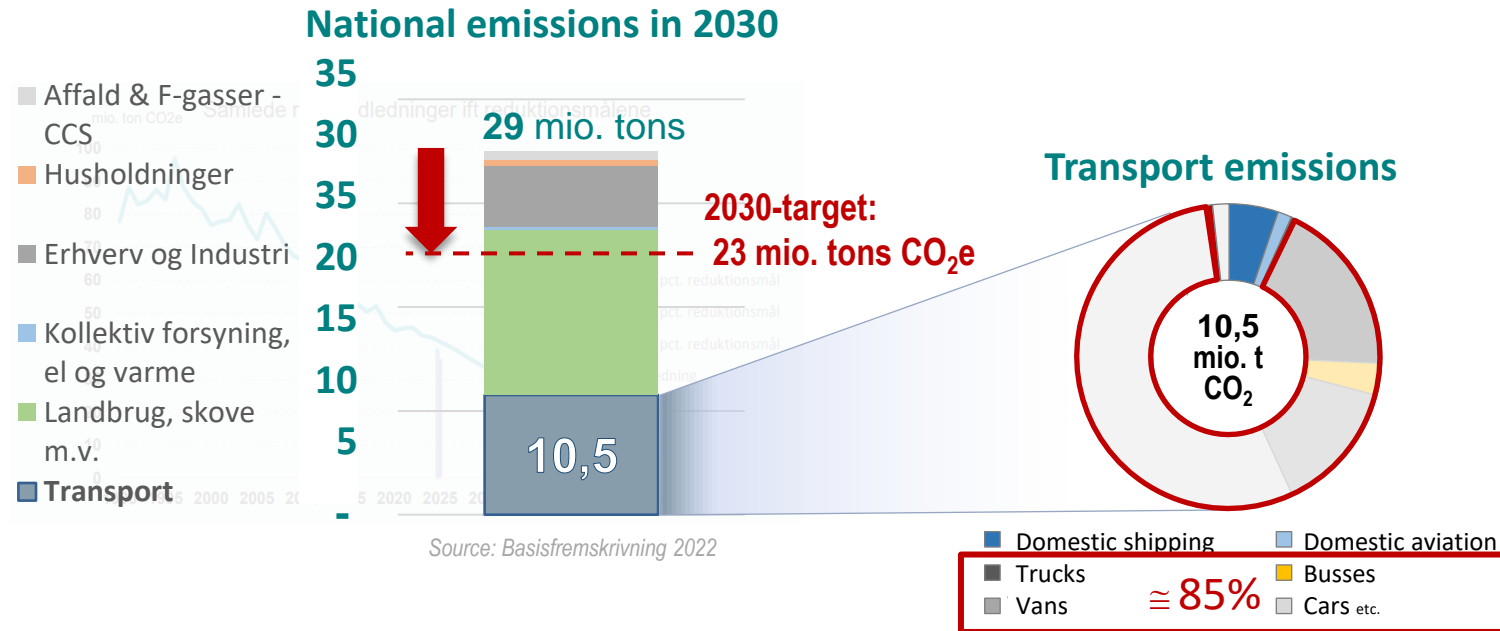
tøi | Transportøkonomisk institutt
Stiftelsen Norsk senter for samferdselsforskning

Klimarådet.



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

in comparison with 1990-level*

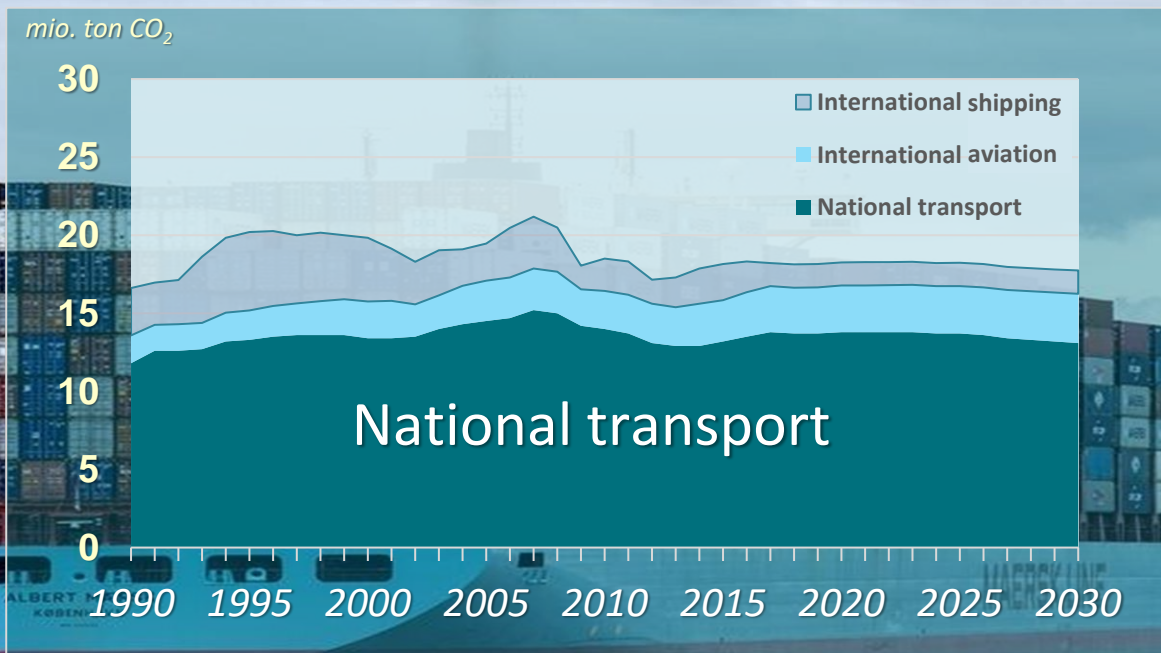


Achieve climate neutrality no later than 2050*

(* the Danish Climate Law of 26 June 2020)



International aviation and shipping are not comprised by national targets

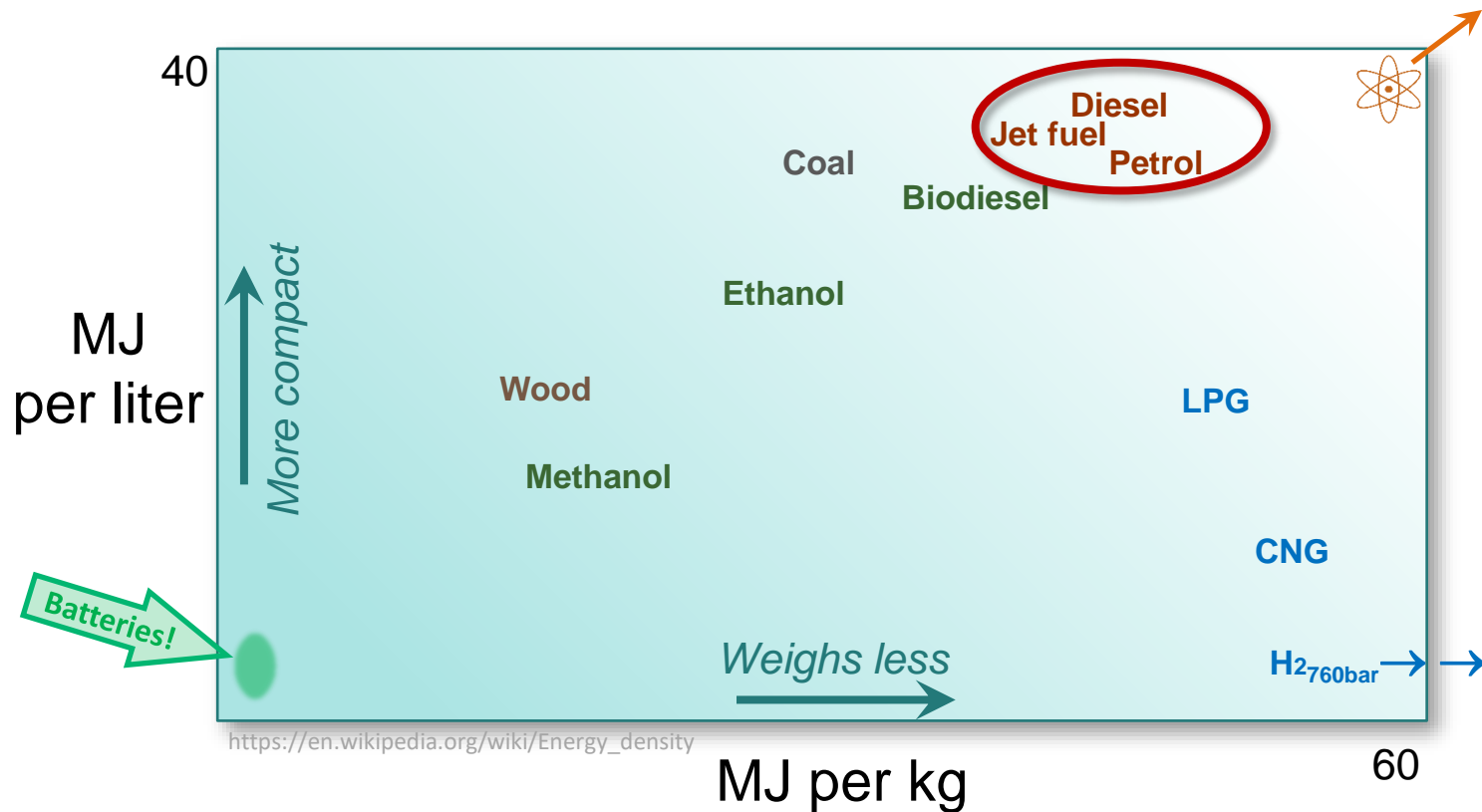


Oil addiction ...



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



- 'Degrowth' (GDP ↓)
- Restrict mobility
(increase price, skip infrastructure improvements)



- 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)

Impact time increases

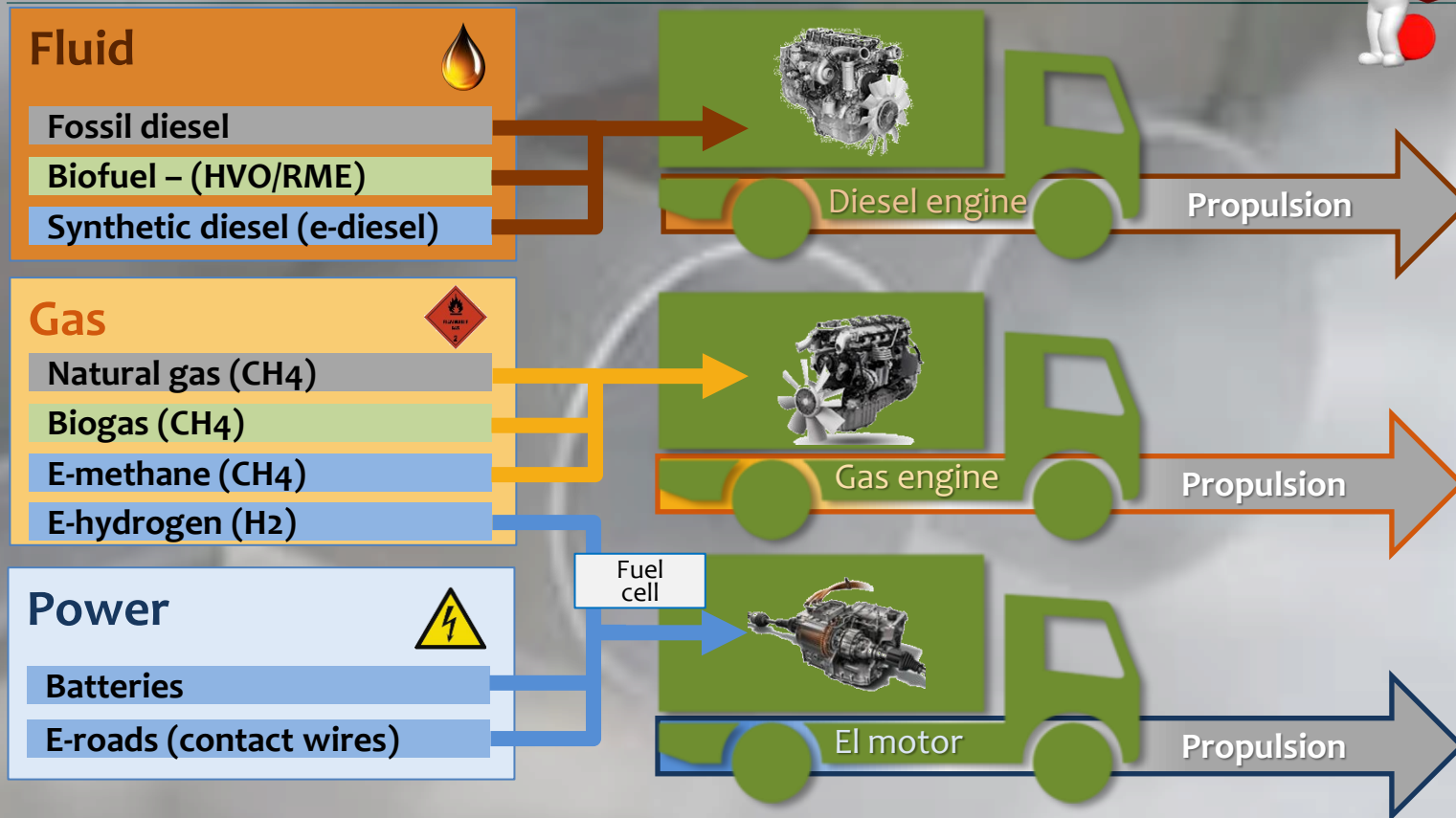
Technology

A close-up, low-angle shot of a car's exhaust system. Two large, dark, cylindrical exhaust pipes are visible, extending from the engine area towards the rear. The background is a bright, overcast sky, creating a high-contrast scene. The overall tone is somber and industrial.

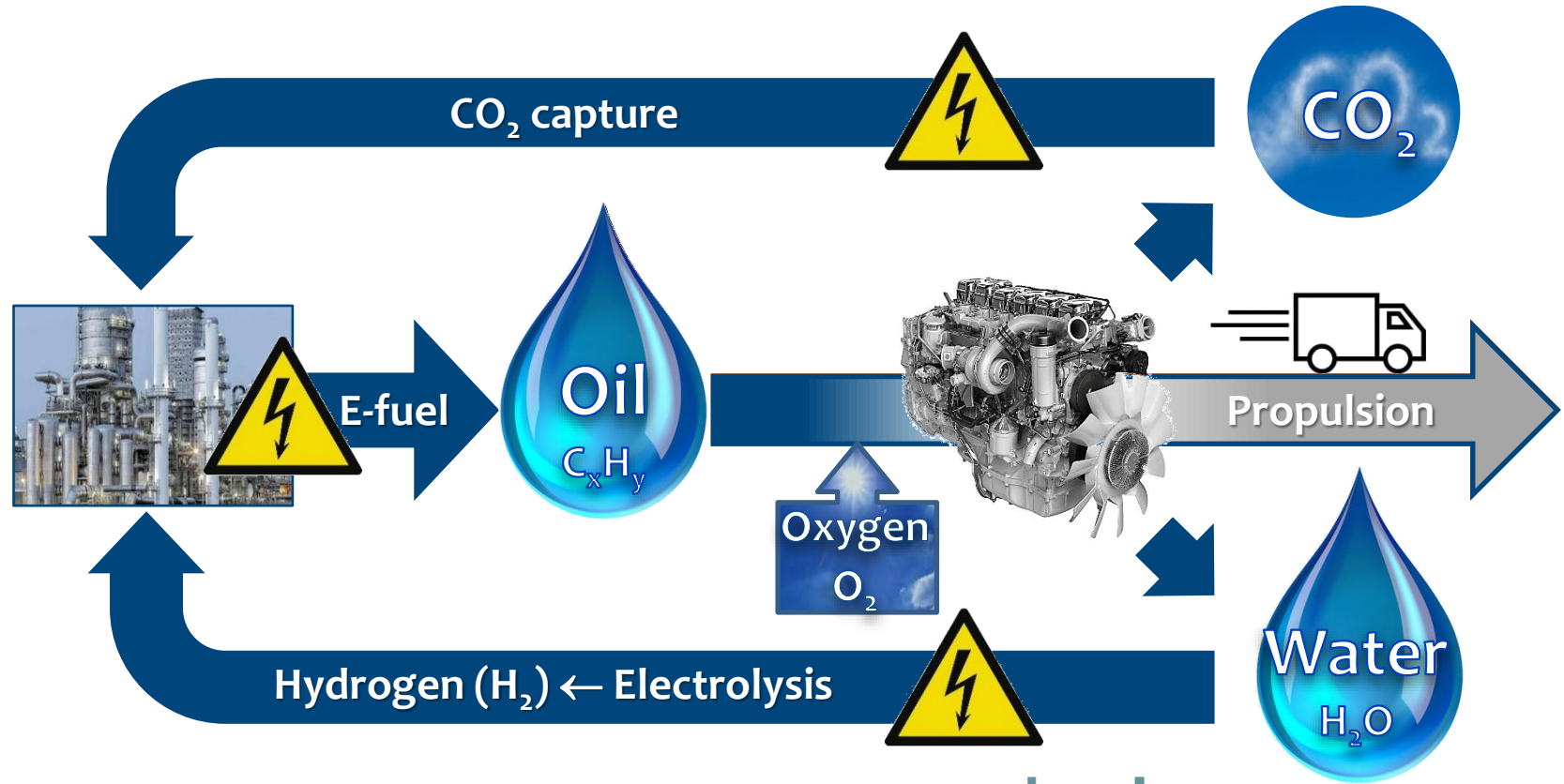
At the end of the day

**We must transform all road transport
to renewable energy**

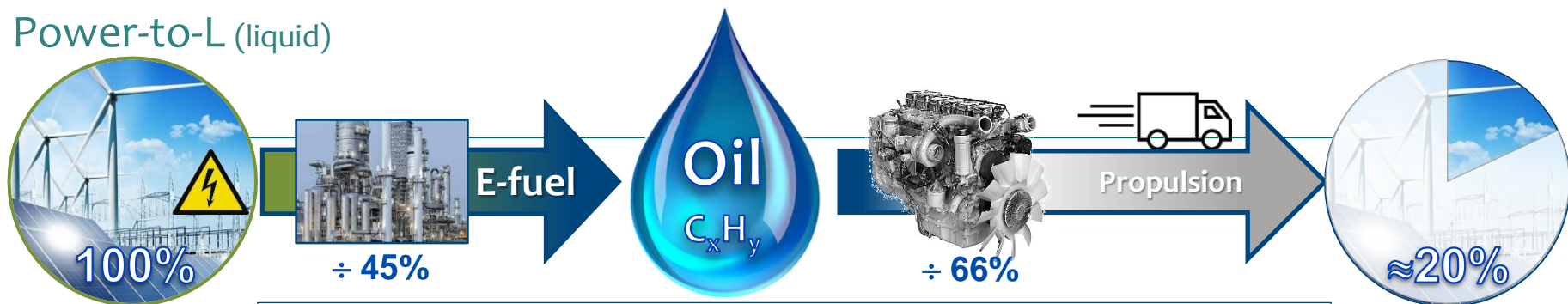
What are the options?



Power-to-Liquid

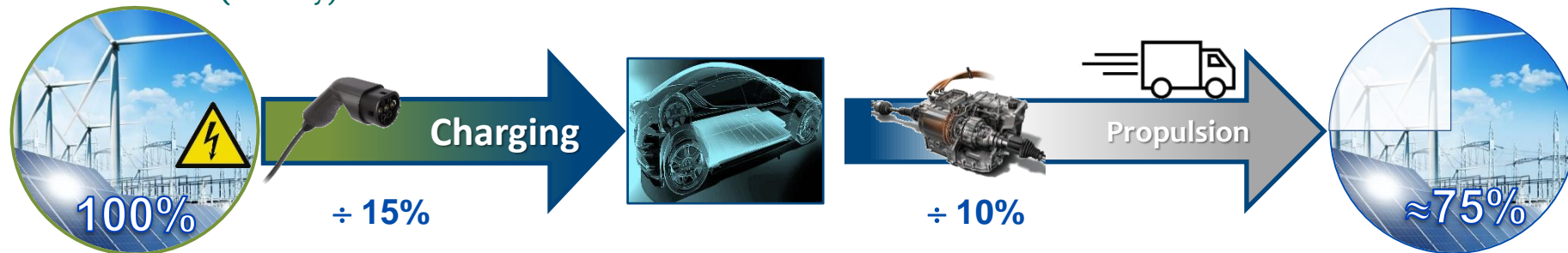


Power-to-L (liquid)



Source: Dansk Energi: Anbefalinger til en P-t-X strategi

Power-to-B (battery)

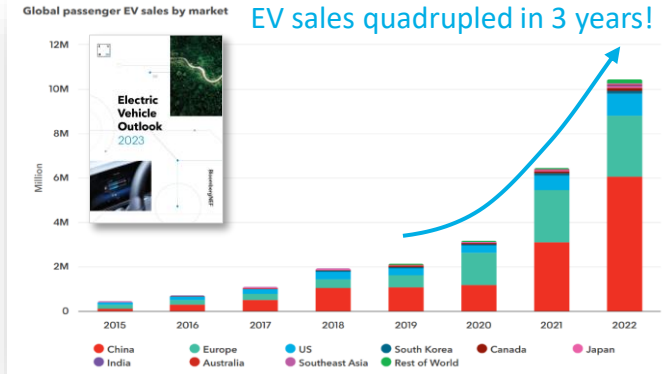
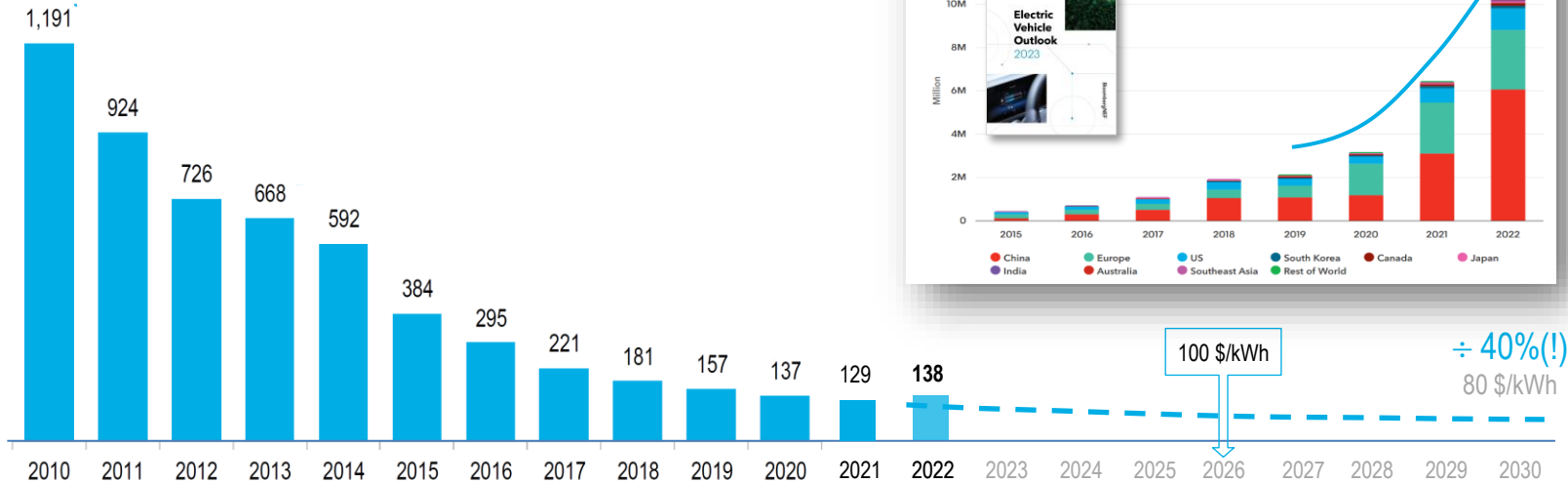


Source for energiefficiencies: Klimarådet: Baggrundsnotat om sektorvurderinger, 2021.

Electrification has the scaling potential

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 and 2022 Lithium-ion Battery Price Survey

Cars and vans will become electric vehicles



Zero emissions



Life cycle analyses for EVs

Klimarådet.

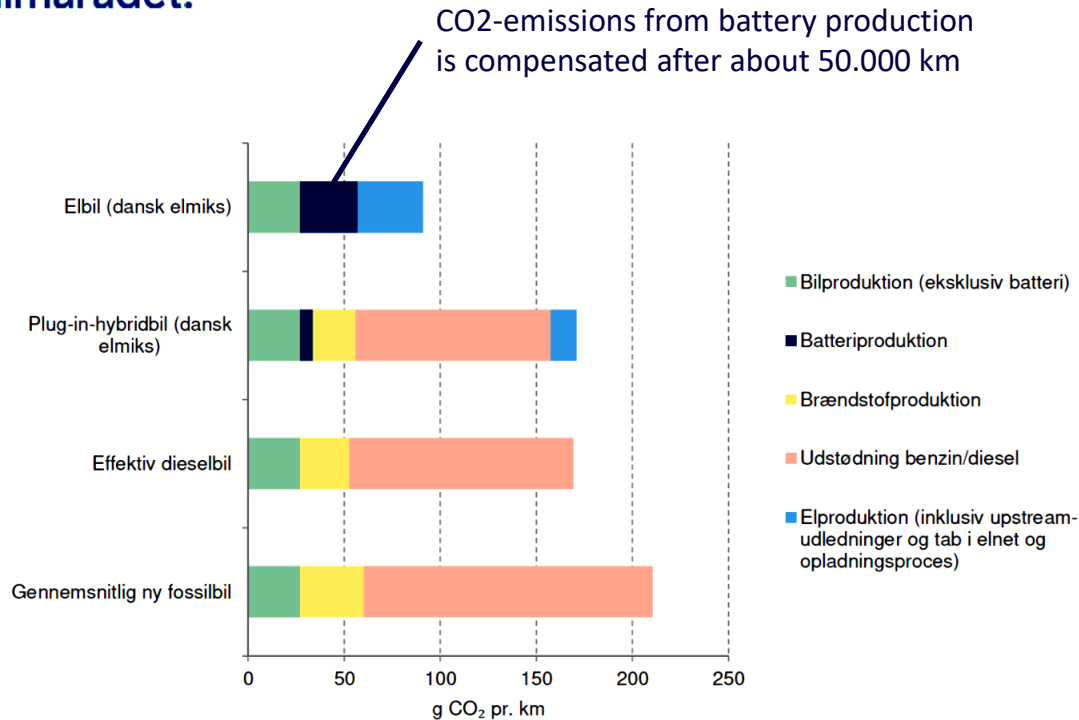


Figure 1: Global CO₂-emissions per km over the lifetime of the car

Klimarådet.

2018

Hvor klimavenlige er elbiler sammenlignet med benzin- og dieselbiler?

Baggrundsnotat til Klimarådets analyse *Flere elbiler på de danske veje*

Indhold

1. Formål og konklusioner	2
2. Elbiler reducerer CO ₂ -udledningen i Danmark	4
3. Livscyklusanalyser kan belyse bilers globale CO ₂ -udledning	5
4. CO ₂ -belastning fra elbiler i dag	9
5. Elbilens CO ₂ -udledning i et fremtidsperspektiv	13
Appendiks: Beskrivelse af de væsentligste beregningforudsætninger	17

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

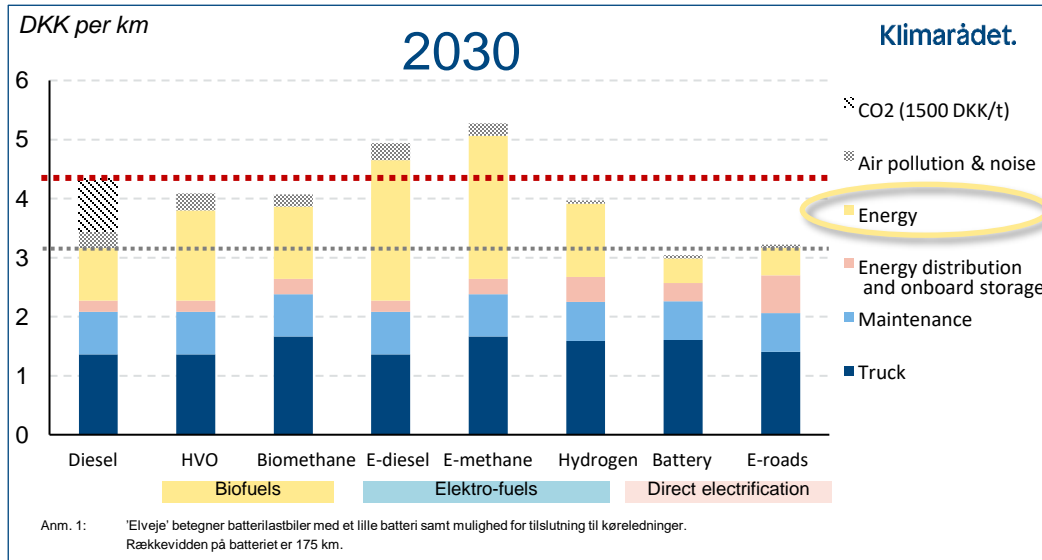
Charging: 2 – 11 hours



Heavy long haul is responsible for the majority of the emissions ... 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

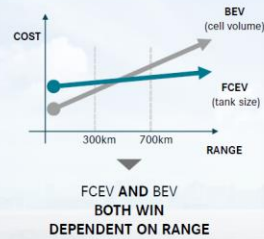
High potential variability in timing – but we are ready for any outcome



ZEV TECHNOLOGY: BOTH BEV AND HYDROGEN WILL BE NEEDED

Three key factors drive our dual strategy

COST PER RANGE:
"THESE LINES MUST CROSS"

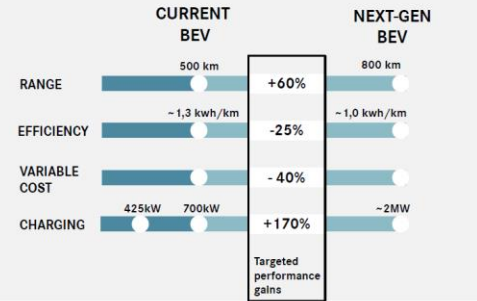


ENERGY DENSITY/CHARGING:
"THESE LINES NEVER CROSS"

GLOBAL ENERGY ECOSYSTEM:
"WILL BE ESTABLISHED ANYWAY"

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

El-lastbiler dækker snart hele paletten af behov

09. OKTOBER 2023 | AF JESPER TORNBJERG



Mikael Voigt, der har ansvaret for e-Mobility og PR i Hessel Trucks/Mercedes-Benz Trucks, og seniorchefkonsulent Søren Jakobsen fra Dansk e-Mobilitet er enige: Elektricitet er vejen frem for det meste af Europas vejtransport. Foto fra Technomania: Jesper Tornbjerg.

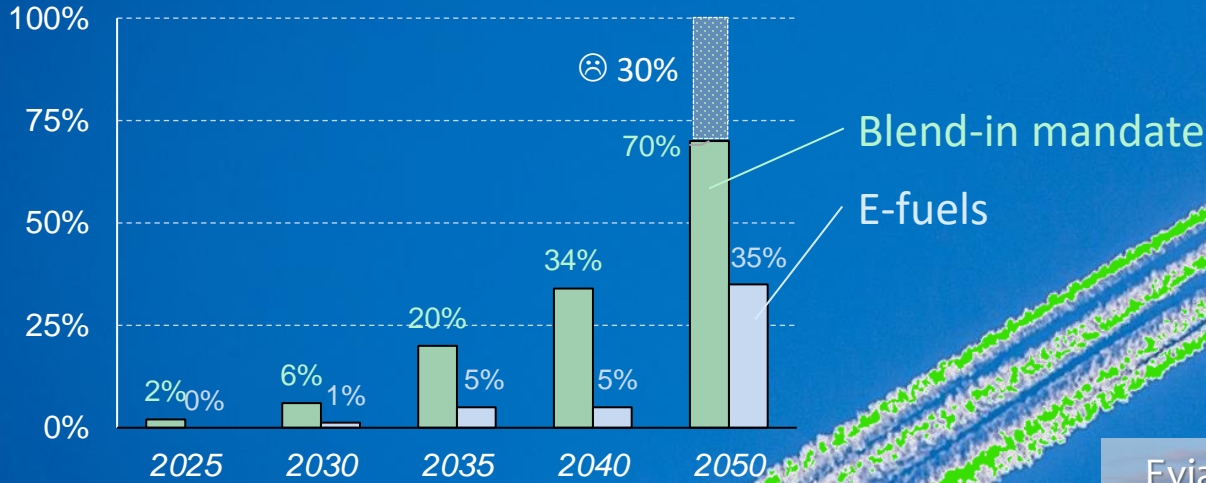
Mercedes-Benz lancerer lastvogns-trækker drevet af elektricitet, så nu nærmer den tyske producent af trucks sig et fuldt sortiment. Samtidig kan vognmænd se frem til noget, der minder om et landsdækkende netværk af offentlige ladestationer inden for få år.

<https://danskemobilitet.dk/nyheder/el-lastbiler-daekker-snart-hele-paletten-behov>

Green fuels for long distances



ReFuelEU Aviation




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



Source: TechCrunch 28.Sep-2022

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
– on of the world's very few non-retreating glaciers ...*

Photo: © Niels Buus Kristensen

Niels Buus Kristensen

nielsbuuskristensen@toi.no



Transportøkonomisk institutt
Stiftelsen Norsk senter for samferdselsforskning

Klimarådet.