

# Pathways to sustainable inland waterway transport

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How to achieve 100% sustainable mobility?

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Wien

# Agenda

- Political background
- Technology paths in inland navigation
- Technology applications
- viadonau towards “zero emissions”
- Conclusions

# Political background

## European Green Deal

- EU climate neutral by 2050

## Fit for 55 (Plan for a green transition)

- Emission reduction by 55% by 2030 (compared to 1990)

## Taxonomy

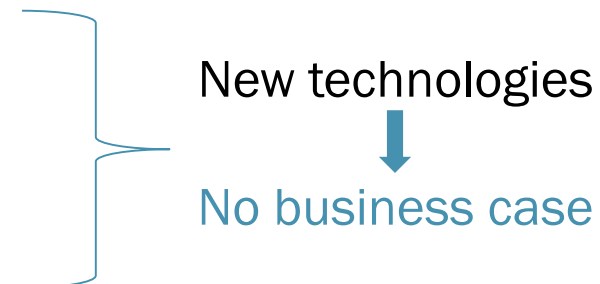
- Gradual emission reduction of GHG to 0%

## Mobility Master Plan 2030, Action Programme Danube 2030

- Climate neutrality of transport sector by 2040

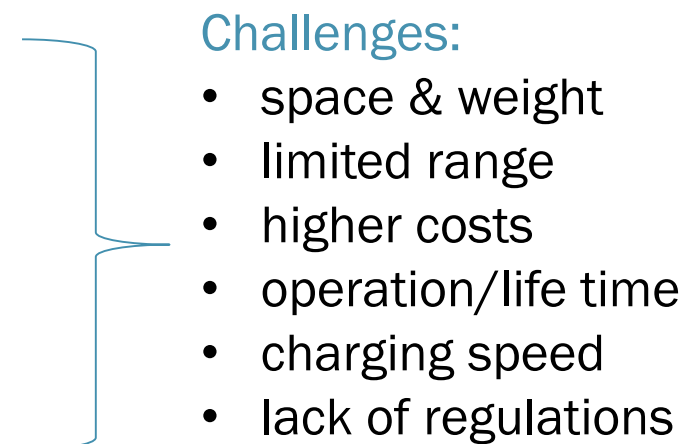
# New technologies - Challenges

- Gasoil as fuel → reduced OPEX
- Ship often depreciated → hardly any CAPEX
- Long life and economic situation → only few newbuildings



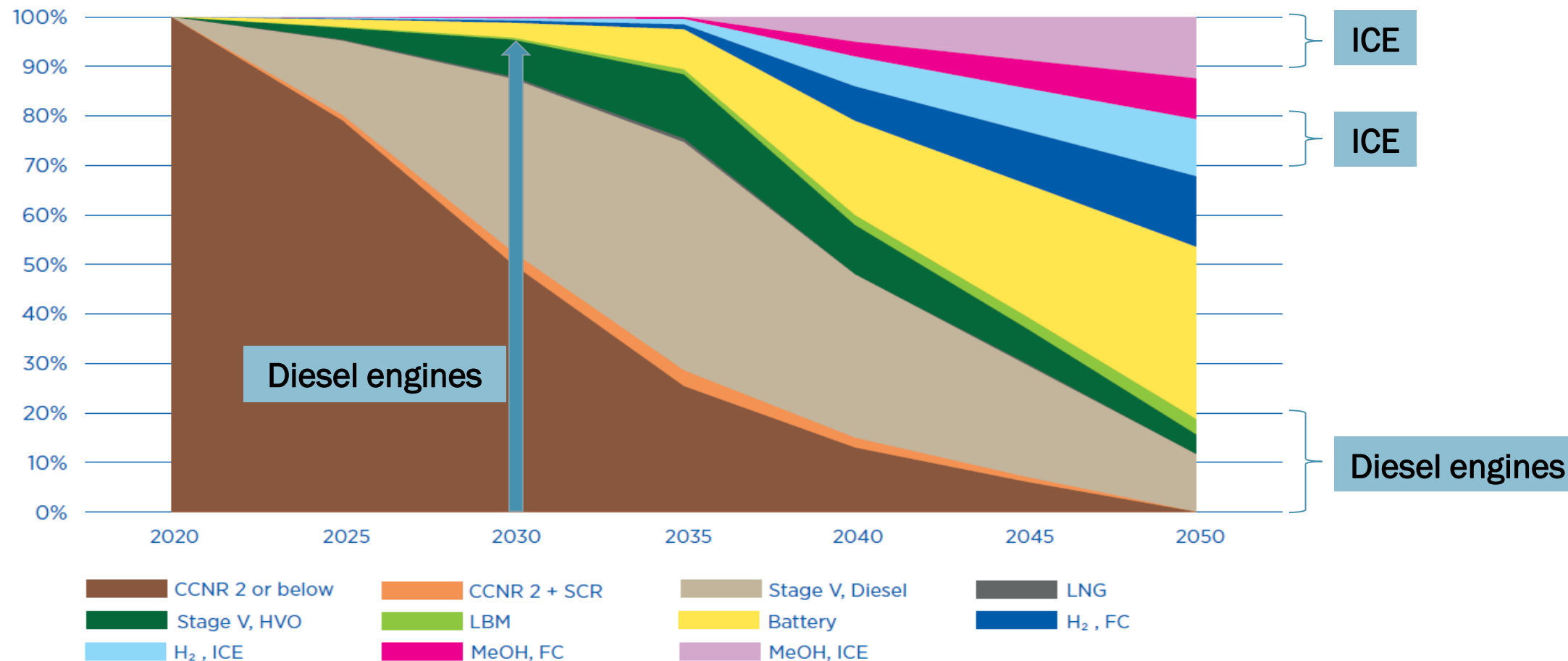
## Danube Navigation:

- Long distances (600 km and more)
- Operational mode: 14/18/24 hours/day
- High propulsion power and fuel consumption
- Lack of infrastructure for alternative fuels



# Development of technologies by 2050

Innovative transition pathway, CCNR Study 2021



Source: CCNR Roadmap for reducing inland navigation emissions, March 2022

# Technology application – Bio fuels

## MS For-Ever (HVO)

- Inland container vessel, built 2012
- L, B = 90m x 11m
- HVO – used cooking oil (Bio-Fuel Oil MR1-100)
- Supplier – Good Fuels
- CO2 Reduction – 90%



www.goodfuels.com

Bio  
Fuels

## Island Crusader (LBG)

- Offshore supply vessel, built 2022
- L,B = 96m x 20m
- Biogas – Supplier: Gasum
- Consumption (2 months): 128 t LBG instead of 124t LNG & 24 t MGO
- CO2 Emission reduction: 372t



www.islandoffshore.com

# Technology application - Hydrogen

## H2 Barge 1 (FC)

- Inland container vessel, retrofit 2023
- L, B = 109,8m x 11,4m
- FC 3 x 275kW, H<sub>2</sub>-Tanks: 2 x 500kg, Batteries 504kWh
- Subsidies: RVO, ZEM Ports NS, Port of Rotterdam
- Operational area - NL - BE
- 2.000t CO<sub>2</sub> yearly

H<sub>2</sub>



www.futureproofshipping.com

## Hydrocat 48 (DF ICE)

- Offshore service boat, retrofit 2022
- L,B = 23m x 7m, capacity 26 Persons + crew
- 2 x 749kW MAN D2862 - H<sub>2</sub>-DF-Engines, 207kg H<sub>2</sub>
- Hydrogen Awards 2023 Marine Category
- CO<sub>2</sub> Reduction - 80%

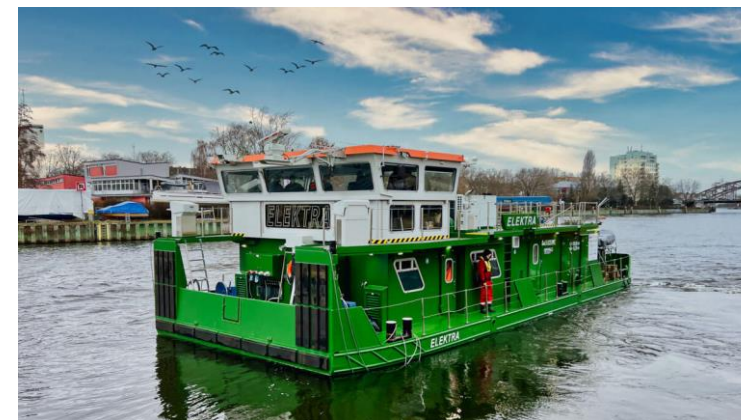
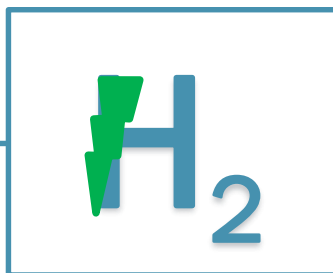


www.cmb.tech

# Technology application – H<sub>2</sub> Hybrid

## Elektra

- Pusher - Electric propulsion 400kW
- FC 3x100kW, Batteries 2.500 kWh
- Range 400km: full electric – 65km (8h) / FC 340km
- Charging time 7 Std.
- CAPEX: 13mil EUR vs. 2mil. EUR



www.argo-anleg.de

## MS Antoine

- Motor cargo vessel, newbuilding 2023
- L,B = 135m x 11,45m
- FC 360kW, Batteries 1.100kWh
- Range – electric 6h, Delfzijl (NL)– Rotterdam (NL)
- CAPEX: 10mil. EUR (4mil. EUR subsidies)
- 880t CO<sub>2</sub> yearly



Source: Lenten Scheepvaart B.V



# Technology application - Methanol

## SMA Pilot Boat SE120 (ICE)

- Pilot boat Swedish Maritime Authority
- L, B = 14,4m x 4,6m
- MD97 DF CH<sub>3</sub>OH Engine 415kW
- Emissions reduction: NO<sub>x</sub> by 75%,  
zero SO<sub>x</sub> & PM
- zero Netto-CO<sub>2</sub> (green Methanol)

CH<sub>3</sub>-OH



<http://www.scandinavaos.com/>

## MS Innogy (FC)

- Day trip boat
- L, B, T = 29m x 4,8m x 0,55m
- Diesel engine 247kW
- FC 35kW – Range extender + Batteries 100kWh
- Autonomy 1 day – Retrofit costs: 2mil EUR
- Subsidies: „Grüne Hauptstadt Europas – Essen 2017“

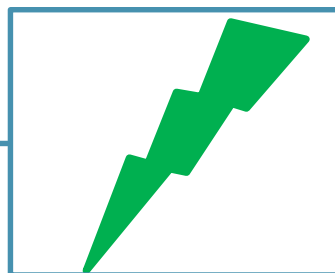


[www.maritime-executive.com](http://www.maritime-executive.com)

# Technology application - batteries

## Kotug E-Pusher 1

- Pusher tug, operational 2023
- L, B, T = 16m x 7,6m x 1,35m
- 2 x 300kWh electric azipods
- „Pay-As-You-Go“ swappable batteries - PwrSwäp
- Range: Amsterdam - Zaandam
- 190t CO<sub>2</sub> yearly



www.kotug.com

## ZEETUG Gisas Power

- Harbour tug
- L,B,T = 18,7m x 6,7m x 3,5m
- Electric engines 2 x 925kW
- Batteries 2 x 1.423kWh
- Charging time 1 hour - Range 5,3 hours
- Yearly reduction: 9t NO<sub>x</sub>, 213t CO<sub>2</sub> 76.668l gasoil



www.zeetug.com

# viadonau towards „zero emissions“ (1)

- New pushboat (FAIRway works)
- $L_{OA} = 22,15$  m,  $B_{OA} = 5,60$  m,  $T = 1,2$  m
- 2 x Scania D09 313A, 257 kW, 2100 rpm  
EU Stage V (SCR and DPF)
- Engine suitable for HVO as fuel  
 ↳ CO<sub>2</sub> Reduction up to 90 %
- Ducted propeller, consumption measurement,  
Exhaust heat recovery → High efficiency



# viadonau towards „zero emissions“(2)

Numerous projects

## SYNERGETICS

- ▶ 100+ Pilots (H<sub>2</sub>, Methanol)
- ▶ H<sub>2</sub> in ICE
- ▶ Methanol in ICE
- ▶ Hydrodynamic optimisation
- ▶ Hybrid drives and power management

[www.synergetics-project.eu](http://www.synergetics-project.eu)



# Conclusions

- Policy framework → **climate neutrality** by 2050
- Inland Waterway Transportation → **major challenges**
- Technology development → pilots & demonstrators → **new solutions** available
- Energy demand and operating profile determine the use
- „One shoe fits all“ solution - very unlikely
- Different solutions for different applications

# Thank you for your attention!

## Contact



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