



Zero-emission logistics
with
uncrewed inland waterway barges and short sea vessels

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Navigating the Future of European Waters with Autonomous Innovation

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These projects have received funding from the European Union's Horizon 2020 research and innovation programme under grant agreements N° 815012, 859992, 861678.

ZULU Associates



ZULU Associates Group is active as an initiator, developer and operator of innovations in the marine component of logistic chains.

Its goal is to enable **zero emission** operation of commercial vessels on short sea, coastal and inland waterways routes through **autonomous operation** and **alternative propulsion**.

ZULU Associates participated in AUTOSHIP.

ZULU Associates developed the innovative ZULU or Pallet Shuttle Barge for European waterways and is now developing autonomous barges as well as short sea vessels.

Uncrewed



- All systems (not limited to navigation) on vessel operate without crew on board during passage.
- Autonomous operation equipment on vessel for present waterway/maritime infrastructure.
- Remote Control Centres (RCC) in contact as required for monitoring and control.
- Autonomous equipment capable of situational awareness and complexity analysis (levels) as well as decision making (AI).
- Situational awareness and complexity communicated from vessel to RCC.
- RCC intervention in steps pending on operational situation & need for intervention.
- Data gathering for multiple purposes including AI development & improvement.



Challenges for IWT and SSS

- Sustainability
- Modal Shift
- Crew shortages

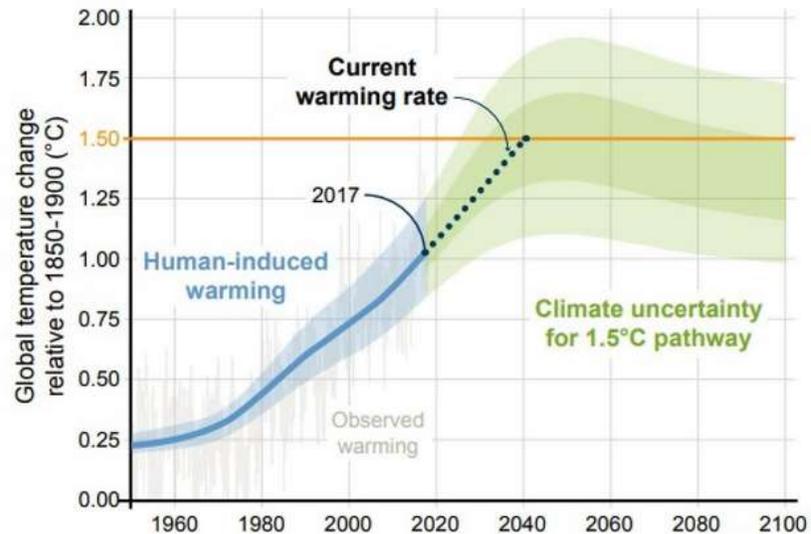


Sustainability



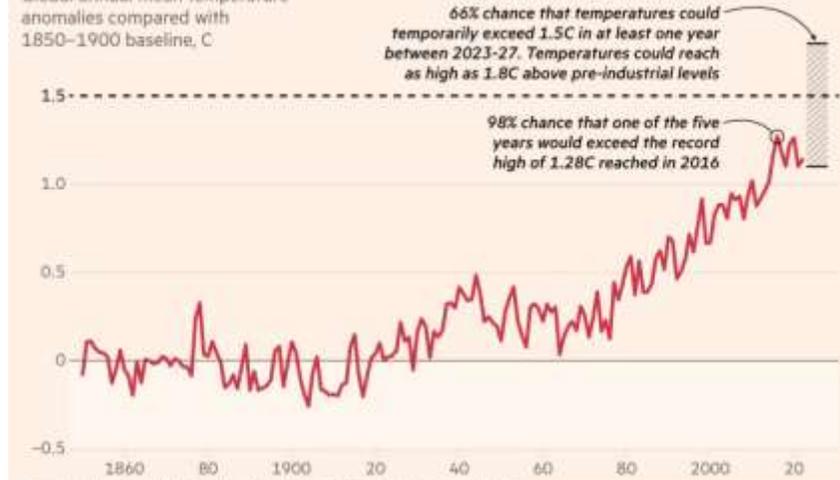
FAQ1.2: How close are we to 1.5°C?

Human-induced warming reached approximately 1°C above pre-industrial levels in 2017



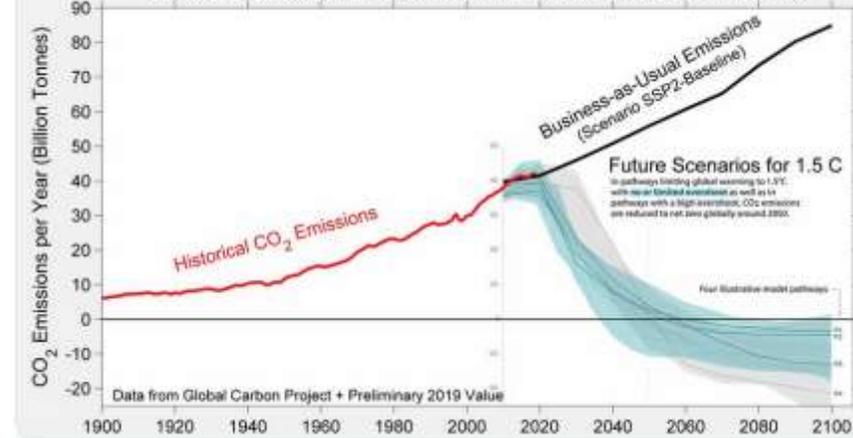
Global warming likely to temporarily exceed 1.5C in one of next five years

Global annual mean temperature anomalies compared with 1850-1900 baseline, C

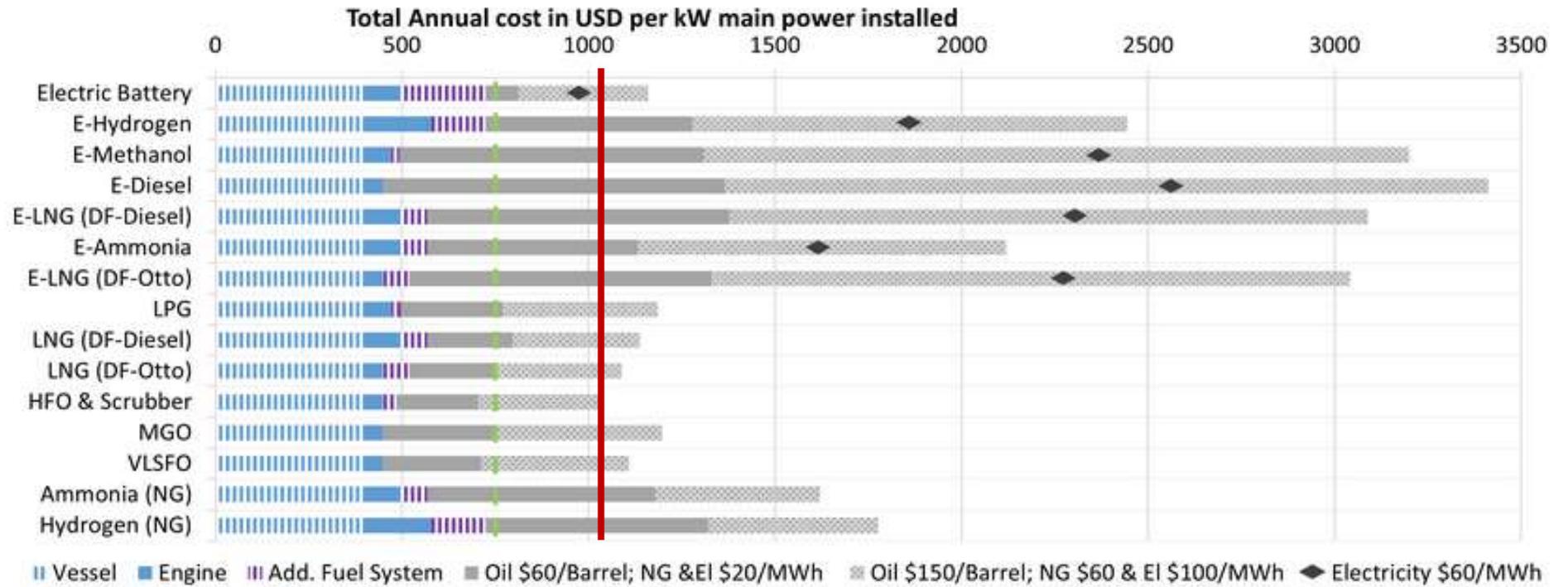


Anomaly is based on WMO analysis of the HadCRUT5 dataset Source: WMO © FT

Carbon Dioxide Emission Scenarios for 1.5 C of Warming



Reducing emissions from Shipping: issue the price handicap vs fossil fuel



<https://blog.sintef.com/sintefocean/zero-carbon-e-fuels-are-they-sustainable-for-maritime-transport/>





Reducing emissions from Shipping: change the economic model

OPEX

Increase energy efficiency of hull to reduce energy needs/costs - energy is new KPI

Reduce maintenance needs

Uncrew the vessel

No safety equipment for crew (SOLAS)

Reduction of human errors/risks

CAPEX

Simplify vessel and equipment

No crew accommodation

No safety equipment for crew (SOLAS)

Build (very) standardised

INCOME

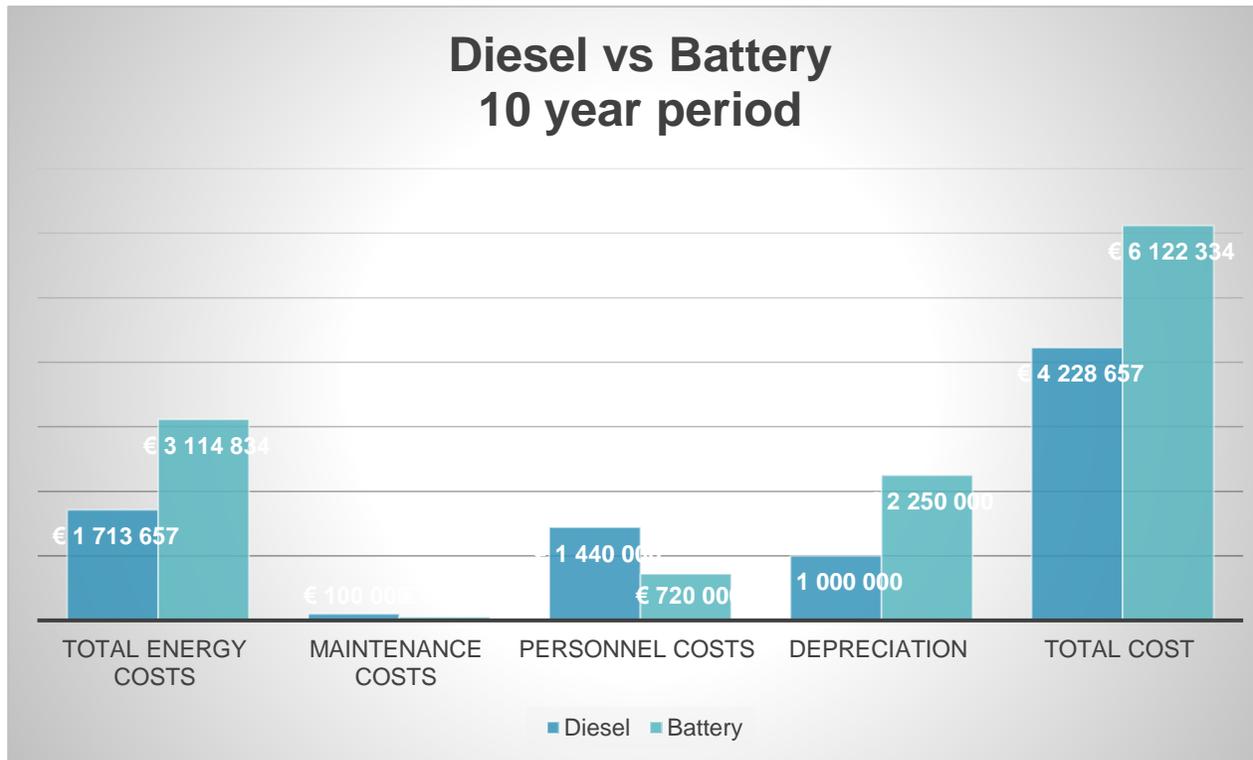
Extend operational hours

Increase operational efficiency through cargo flow digitalisation & sailing plan



Economics

Example of existing manned 120 TEU diesel barge vs autonomous 90 TEU battery powered barge

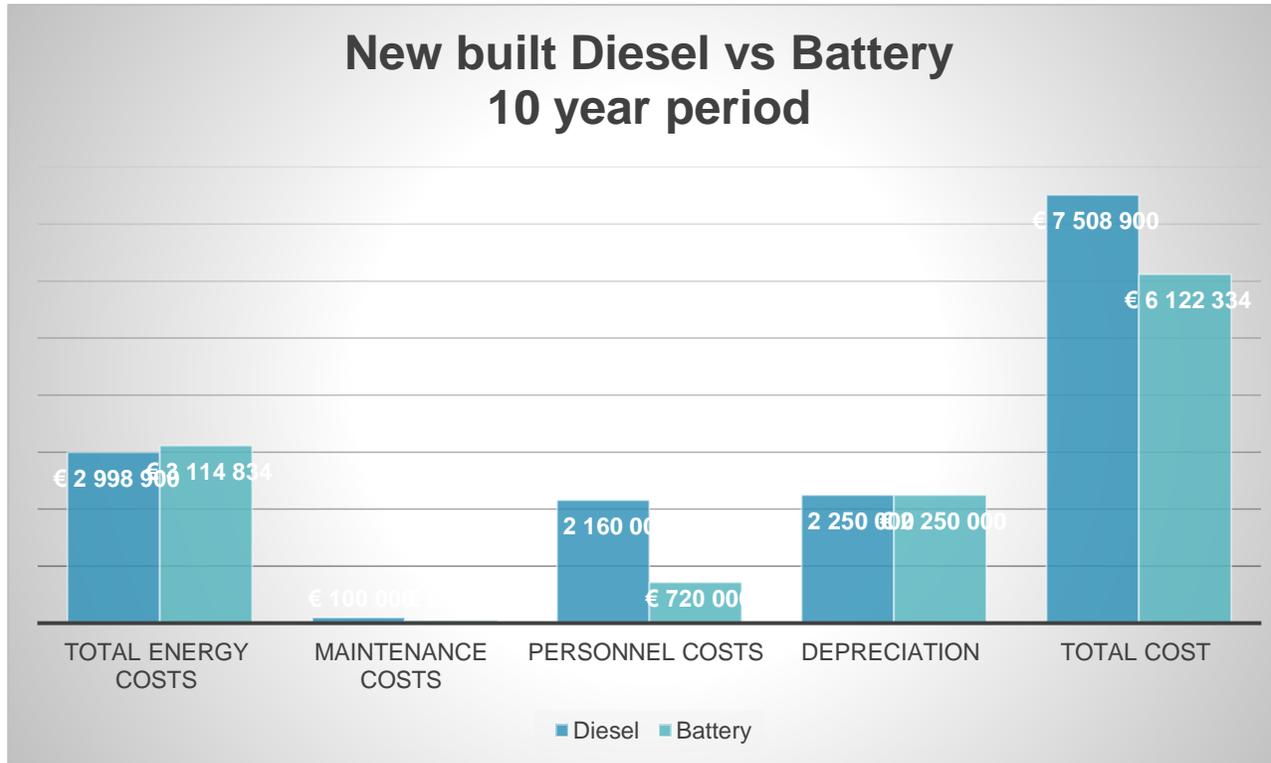


Because the autonomous barge operates 24/24, it sails 60 hrs a week and moves 491,400 TEU vs 36 hrs and 280,800 TEU moved for the manned diesel barge.

The cost per TEU is € 12,46 for the autonomous barge and € 15,06 for the manned barge.

Economics

Example of newly built traditional manned 120 TEU diesel barge vs autonomous 90 TEU new concept battery powered barge



When a new built diesel barge is considered operating 24/24 then the battery barge has a lower overall cost.

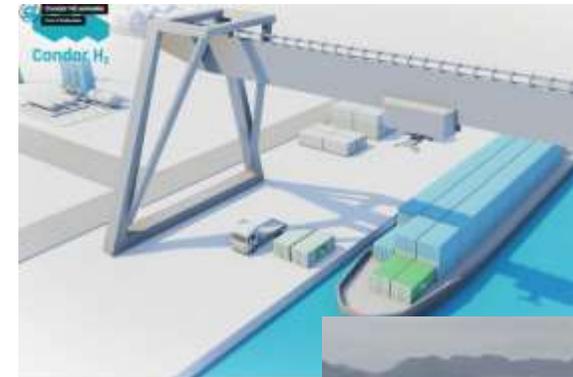
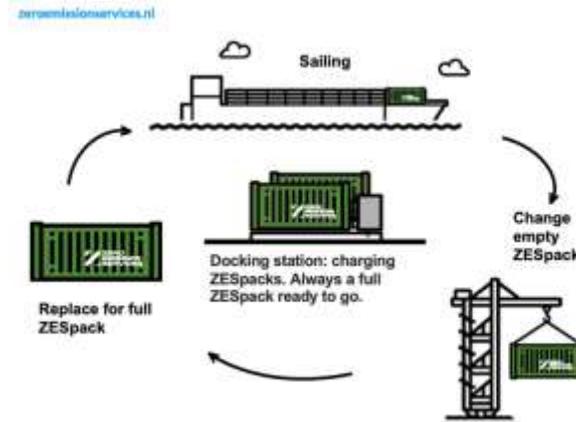
The cost per TEU is € 12,46 for the autonomous barge and € 15,28 for the manned barge.

Reducing emissions from Shipping: availability alternative energy carriers



Batteries

Hydrogen



Reducing emissions from Shipping: availability alternative propulsion



Wind

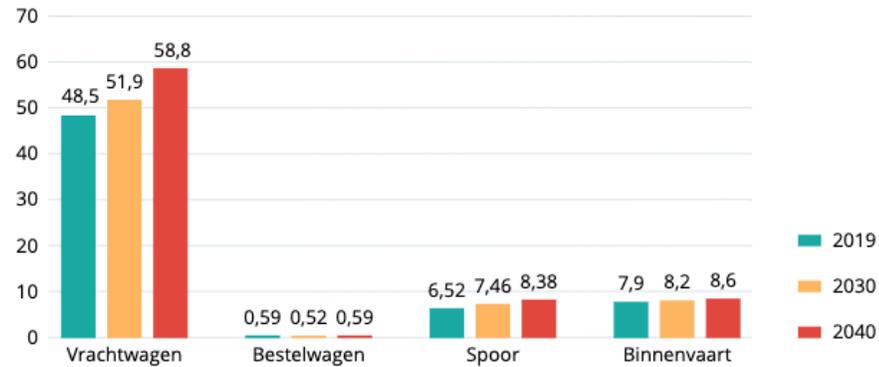
Foils



Modal Shift: Inland



Figuur 14: Evolutie van de vervoersvraag in het goederenvervoer per modus (miljard tonkm)



Bron: Federaal Planbureau



VS



Modal Shift: Short Sea



→ Congestion
Energy availability
Land occupation

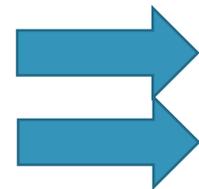




Modal Shift

To have a successful Modal Shift, the total alternative logistic chain needs to be:

- Price Competitive
- Time Competitive
- Sustainable
- Cargo flow digitalisation is key
- Vessel size becomes a function of distance, vessel and cargo handling, terminal equipment, terminal size, multimodal access to the terminal.



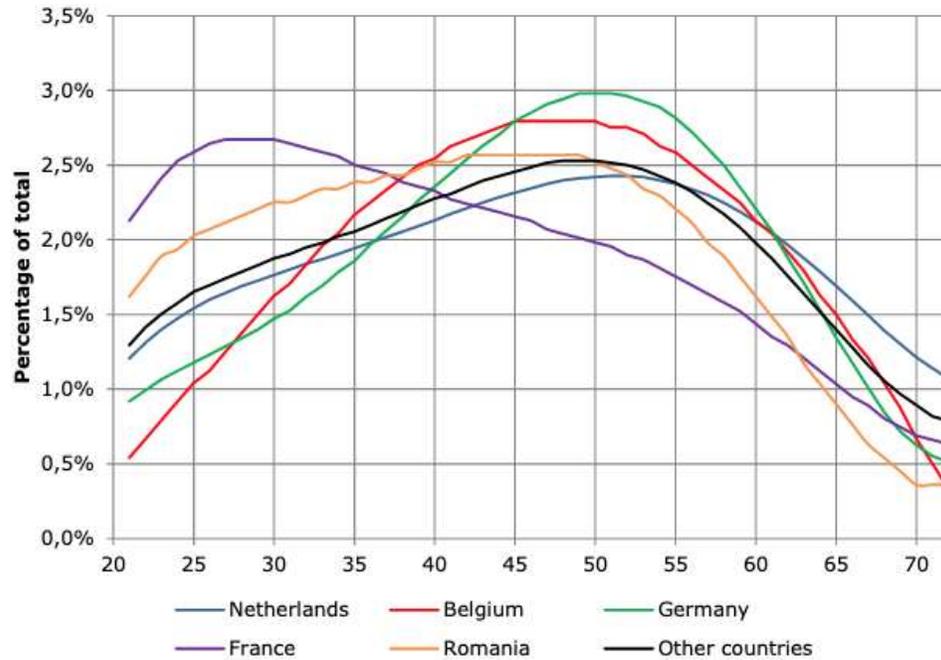
Big is no longer the paradigm

Energy issue becomes manageable

Crew Shortages/Safety



Figure 6.3 Age distributions for the five countries with most workers in IWT for 2013



Source: Panteia (2013) based on data from ITB and Ecorys (2013)



Autonomy/Digitalisation : Other Benefits



- Adherence to sailplan resulting in:
 - more efficient vessel operation & energy use
 - more efficient use of infrastructures
 - more efficient logistic chain
 - Flow data used for efficient handling of cargo
 - Reduction human error
 - Better predictability of risks
 - Most expensive asset not on board
 - Size becomes irrelevant
- } lower insurance premiums



Conclusions





Zero emission logistics with IWT and SSS is feasible, when it is economically competitive:

- Efficient hull design
- Uncrewed operation
- Availability of energy carriers
- Increased logistic efficiencies

➔ Redesign of logistic chains: not remaining with existing logistic chains and paradigms

Alternative propulsion will need a holistic approach: vessel and energy infrastructure



Thank you

Rotterdam Ahoy
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