POTENTIAL FOR HYBRID AND BATTERY ELECTRIC PROPULSION SYSTEMS FOR A SELECTED FLEET OF INLAND WATERWAY VESSELS IN GERMANY

25th DNV Nordic Maritime Universities Workshop

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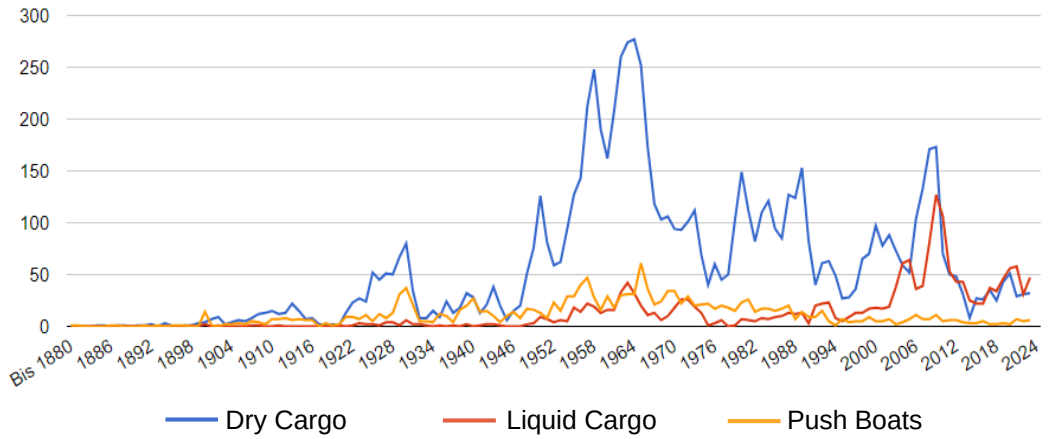
DLR

Motivation

- IWW among the most sustainable forms of transport

  → 1 vessel replaces up to 500 trucks
- Average vessel is >60 years old
- 95 % use diesel engines

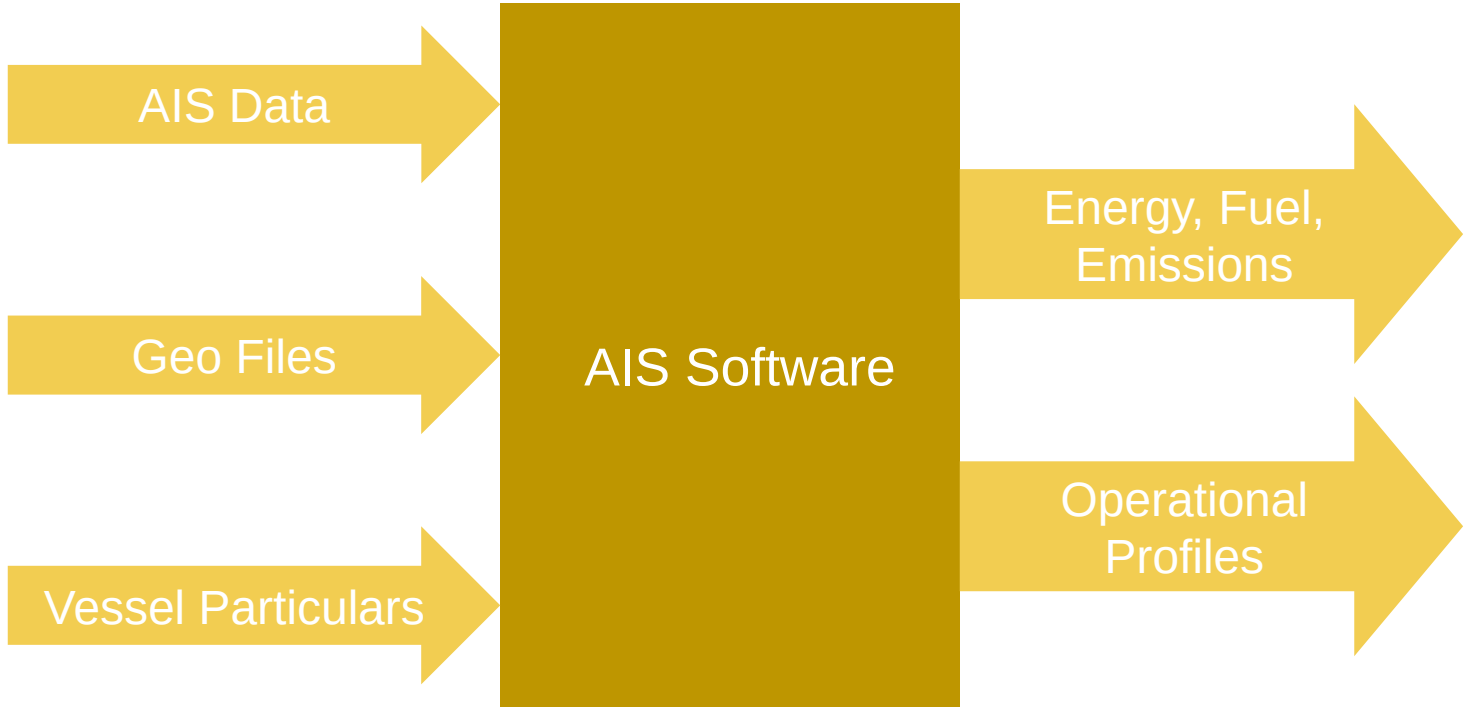


Source: ZKR 2024

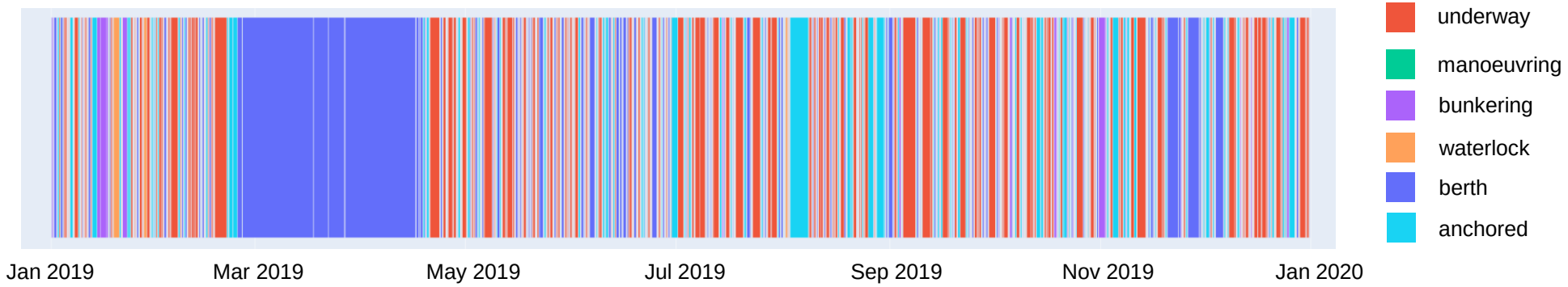
→ Batteries may be suitable due to short trips and frequent charging opportunities
→ IWW transport struggles to compete in terms of level of service & flexibility

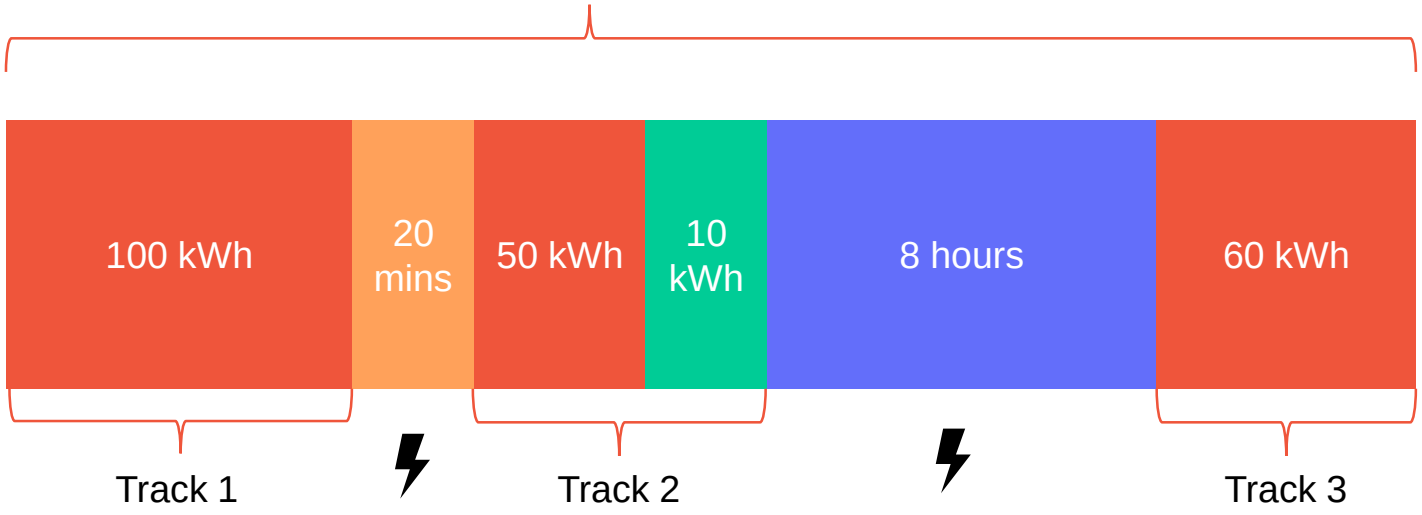
METHODS

Methods – AIS Data

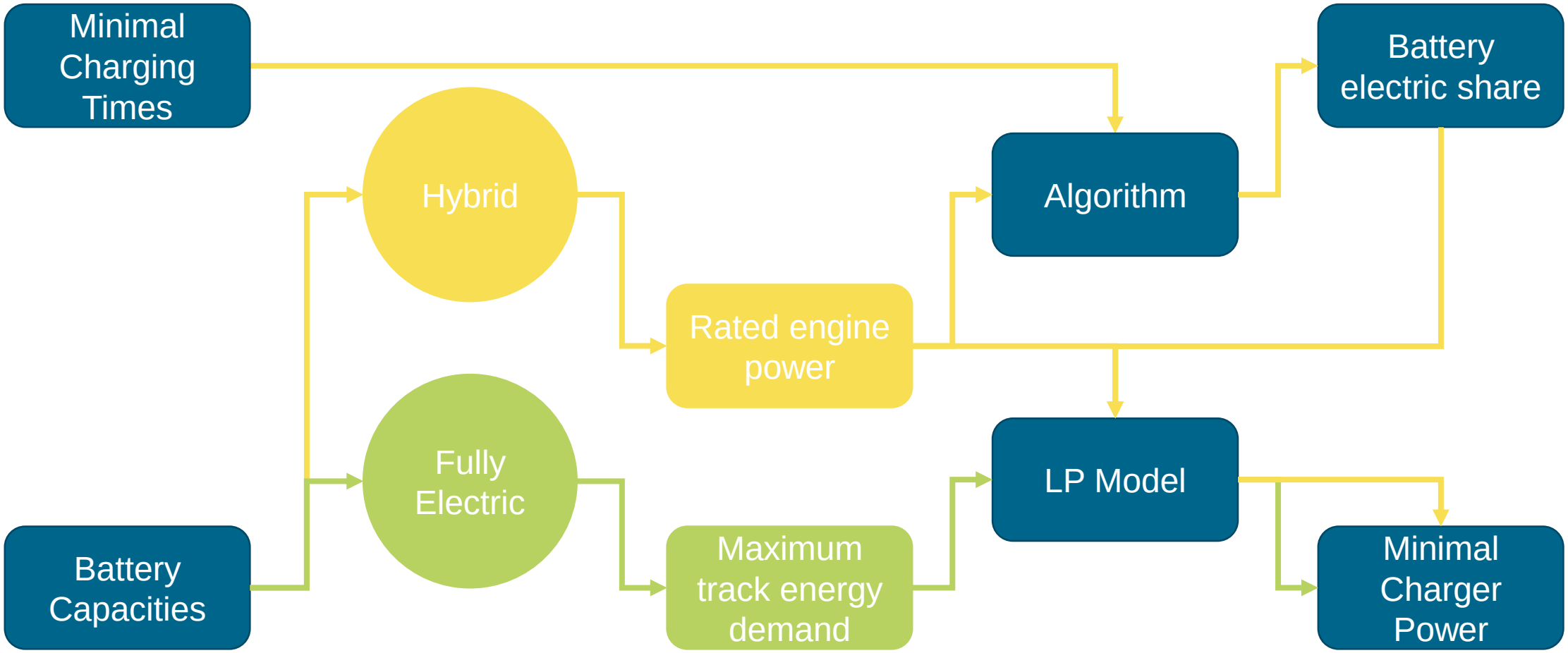


Methods – AIS Data – Operational Profiles



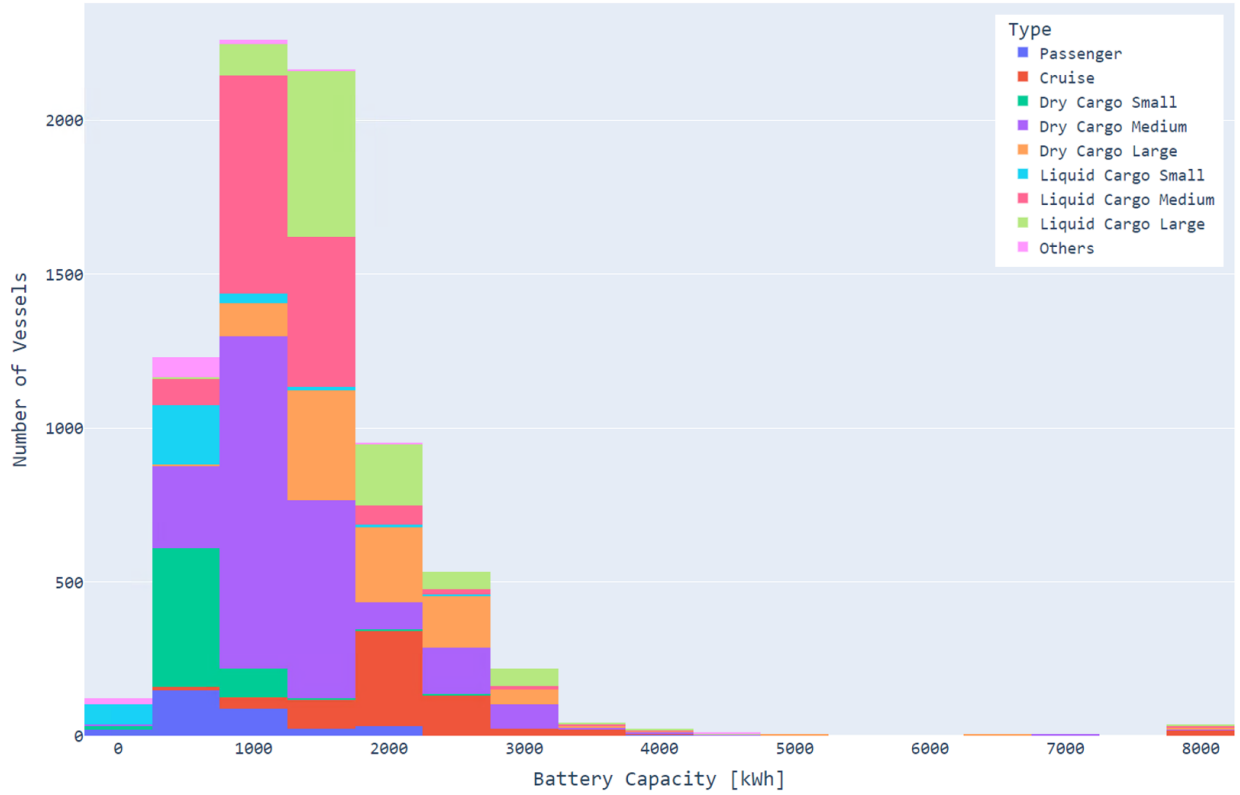


Methods – Deriving electrification potentials



Results – Hybrid Propulsion Assumptions

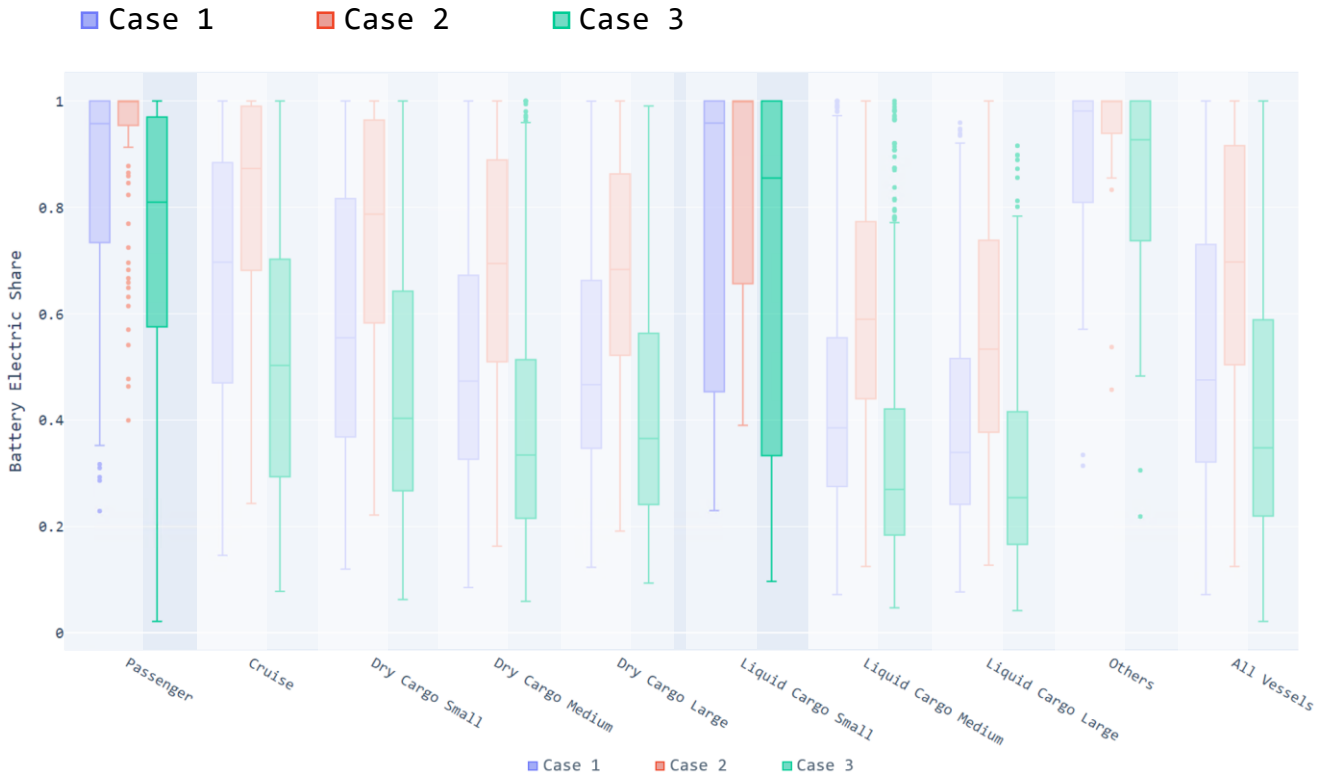
	Case 1	Case 2	Case 3
Battery Capacity (Max Operating time at rated power)	1 hour	2 hours	1 hour
Min Charger Time	10 mins	10 mins	60 mins



RESULTS

Results – Hybrid Propulsion

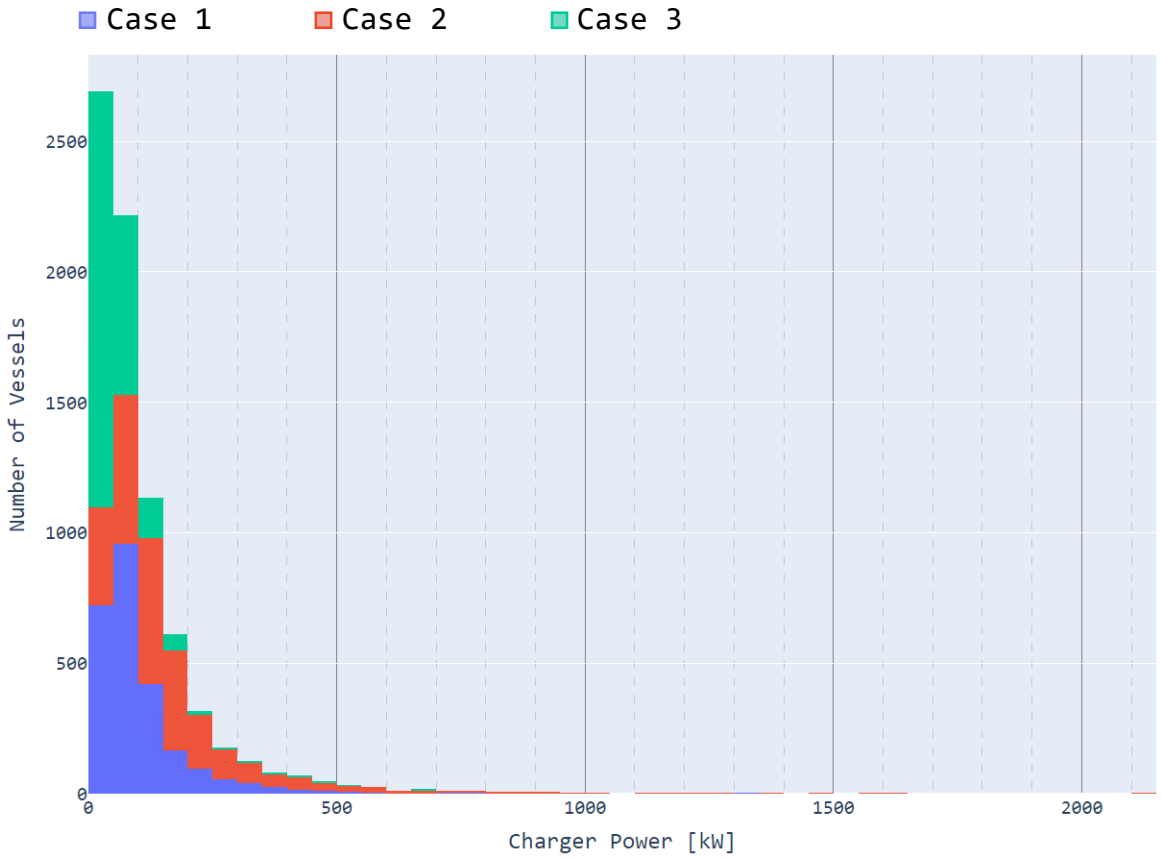
- Median El. shares between 35 – 70%
- Passenger Vessels & small tankers exhibit the best potentials
- Sharp decrease in case 3 due to water locks



→ Hybrid Propulsion Systems could reduce tank-to-wake CO_2 emissions by 26 – 52%

Results – Hybrid Propulsion

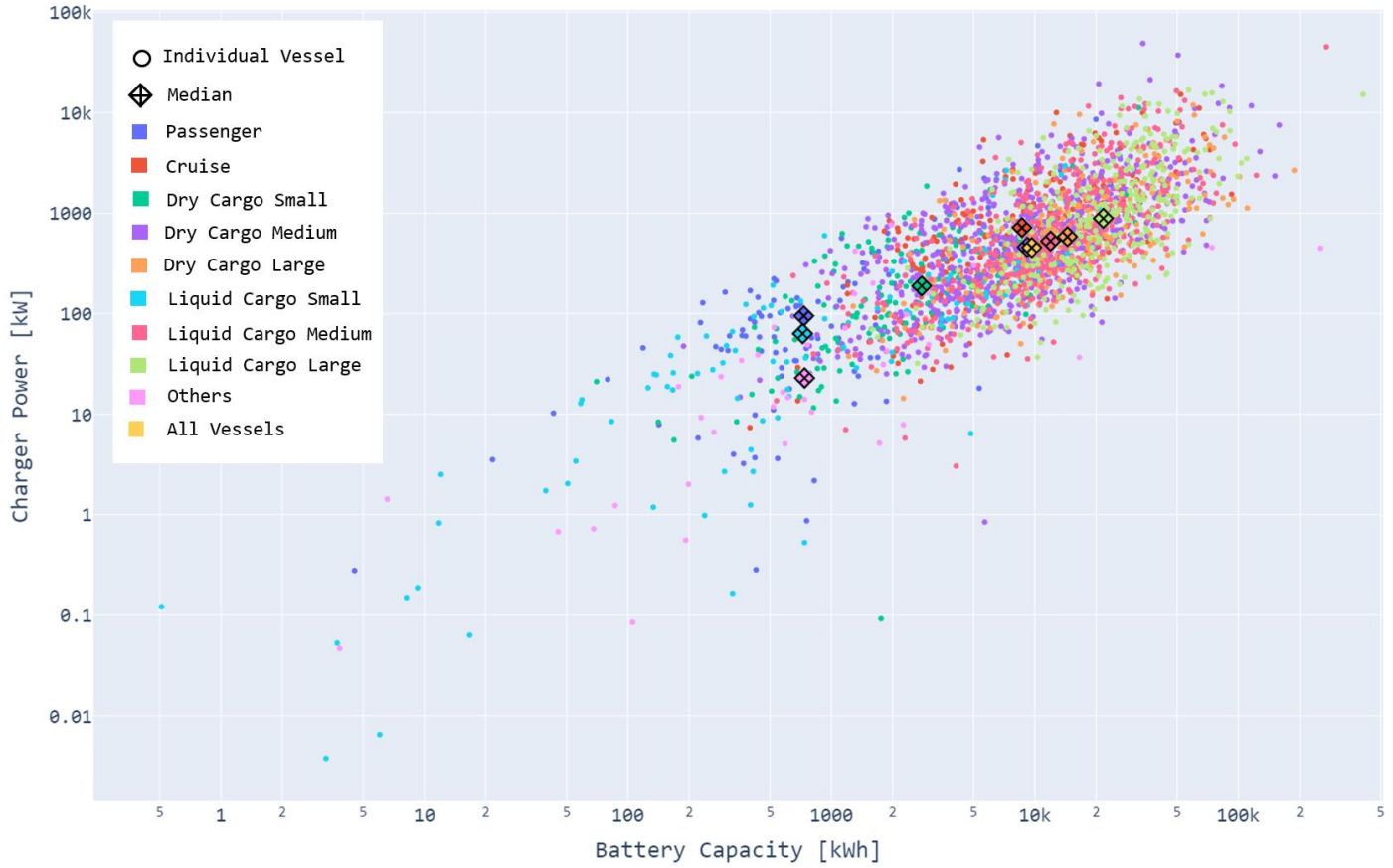
- Electric shares of total energy demand achievable with 100 – 200 kW for most vessels
- Similar power range to road vehicles



→ Intermodal charging stations (e.g. for trucks and IWW vessels) to mitigate economic risk may be feasible

Results – Fully Electric Propulsion

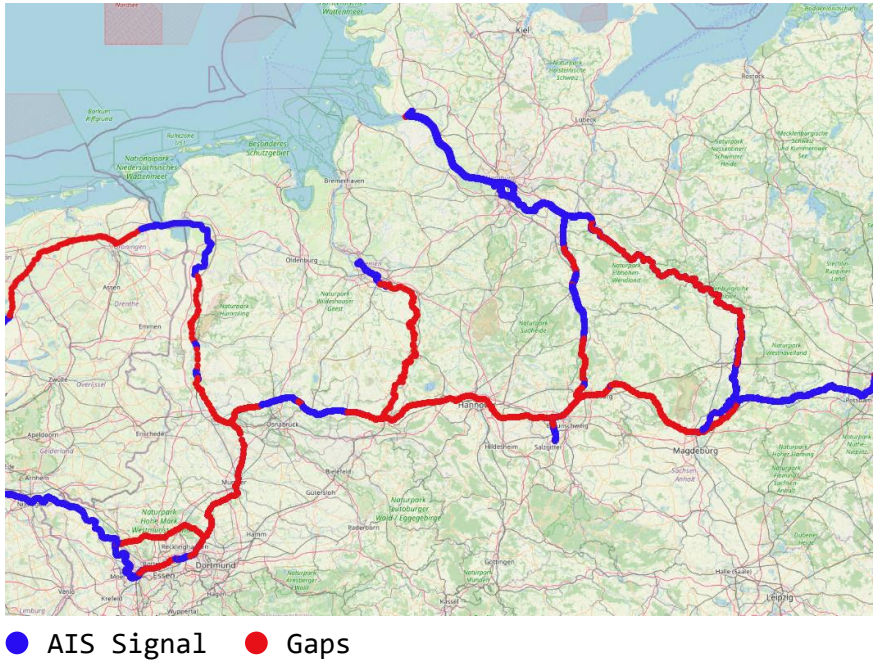
- Median Vessel: Battery Capacity 9.66 MWh
  Charger Power 454 kW
- Small Tankers and Passenger Vessels exhibit biggest potentials



→ Fully Electric Propulsion may be an option for parts of the fleet
→ Other Ships may need additional stops to charge

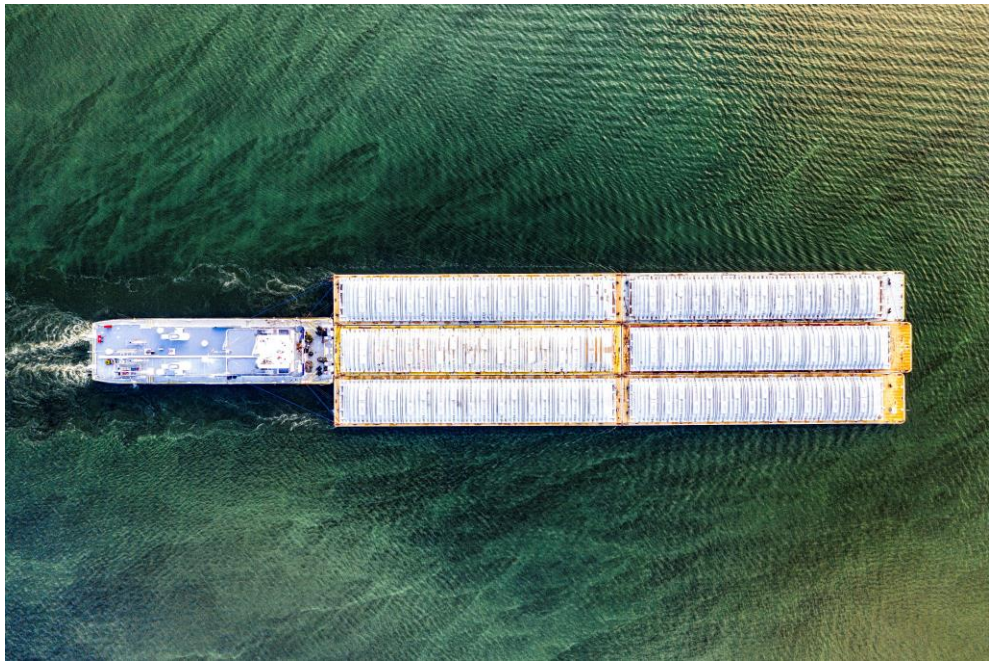
Discussion

- Gaps in AIS data should be addressed
  → 30% had to be discarded
- More investigation into retrofitting options



Conclusion

- Significant potentials for electrification in IWW fleet
- Charging powers in similar range as road vehicles → Intermodal stations?
- Some vessels may require additional stops → Opportunity to make IWW transport more efficient ecological and economical



Source: Pexels https://www.pexels.com/de-de/foto/sonnenuntergang-segeln-transport-schiff-9508989/

Impressum

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