Clean Maritime Policy Unit

POLICY BULLETIN

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Port emissions reduction through energy-aware ferry scheduling

Ferry ports have limited shore power (cold ironing) facilities, and ferry fleets are in the process of transitioning to hybrid (diesel and electric battery power) vessels. This research demonstrates that optimising berth allocations can deliver immediate reductions in port emissions while increasing the return on investment in shore-power infrastructure, while serving the same travel demand, and reducing the need for grid upgrades.

An Energy-Aware Scheduling (EAS) model was developed to simultaneously consider ferry type (hybrid or diesel), port berth type (cold ironing (CI) or regular), berthing times, phased CI upgrades, and car and freight demand. Three objectives were set on emissions reduction, energy reliability and cost efficiency to optimise berth allocation for ferry type.

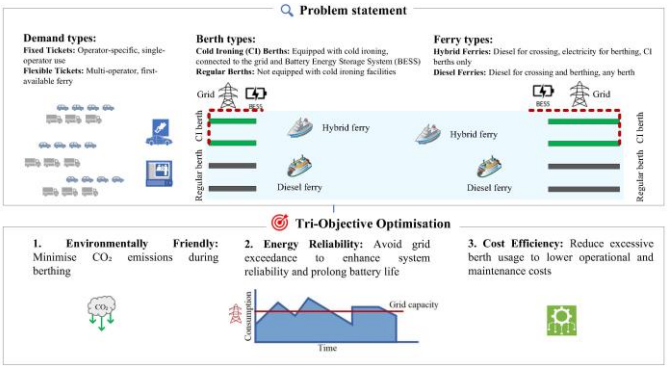

Figure. EAS model problem setting & objectives

KEY FINDINGS:

- **EAS alone cuts emissions:** CO_2 reductions 12% (busiest day) to 40% (quietest day) versus operators' actual schedules, by removing unnecessary under-filled crossings.
- **Shore power delivers most emissions reductions at berth:** Berthing CO_2 falls by 16–20% in early phases and 70% at full hybrid fleet versus all-diesel. Hybrid ferries still use diesel for crossings and operator's total daily emissions fall by a more modest 5–9%.
- **Fewer, fuller crossings.** EAS cut daily crossings (e.g. 40 to 24 on a quiet day) and raised throughput per crossing by up to 40%, by sharing flexible freight across operators while meeting each operator's car demand.
- **No diesel fallback at berth.** Even at simultaneous peak car and freight demand, EAS kept every hybrid ferry on shore power rather than needing diesel fall back.

Overall, operational optimisation is critical to ferry decarbonisation, complementing investment in hybrid vessels and shore power.

POLICY IMPLICATIONS

Operational optimisation should sit alongside infrastructure investment in ferry ports and operators' decarbonisation strategies. EAS delivers early, low-cost emissions cuts precisely when infrastructure is most constrained.

Policy suggestions for Department for Transport:

- Scheduling optimisation to be made a priority, usable now and through the early transition phases, not only after capital investment.
- Time capital upgrades on the evidence: Target grid and battery reinforcement where scheduling reaches limits to avoid overbuild.

Targeted policy support can deliver early emissions reductions while managing costs and infrastructure constraints during decarbonisation.

RESEARCH PUBLICATION

Forghani, A., Xie, Y., Jahangard, M., Song, D., Feng, Y. (2026). *Energy-aware scheduling and berth allocation for ferries under phased cold ironing upgrades*. Transportation Research Part E. https://doi.org/10.1016/j.tre.2026.104800

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