

Who influence energy efficiency in ship operations?

René Taudal Poulsen

Methods

- **Ethnographic research**
- Observation studies onboard **eight merchant ships** and over **100 interviews** with shipping managers and crews
- We study **what people do**, not just what they say the do
- We include **all major shipping segments**, including tanker, dry bulk, container, and ferry shipping
- We control for the effects of changing freight rates and fuel prices with a data set that covers the period **2012-21**
- We use the Energy Efficiency Operational Indicator (**EEOI**) as metric for energy efficiency in ship operations:

$$\text{EEOI} = \frac{\text{CO2 emissions}}{\text{Transport-work}} = \frac{\text{CO2 emissions}}{\text{Cargoes carried} \times \text{distances travelled}}$$

Research question: Who influence these metrics?

Key energy efficiency decisions

Voyage planning: Commercial decisions

Voyage execution: Nautical decisions



Ballast voyages

- Optimize liner networks and schedules
- Triangulate in tanker and dry bulk shipping
- Use tanker and dry bulk pool managers

Ship handling

- Optimize trim and ballast
- Optimize auxiliary engine usage
- Optimize generator usage

Speed choice

- Reduce service speed
- Adjust liner schedules
- Use virtual arrival clauses in tanker and bulk charter parties

Speed choice

- Depart punctually from port of loading
- Equalize speed over voyage
- Take shallow water effect into consideration
- Arrive just in time to port of discharge

Route choice

- Transit via canals, when feasible

Route choice

- Use weather routing

Commercial decisions influence fuel consumption and transport-work

Nautical decisions influence fuel consumption

Who makes the decisions?

Voyage planning: Commercial decisions



Ship-owners and pool managers often take commercial decisions that improve energy efficiency

Cargo-owners, pool managers, port stakeholders, and governments also influence voyage planning.

They undermine energy efficiency, when:

- Vessels take longer routes to avoid costly canal transits
- Cargo-owners dictate high service speeds to reduce transit times
- Cargo-owners speculate in oil prices and dictate waiting at anchorage
- Government tenders require frequent ferry services despite low traffic volumes

Voyage execution: Nautical decisions



Crews and technical ship managers make numerous nautical decisions, which can improve energy efficiency by reducing fuel consumption

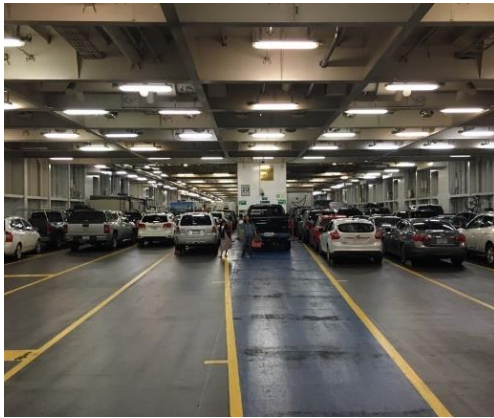
This is a source of **professional pride** for them

However, they are **limited in their actions** by commercial constraints and safety considerations, which often undermine energy efficiency

Most decisions for energy efficiency are made in voyage planning

Commercial decisions matter the most

Voyage planning:
Avoiding ballast voyages



Voyage execution:
Weather routing



Commercial decisions that support and undermine energy efficiency, respectively

Examples of commercial decisions that support energy efficiency

“Our claim to fame... is to run operations as efficiently as possible...”

COO for container line

“If the vessel is not full ... EEOI quickly moves in the wrong direction.”

Energy efficiency manager for tankers

Examples of commercial decisions that undermine energy efficiency

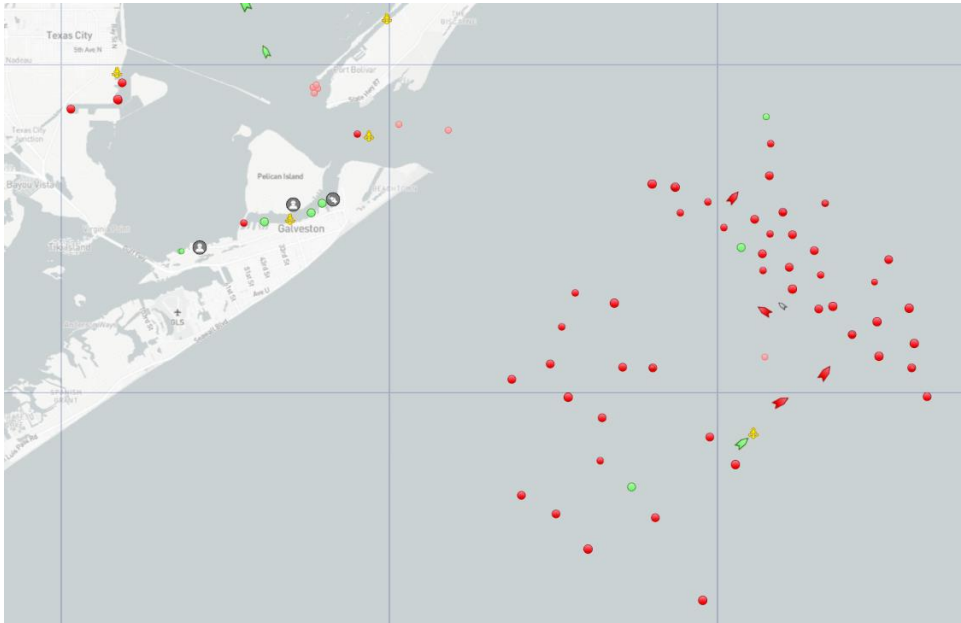
“We should not use the shorter ballast [voyage], if a longer ballast [voyage] pays more money”

VP for tanker operations

“The starting point [for speed choice] is today’s market. What pays the best? If the market is 40,000 dollars per day, we obviously go at full speed to make as many voyages as possible.”

Director for product tanker shipping pool

Waiting time at anchorage undermines energy efficiency and cause noise

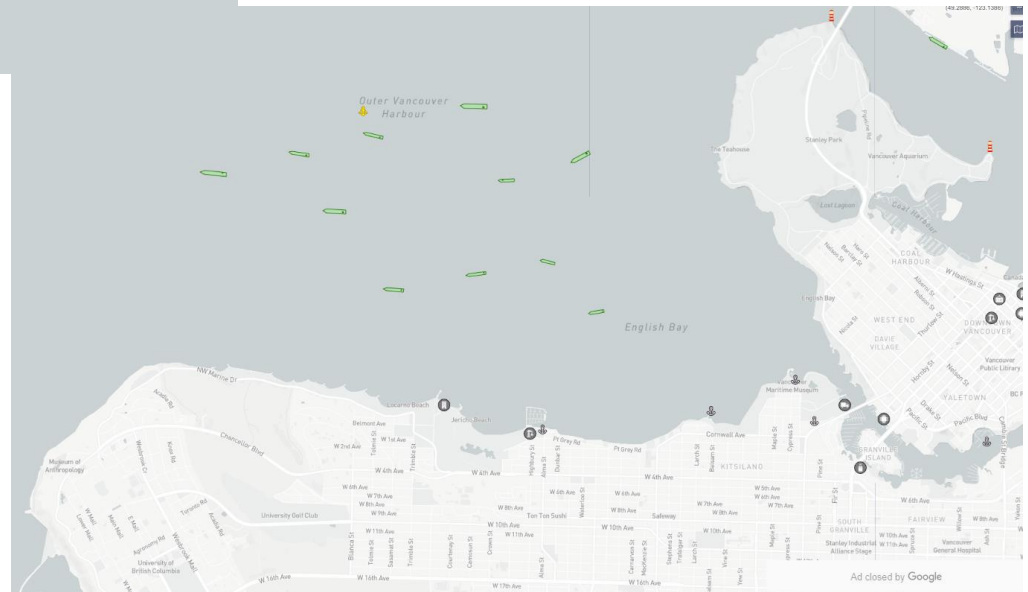


Tankers at anchorage
Galveston, Texas
September 11, 2023

Cargo-owners can speculate in oil prices
and may dictate waiting at anchorage

Port congestion and decisions by
port and terminal operators
cause waiting time at anchorage

Bulk carriers at anchorage
Vancouver, British Columbia
September 11, 2023



Conclusion

- **Shipowners and technical managers are not in full control of energy efficiency**
- **Nautical decisions for energy efficiency** are relevant under all market conditions, but crews and technical ship managers who make such decisions are limited by commercial constraints and safety considerations, which often undermine energy efficiency.
- **Commercial decisions relating to service speed and ballasting** depend on dynamic shipping markets and matter more for energy efficiency than nautical decisions do.
- **Cargo-owners**, commercial managers, ship operators, port stakeholders, and governments **influence** voyage plans, and often undermine energy efficiency.
- To mitigate climate change, policy makers should broaden the regulatory focus to the markets that condition energy efficiency and emissions – and **direct attention towards the stakeholders, who benefit from maritime transport and influence ship operations.**

Thank you very much for your attention!

René Taudal Poulsen (2021). IMO must include cargo owners in emissions reduction policy, *Lloyd's List*, Dec. 2.

René Taudal Poulsen, Martin Viktorelius, Hanna Varvne, Hanna Barbara Rasmussen and Hannes von Knorring (2022). Energy efficiency in ship operations: Exploring voyage decisions and decision-makers, *Transportation Research Part D: Transport and Environment* 102C: 103120.