

Energy efficiency retrofit selection in shipping – science or social experiment?

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Reducing GHG emissions





Why retrofits?

- Vessels are seeing extended lifetimes (≈30% of vessels that will be operating in 2025 have already been built)
- Reduce the gap in a two-tier market (Stulgis, 2014)
- Retrofitting will always be required as older ships compete with younger tonnage especially if operating under a carbon tax or other MBMs (Raucci, 2017)

Increasing efficiency is will always be relevant





Decision-making as problem solving

Stable context Commonplace Recurrent Programmable Easily accessible information Decision criterion understood Focused decision strategy

> Structured Certainty

Volatile context Atypical, unique Discrete Intuitive, creative Problematic access to information Decision criterion unclear Multiple decision strategies

> Unstructured Uncertainty

Characteristics of problem structure (Simon, 1960)

Decision-making is a subset of problem solving





Decision-making features

- Complexity
- Multi-disciplinarity
- Multiple stakeholder involvement
- Optimisation criterion
- Use of information





Direct stakeholders







Direct stakeholders





Decision-making models





Garmston, H. M. (2017). *Decision-making in the selection of retrofit facades for non-domestic buildings*. Plymouth University. Retrieved from https://pearl.plymouth.ac.uk/handle/10026.1/8811



Normative

- Rationality
- Utility
- Classic economic theory

$$1 + 1 = 2$$





Descriptive

• Irrationality



$$1 + 1 = 42$$



Wilson, C., & Dowlatabadi, H. (2007). Models of Decision Making and Residential Energy Use Thaler, R. H. (2016). Behavioral Economics : Past, Present, Future. *American Economic Review*, 106(7), 1577–1600.



Decision-making in shipping

- With reference to energy efficiency:
 - Very poorly documented
 - Very poorly evaluated





Decision support in shipping

- Very theoretically focused
- Embrace power of computation

but . . .

- Very opaque and inaccessible
- Do not answer the questions that stakeholders want answered





Barriers to energy efficiency





Rehmatulla, N., & Smith, T. (2015). Barriers to energy efficiency in shipping: A triangulated approach to investigate the principal agent problem. *Energy Policy*, *84*, 44–57.



Information creation-use gap



Cash, D. et al., (2002). Salience, credibility, legitimacy and boundaries: linking research assessment and decision making. Harvard University.

Li, F., & Pye, S. (2017). Energy Pathways under Deep Uncertainty : What do Decision Makers Really Think is Important? 14 - Interview findings.



Who needs decision support related to efficiency?



Indirect Influencers

- Academia/Research
- NGOs
- Marine intelligence
- Owner associations
- Shipper
- Shipbuilder
- DAQ service providers
- Engine manufacturers
- Brokers
- P&I clubs

Regulatory Bodies

- IMO/Nations
- EU
- Class
- Standards
- Flag states
- Port authorities





Work looking forward

- Case study and interviews into decision making related to retrofitting
- Investigate and develop methods to close the information creation-use gap
- Aiming to increase transparency while doing so





Questions?



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