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The logic of business vs. the logic of energy management practice: understanding the choices and effects of energy consumption monitoring systems in shipping companies

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A B S T R A C T

A major part of the world fleet of more than 47,000 merchant ships operates under conditions that hamper energy efficiency and efforts to cut CO_2 emissions. Valid and reliable data sets on ships' energy consumption are often missing in shipping markets and within shipping organizations, leading to the non-implementation of cost-effective energy efficiency measures. Policy makers are aiming to remedy this, e.g., through the EU Monitoring, Verification and Reporting scheme. In this paper, current practices for energy consumption monitoring in ship operations are explored based on interviews with 55 professionals in 34 shipping organizations in Denmark. Best practices, which require several years to implement, are identified, as are common challenges in implementing such practices—related to data collection, incentives for data misreporting, data analysis problems, as well as feedback and communication problems between ship and shore. This study shows how the logic of good energy consumption monitoring practices conflict with common business practices in shipping companies – e.g., through short-term vessel charters and temporary ship organizations – which in turn can explain the slow adoption of energy efficiency measures in the industry. This study demonstrates a role for policy makers or other third parties in mandating or standardizing good energy consumption monitoring practices beyond the present requirements.

1. Introduction

Rising fuel prices and an excess supply of ships have driven shipping companies to improve their energy management practices in recent years. Some companies, however, have seen more success than others (Kühnbaum, 2014; Wang and Lutsey, 2014). Why is this the case? This article argues that prevailing business practices in the shipping industry are incompatible with the logic of effective energy management, leading to excess energy use on many ships.

Assessments have indeed identified an energy efficiency gap (Jaffe and Stavins, 1994) in shipping; a large number of measures that could increase energy efficiency are available at negative net costs (Buhaug et al., 2009; Eide et al., 2011; Faber et al., 2011). These assessments have been carried out to understand the potential for reducing green-house gas (GHG) emissions. Consequently, a part of the rhetoric of policy-making has been that regulations to reduce GHG emissions from shipping will save the industry vast amounts of money (EC, 2013; IMO, 2011). Moreover, a large gap exists between projections of future emissions from the international shipping industry and the industry's own role in mitigating in impact on global climate change (Anderson and Bows, 2012). The industry's share of global emissions are estimated as 2.7% (Smith et al., 2014), but this share may increase up to 8% by 2050 unless further action is taken (Anderson and Bows, 2012).

International shipping was left out of the Kyoto Protocol, partly on the grounds that countries could not agree on how to allocate emissions to individual countries (Oberthür and Ott, 1999). The task of mitigating CO_2 emissions from shipping was passed onto the UN's International Maritime Organization (IMO). In 2011, the International Convention for the Prevention of Pollution from

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Ships (MARPOL 1973/78) was amended to include two mitigation measures: the Energy Efficiency Design Index (EEDI) and the Ship Energy Efficiency Management Plan (SEEMP) (IMO, 2011). While the EEDI introduced design limits for new ships, the SEEMP aims to improve the day-to-day operations of existing and new ships. A report for the IMO quickly showed that the EEDI and the SEEMP are not expected to reduce total emissions from the sector, only to slow down the growth (Bazari and Longva, 2011; Smith et al., 2014).

Countries have also discussed market-based instruments (MBMs) for shipping in the IMO, but no agreement has been reached (Miola et al., 2011). While technical and management standards for energy efficiency could be agreed upon, the conflict between the concept of Common but Differentiated Responsibilities (CBDR)—part of the United Nation's Framework Convention on Climate Change (UNFCCC) process—and the IMO principle of giving 'no more favourable treatment' (NMFT) to any ship has hampered further discussions (Gilbert and Bows, 2012; Kågeson, 2011; Lema and Papaioanou, 2013). Either a policy applies to all ships regardless of flag, or it should apply not at all; a policy that would exempt non-Annex I parties to the Kyoto Protocol from, e.g., a fuel tax would easily be avoided through flagging out vessels. Marine fuel is typically not taxed due to the ease of acquiring it in many places. In dissatisfaction with the IMO's progress to regulate GHG emissions, the EU has pushed forward with a regional monitoring, verification and reporting (MRV) scheme. In the longer term, the EC has expressed the intention to combine the scheme with an MBM. The European Commission (EC) expects an improvement in energy efficiency of approximately two percent in the short term, as valid and reliable data sets on ships' energy consumption will become available in shipping markets and within shipping organizations (EC, 2013). Such a system would enable shipping companies to identify fuel saving potential and enable buyers of transportation services to identify the most efficient ships on the market (Maddox Consulting, 2012).

The arguments of the EC are well known from the energy efficiency literature. From the perspective of economics, information asymmetries and imperfections are sources of market failures and as such require policy intervention (Fisher and Rothkopf, 1989; Gillingham et al., 2009; Jaffe and Stavins, 1994; Sanstad and Howarth, 1994; Sutherland, 1991). From a business perspective in many industries, energy consumption monitoring[2] (ECM) is a key aspect of best energy management practice (Bunse et al., 2011; Sivill et al., 2013; Thollander and Ottosson, 2010). Although the monitoring of ships' energy consumption has been observed as crucial for energy efficiency in shipping for decades (Banks et al., 2013; Drinkwater, 1967; Petersen et al., 2011; Sweeney, 1980) the actual monitoring practices employed by the industry remain unexplored. A range of ECM options are available, some more advanced than others (Faber et al., 2009).

In this article, ECM practices in ship operations are explored, especially the perceived validity and reliability of data on ship energy consumption available within organizations and markets. Based on a qualitative analysis of interviews with 55 shipping executives and middle managers, the diversity of ECM practices are discussed and best practices are identified. The study shows that best practice in ECM is not compatible with common business practices and ends with a discussion of the academic and wider policy implications.

[2] The terms "energy end-use monitoring" and "energy performance monitoring" are also used in the literature somewhat interchangeably.

2. The commercial conditions for ship operations

Shipping accounts for approximately 90 percent of world trade in terms of transport work, and cargoes include important dry commodities (e.g., iron ore and coal), liquid energy (oil and gas) as well as semi-manufactured and consumer goods (Hoffmann and Kumar, 2010). The prices of transportation (freight rates) are negotiated in the freight market between cargo owners and shipping companies. Freight rates are highly volatile and can change overnight. While demand for shipping can shift suddenly (e.g., due to a political crisis or the closure of the highly important Suez Canal), supply can only respond slowly to such changes. It can take up to three years to build a new ship, and ships have a commercial lifelength of approximately 25 years. Freight rate volatility cascades into the markets for new buildings and second-hand ships (asset prices), and this provides asset players with business opportunities. Asset players make their main profits from buying and selling ships timely, and in some cases they are willing to accept losses in the freight market while waiting for asset prices to increase (Stopford, 2009).

To understand the nature of ship operations, two issues are key and concern the following:

1. The commercial conditions for ship operations, and
2. The organizational conditions for ship operations.

The commercial conditions are settled in the freight market and written in charter parties. Charterers with a need for transportation are on the demand side, and on the supply side, shipping companies provide the required ships. A charterer can be a cargo-owner as well as a shipping company, which needs additional ships. Charter parties differ in terms of duration and the distribution of risks and ship costs (see Table 1). Ship costs are usually divided between capital costs (investment in the ship itself), operating costs (mainly supplies, maintenance, salaries for crews, and marine insurance) and voyage costs (fuel costs and port and canal dues) (Stopford, 2009). Three types of charters exist: 1) Spot charters (also known as voyage charters), where the ship owner assumes all costs (and risks) and receives payment from the charterer based on the quantity of cargoes carried and the rate per unit cargo. Spot charters concern one voyage. 2) Time charters can have durations from months up to several years. Here, the vessel capital costs and operating costs are paid by the ship owner, and voyage costs including fuel costs, are paid by the charterer. Charterers' payment to ship owners depends on the daily hire rate, duration of contract and vessel off-hire time. 3) Bareboat charters, where the ship owner pays capital costs and leaves all other costs and operational decisions to the charterer. Here, the charterer's payment to the ship owner depends on the daily hire rate and duration of the charter.

The choice of charter party depends on the individual companies' needs and expectations for the future, bearing in mind the high freight market volatility. If a cargo-owner (charterer) has a constant need for transportation services over, e.g., the next five years and anticipates rising spot market rates, a long-term time charter may be preferable to spot charters. In this way, the charterer gains certainty for transport capacity and freight rate. If the charterer has capabilities in commercial and technical ship operations, a bareboat charter may be attractive. A charterer with short-term transportation needs and no such capabilities will prefer a spot charter and leave the ship operation to a shipping company. A company with access to cheap ship financing but lacking the technical and commercial capabilities for ship operations may own large fleets of vessels, which they bareboat-charter to other companies. In this case, the ship owner serves as a tonnage provider for