DYNAMIC POSITIONING CONFERENCE

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POWER

Energy efficiency Proxy. What does offshore have to do with it?

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Abstract

With the aim of reducing GHG emissions, much has been said about the Energy Efficiency Proxies EEXI and CII that are related to the amendments to Circular 4350 defined in MEPC 75, which will enter into force in January 2023 for existing vessels.

Although these requirements do not include *offshore vessels,* since 2020 IMO has been studying a way to include these vessels in the short-term measures established by MEPC Res.304.

IMCA Proposal

Among the measures suggested is the IMCA proposal that, through the document MEPC 74/6, proposes two specific proxy possibilities for offshore vessels, namely: Proxy A and Proxy B.

The two proxies have an annual analysis with different approaches, the proxy A on the gross power generated by the vessel and the second on the operating time.

Main objective of the study

The objective of this work is to analyze the behavior and the impacts of the adoption of each Proxies (A and B) indicated by the IMCA in the Brazilian offshore industry, using as a case study 10 PSV's vessels with Dynamic Positioning class 2 of the Brazilian flag.

Introduction

The IMO is committed to reduce GHG emissions from maritime transport as soon as possible yet in this century.

The goal is reduce greenhouse gas emissions by 50% by 2050, and all of these targets have a direct impact on the vessel.

Based on various long-term economic and energy scenarios (without considering the long-term effects of the COVID-19 Pandemic), and without any additional measures, IMO in the 4th Study describes that transport emissions are projected to increase emissions by about 90% to 130% by 2050.

Bibliographic Research

IMCA has been working on development proxies specifically for offshore vessels since 2017.

The proposal of indicators for offshore vessels is part of the strategies described in MEPC 304, categorized as short-term measures by IMO, as measures with priority of support. The proposal developed by IMCA, and Russia is in line with the measures foreseen in the IMO strategies.

In 2019, IMCA, through document MEPC 74/6, proposed two specific indicators for offshore vessels called Proxy A and Proxy B. In the proposed indicators for offshore vessels included, according to MEPC74/INF15.

How to define energy efficiency for non-conventional propulsion vessel

Currently, IMO indicators express/define energy efficiency as provides a specific figure for an individual ship, expressed in grams of carbon dioxide (CO2) per ship's capacity-mile (the smaller result show the more energy efficient ship) and is calculated by a formula based on the technical parameters of ship.

The main difficulty of IMO is the definition of what is energy efficiency for non-conventional propulsion vessels.

Brazil Scenario

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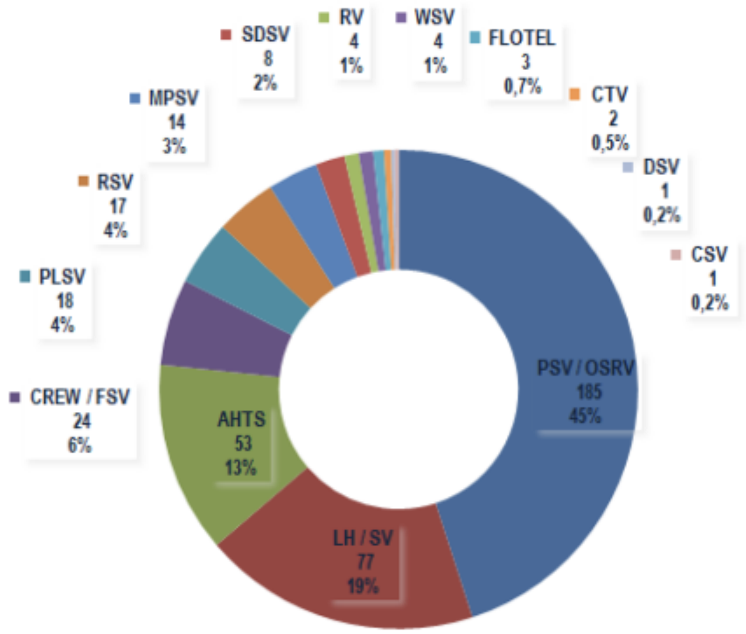
Currently, there are, 7555 offshore vessels worldwide. Among these, according to a ABEAM's inventory, 411 are operating in Brazilian jurisdictional waters, of which 367 are Brazilian flag.

Brazilian offshore vessels account for just over 5% of the total offshore vessels in the world.

As can be seen in Figure 1 the offshore vessels with the highest quantity in Brazilian waters are the PSV vessels, which in June 2022 totaled 185 vessels (45%).



Data used

The data used in this work were voluntarily sent by the companies through ABEAM and are related to the particularities of the boats and consumption during the years 2018, 2019 and 2020 in order to discover the Brazil curve of each proxy.

Type of vessel	PSV
DP class	2
Dwt	(ton)
Speed (average 3 years)	(Kn)
Maximum Continuous Rating	(kw)
Hours in operation in DP	(h)
Hours in navigation	(h)
Hours in port	(h)
Hours in repair	(h)
Main Engines quantities	(un)
Power - Man Engine	(kw)
Specific Fuel Oil Consumption – Main engine	(g/kw h)
Amount of Auxiliary Engine	(un)
Power - Auxiliary Engine	(kw)
Fuel Type	MDO
Specific Fuel Oil Consumption - Auxiliary Engine	(g/kw h)

Objective

Among the data sent, 10 vessels DP class 2 were selected with characteristics of the general average of the Brazilian PSV vessels that similar with the international averages exposed in the 4th IMO Study.

Ship type	Offshore
Number of vessels (un) Avg.	7.555
DWT (tonnes) Avg.	4.765
design speed (kn) Avg.	13,98

Table 1 - Averages of the general characteristics of offshore vessels in the world

Source: 4th IMO Study

PROXY A – Approach to annual energy consumption

$$R = \frac{E}{Pg} = \frac{\text{Total kg } CO_2 \text{ emitted / year}}{\text{Total gross power output generated/year}} = \textbf{kg } \mathbf{CO_2} \textbf{ / Gross kWh}$$

(i.e.$\sum$ installed rated power per engine x yearly running hours per engine)

A: The average energy ratio based on a measure of E and Pg.

E: Total kg CO_2 emitted/year, i.e. the total amount of CO_2 calculated on the basis of the fuel consumed per year, taking into account the applicable conversion factors for a particular type of fuel.

Pg: Total calculated gross kWh generated/year, i.e. the sum of the installed rated power per engine multiplied by the yearly running hours per engine.

PROXY B - Effective (operational) approach to vessel use.

$$R = \frac{E}{U} = \frac{\text{Total kg } CO_2 \text{ emitted / year}}{\text{Total hours under way / year}} = \textbf{kg } CO_2 \textbf{/ operational utilization hour}$$

A: The average energy ratio based on a measure E and U.

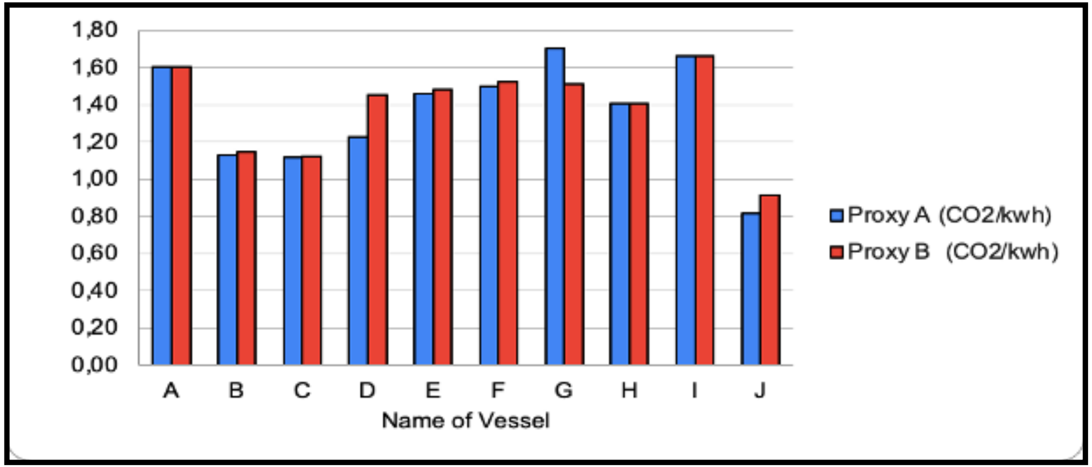
E: Total Kg CO_2 emitted/year, i.e. the total amount of CO_2 calculated on the basis on the basis of the fuel consumed per year, considering the applicable conversion factors for a particular type of fuel.

U: Total hours under way. Time spent undergoing repairs or mobilizing in port should not be included in the calculation.

Results

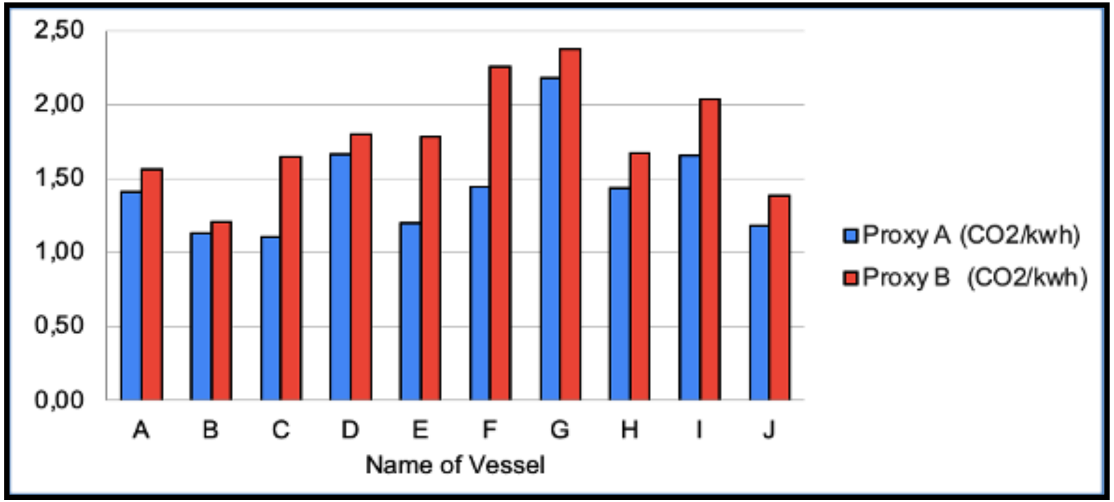
It was analyzed and compared the performance of 10 boats with characteristics common to Brazilian vessels during the period 2018 to 2020.

In 2018, Graph 1 shows that the 10 Brazilian vessels analyzed had a low variation in the behavior of Proxy A and B throughout 2018.



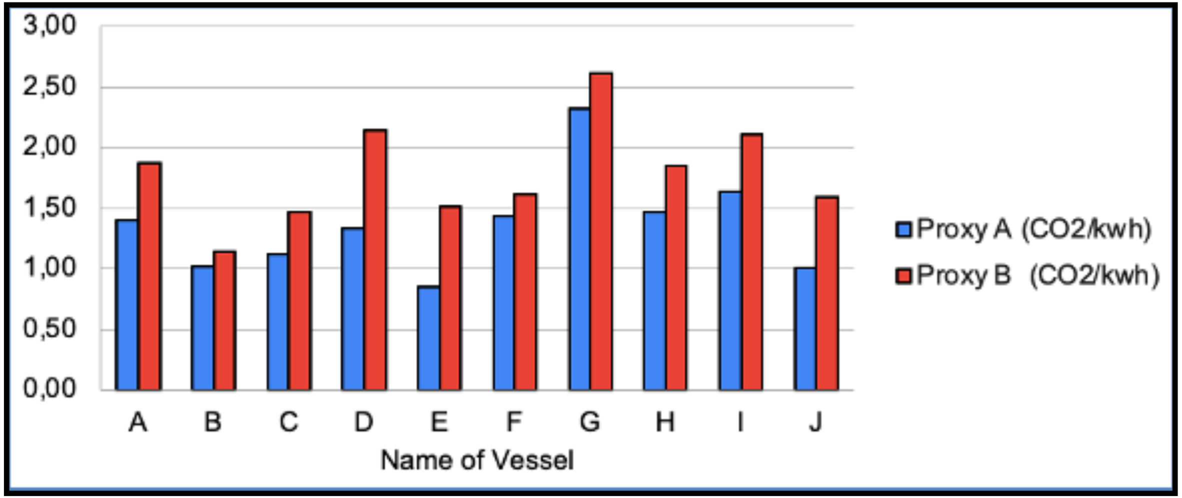
Results

In 2019, the graph 2 shows a considerable increase in the variation between proxies A and B. In this period, the data show studied that the annual powers average of the vessels was less than the number of hours of operation of the vessels.



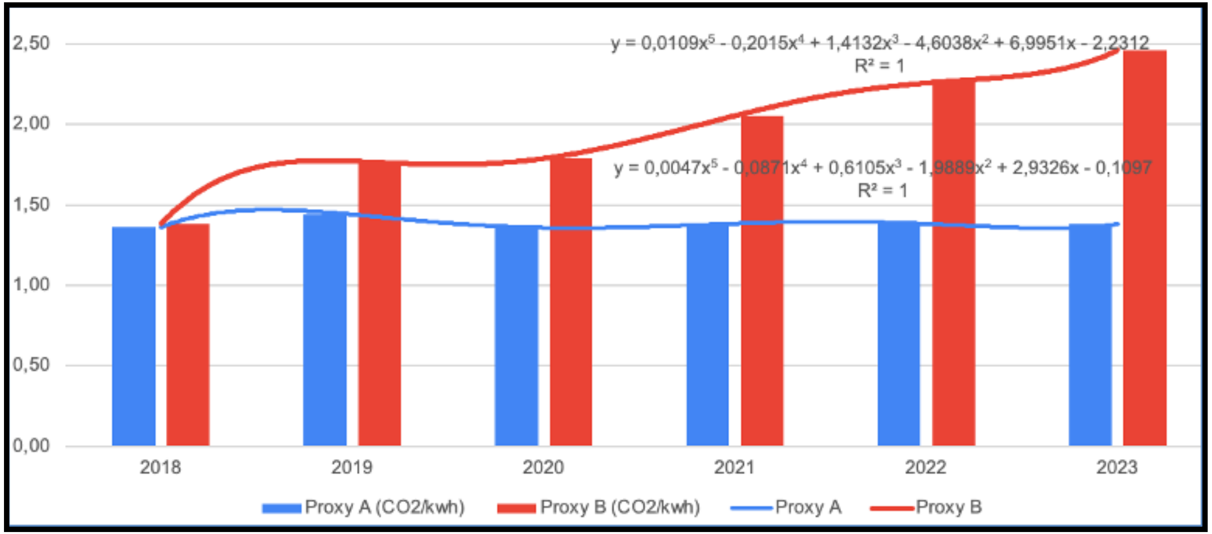
Results

The year 2020 was an atypical year due to COVID and the compulsory adoption of low-sulfur fuel. In graph 3, a fall is used in Proxy A and B. Which are justified by the decrease in specific fuel consumption below the estimated level in 2018 and a decrease in operating hours in DP considering the year 2019.



Results

Considering the vessel behavior from 2018 to 2020, shows the trend curve to predict the behavior of the vessel for the years 2021 to 2023.



Curve to predict the behavior of the vessel for the years 2021 to 2023

Conclusion

Comparing proxies A and B:
1 - The variability of proxy A over the years is smaller than that of proxy B.

2 - Proxy B has tendency for these variations increase mainly at Proxy B where the curve has an exponential behavior while A has a more linear.

3 - The results showed that proxy A has a more conservative strategy, which the trend curve has a trajectory with very few variations at the 5-year

4 - Proxy B, which presents larger variations and has temporally propagative characteristics.

Future Work and Solutions

After surveying the behavior of vessels that suggests the Brazilian standard, the next step is to identify patterns in energy balances and exercise of offshore vessels in the use of energy (1st law of thermodynamics) and exegetic (second law of thermodynamics) for analysis of the quality of consumption.

The objective is to identify the main inefficiencies and evaluate the potential for residual heat recovery and improvement of engine efficiency, represented in the Grassmman Diagram. [12] The implementation of these system modifications allows the ship to reduce specific energy consumption and consequently contributes to reducing emissions.

Acknowledgment

I am thankful to the Brazilian Association of Offshore Supply Vessel (ABEAM) for their support in carrying out the experiments and in the assignment of data. ABEAM was founded on April 4, 1977, and its main purpose is to contribute to the Brazilian development of the Maritime Support sector, to the activities of production and exploration of hydrocarbons and minerals in the Brazilian continental shelf, as well as Marmec Engineering and Consulting of the study.

Thank you

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