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SHORT COMMUNICATION

Marine fuel efficiency for oil and gas offshore operation support by applying the technology-based speed control and contractor performance management

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Abstract. PHE ONWJ is an upstream oil and gas company conducting exploration and production of oil and gas. It is the subsidiary of Pertamina Hulu Energy (PHE) which is under the PERTAMINA Group with working areas of 8.300 km^2 covering offshore and onshore sites. As the response to the declining of global oil price, PHE ONWJ was required to reduce its operating costs including in the marine that accounted for 10% of the total operating cost, 53% of them was the cost of energy (fuel). The marine fuel efficiency program was an approach based on technology which applied series of interconnecting activities namely the determination of vessels' economical speed, the control of vessel using Fuel Monitoring System (FMS) and Vessel Tracking System (VTS), and the improvement of contractor performance management. This program has saved diesel fuel consumption for approximately 10,000 kiloliter which was around 34% of the former use. Financially it has saved Rp 80 billion. It has also reduced the emission of CO2 by 40 ktons during 2016. The keys to the success of this program were the strong commitment to implement economcal speed, contractor partnership, and capacity and awareness building to raise contractor's competence and behaviour towards the energy efficiency.

Keywords: energy efficiency, economical speed, fuel monitoring system, PHEONWJ, vessel tracking system.

1. Introduction

PT. Pertamina Hulu Energi Offshore North West Java (PHE ONWJ) is an upstream oil and gas company performing exploration and production of oil and gas. It is the subsidiary of Pertamina Hulu Energy (PHE) under PERTAMINA which operates the Offshore North West Java (ONWJ) block. The block is situated at West Java Sea-Indonesia and covers an area of 8,300 sqm. PHE ONWJ Production Sharing Contract (PSC) is one of the first PSCs in Indonesia which started the operation in 1971 under Atlantic Richfield Indonesia and later

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became BP West Java and in July 2009, it transferred the operatorship to PHE ONWJ (PHE ONWJ, 2016).

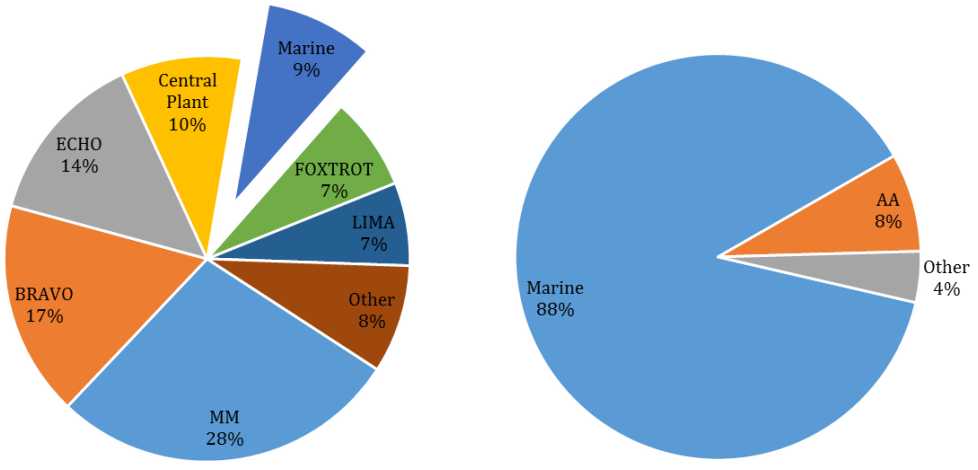
PHE ONWJ production capacity is 300 MBOPD of oil and 300 BBTUD of gas, yet now the former one decreased to 35 while the latter one to 100. Recently, oil and gas productions are continuously declining, hence we need to discover new reserves to maintain the production level.

In addition to this situation, oil and gas companies including PHE ONWJ has been experiencing substantial decline on the energy price since 2015. To ensure the sustainability of this business, PHE ONWJ encourages some initiatives of efficiency which include the energy efficiency.

As stipulated in the (Government Regulation No 70, 2009), every corporation which annually consumes energy ≥6,000 Ton of Oil Equivalent (TOE) is obliged to take part in the energy conservation by implementing the energy management. PHE ONWJ's annual energy consumption in 2015 was around 230,000 TOE.

For the environmental preservation purpose, every corporation in Indonesia is not only required to manage energy as a part of the natural resource but also to annually conduct monitoring through the *Program for Assessment of Company's Performance Rating in Environmental Management* (PROPER). PROPER is a prestigious annual award conducted by the Ministry of Environment and Forestry. Considering its high importance, PHE ONWJ established PROPER as the Key Performance Indicator (KPI) on its management and declared an energy efficiency regulation on its policy.

To understand the significance of marine energy consumption in PHE ONWJ, two aspects that have to be considered include the energy consumption and energy cost. As an offshore oil and gas company, the activities in the marine that it conducts consume the high amount of energy in PHE ONWJ as shown in Figure 1. Marine activities take 9% of overall energy that it consumes. In term of the energy cost, marine energy spent the biggest cost compared to other fuel gas source (which is own-use and not purchased).



(a) (b)

Figure 1. PHE ONWJ energy consumption. (a). PHE ONWJ energy consumption by area, (b). Non-fuel gas PHE ONWJ energy consumption by area.

PHE ONWJ implements the energy efficiency program as an approach to maintain the production level. PHE ONWJ has a strong commitment towards energy efficiency program includes, first, the *management's commitment*. PT PHE ONWJ is committed to reducing the CO_2 gas emission. As stated in the company's strategic plan, the target of emission reduction is 3% by 2020 with baseline calculations from 2015. Secondly is the *decrease in oil and gas production*. Lower production means lower company revenue. It has prompted the necessity of cost savings in every department. Marine transport contributes approximately 10% to the company's operating costs which 53% of it is the fuel costs. Thirdly is *the decline of oil price*. The global oil price substantially dropped from 109 USD/barrel in 2012 to USD 35/barrel in 2016. Lastly is the *ISO 50001 Energy Management System* implementation. The certification of EnMS has been initiated in 5 locations and currently, it is being implemented in all operations area.

2. Method

Marine fuel efficiency program is based on three pillars namely economical speed, vessel trip optimization and contractor's performance management.

Economical speed

Based on some studies on of the Fuel Consumption Test (FCT), it is identified that the higher speed leads to higher vessel's fuel consumption. However, vessel speed is not always proportional to vessel revolution per minute (rpm), yet in some cases, the increasing rpm does not generate more vessel speed. Every vessel has a specific economical speed curve.

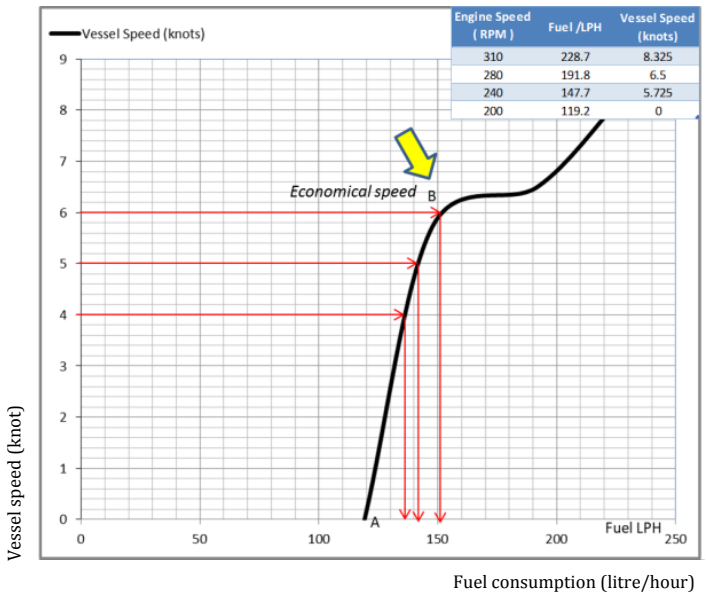


Figure 2. Example of fuel vs. vessel speed correlation curve

PHE ONWJ has conducted a fuel consumption test for each vessel with the parameter test which consisted of engine speed (measured in rpm), fuel consumption and vessel speed (Knots). This test was conducted to various speeds to seek the most economical one. Furthermore, the result of the test was used to determine the vessel speed as the standard reference for the monitoring and control of vessel fuel efficiency. The purpose was to address the vessel with an economical speed curve. For the monitoring and control purposes, PHE ONWJ developed Fuel Monitoring System (FMS) and satellite-based Vehicle Tracking System (VTS). To standardize the economical speed of every vessel, some measures that were taken included: the fuel consumption test for every vessel (FCT), the determination of vessel's standard speed, the dissemination of the standard to contractor & crew, and monitoring and control of the vessel speed with FMS & VTS.

Optimization of vessel trip

Principally, the energy efficiency could be achieved by optimizing the vessel trip. This principle was applied in the operation of vessels by means of optimization of the boat trips. The process included four main activities. The first one was the planning of the vessel trip that was well-integrated with operational schedule needed to avoid unnecessary vessel trip. Another one was the supervision of the efficient trip routes using Vehicle Tracking System (VTS) that could be monitored in the real-time to avoid the unrequired route. The next was the provision of sufficient logistics to avoid the extra trip in loading from the shore-base. Lastly, a capacity building for vessel's crews were required to perform in-house trouble-shooting

Management of contractor's performance

The company workers have a significant role in achieving energy efficiency because their working habits could directly affect the vessel energy consumption. In this regards, raising the staffs' awareness and competence in operating and maintaining the vessel is very important. Particularly for contractors who mainly work with vessels, they should be completed with a set of energy use rules.

Contractor's performance management is arranged by the partnership to encourage them playing an active role and generating their awareness on energy efficiency. This effort would support the efficiency of vessel maintenance. Those activities included:

- Signing a renegotiation contract to incorporate the economical speed and remuneration standard.
- Selecting the key personnel of the vessel's crews by considering their competence, behaviour and energy efficiency awareness.
- Enhancing the competency of crew members in the operation, maintenance and troubleshooting of vessel's machinery to be more efficient in the energy consumption.
- Monitoring regular efficiency performance in daily, weekly and monthly basis.
- Evaluating the performance and the contract evaluation periodically, including the setting of energy efficiency criteria in the tender documents

3. Result and discussion

3.1. Impact

The consumption of the vessel's diesel fuel to support oil and gas offshore activities in 2016 reduced significantly. Fuel saving of 10.7 kiloliters equivalent to 35% was achieved which shows that it was lower than the consumption in 2015. PHE ONWJ has reduced the emissions of CO2-e by 40 kTon. The implementation of vessel fuel efficiency program spent approximately Rp 2 Billion. The major investment was the procurement of transceiver fuel monitoring system on 24 vessels. Financially speaking, the program has successfully reduced the energy costs by approximately Rp. 80 Billion per year. The payback period of the investment was very short which was only in 0.03 years (less than 1 month). This program was considered to be very worthy, considering the payback that was shorter than 3 years fulfilling the criteria of bankable investment.

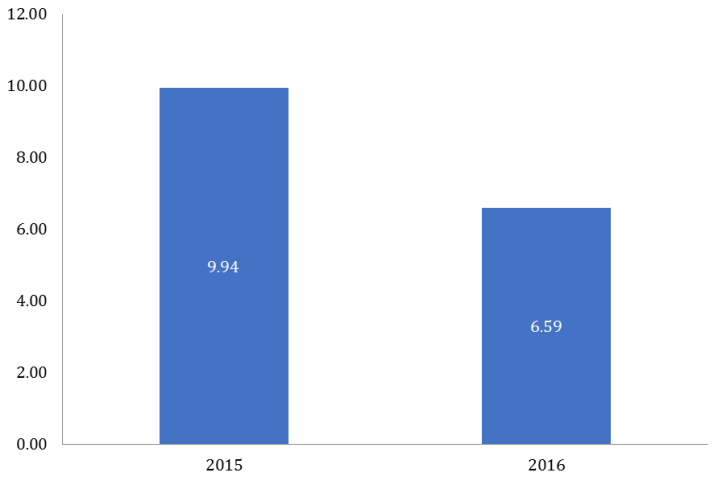


Figure 4. Fuel consumption-production ratio

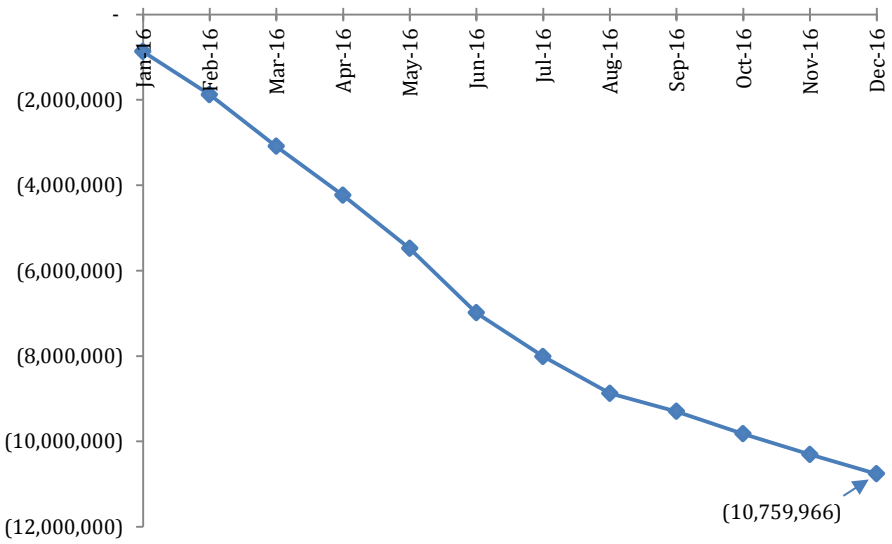


Figure 5. Fuel Consumption Savings PHE ONWJ

3.2. Replicability

Management practice

The entire approach implemented in the program was replicable not only to subsidiaries of PT. PHE but also to other companies utilizing vessel transport with multiple-location because of the three following activities.

The first one was the *standardization of speed*. The program commenced with the application of energy efficiency at three vessels as a pilot project. After it had been tested, this program was replicated to all 24 vessels contractors in PHE ONWJ. Each vessel had a specific curve of the FCT then every new vessel contract was required to do the test fuel consumption to obtain the economical speed.

The second step was the *optimization of the trip*. There are three managerial practices that can be replicated including the reduction of the unnecessary vessel trips, a further integration of the vessel schedule and operations plan, and the development of troubleshooting ability.

Another strategy was the m*anagement of contractor's performance* that can be replicated to other companies. These included the determination of the fuel remuneration in the contract, the negotiation of the economical speed application, the development of the crew competence, and periodic coordination for problem-solving and performance evaluation.

Technology

The use of the Fuel Monitoring System (FMS) and Vessel Tracking System (VTS) based on satellite as a speed standard application control and setting the trips vessel could be replicated for the management of marine transportation company. This was very important considering that the vessel trips were very risky to face irregular routes.

4. Conclusion

This program has successfully saved the diesel fuel consumption by approximately 10,000 kiloliters equivalent to 34% of savings. Financially, it saved Rp 80 Billion. It also reduced the CO2 emission by 120.646 tons during 2016. The keys to success in this program were the strong commitment to implement economical acceleration program through a partnership with the contractor, and capacity building to raise the contractor's competence and behaviour towards energy efficiency.

Acknowledgement

This work would not have been possible to finish without support from the management. The initiative was from the Marine Captain at PHE ONWJ who insisted to reduce the fuel consumption and improve the sustainability engine. Gratitude is also expressed to the operation/production team, who are always cooperative in implementing this new system.

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