FIRST STAGE REPORT OF SEAFDEC-FAO ENERGY AUDITS

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Abstract

All Thai commercial trawlers depend on diesel oil. To indentify techniques of saving fuel and reducing expense the first project on energy audit was developed under cooperative working among Food and Agriculture Organization for funding supporter and South East Asian Fisheries Development Centre/ Training Department for auditing operator. The audit process exposed to find conditional values concerning fuel consumption of trawl fishing vessels. Fuel consumption profiles of six trawlers were created for estimating their consumption rate at various engine revolutions. A method is to save fuel by reducing ship speed two knots contributing to decrease fuel consumption rate at 50 % of W. Yingcharoen and 52.3 % of Choknimitr. In addition to consideration of fuel consumption rate, earning per fuel consumption is also important parameter. The audit results reported that W. Yingcharoen trawler consumes the highest total fuel consumption but it has the better revenue per fuel consumption, 72.5 THB/litter. The ship fuel consumption results from energy audit project provide for fishers to understand for monitoring trawler at optimum level during fishing operation contributing to decrease fuel cost.

Keywords: Energy audits on trawler, Auditing Thai Trawler

Introduction

Recently, tendency of fuel price impacting Thai fishery sector is declined due to world crude price under high competition pressure among producer organization in united state and Middle-East. However, with fluctuation of energy price and uncertainty of competition of several world crude oil producers, trend of fuel cost will be increased as an important factor again in the near future because of propulsion engine of fishing vessels almost relied on diesel oil. Nevertheless, marine resources in several fishing grounds are limited and sometime to be conserved in a period of conservative season so that it is both direct and indirect heavily impact and create negatively competition among fishery stakeholders. Various works attempted to seek several ways to improve efficient use of fuel with reducing water resistance occurred on both hull and fishing gears by remodelling, or maintaining good condition of engine, cleaning hull surface, or even reducing ship speed which is a simple method to be suggested, and etc.

To alleviate the situation, an energy audit methodology for fishing vessels has been developed, with three objectives: a) to develop efficient fuel use based on Australian energy audit process, b) to undertake a pilot energy audit for selected Thai trawlers, c) to disseminate results on benefits from energy audit to local fishers to estimate fleet wide costs and earnings, including the payback times, and provide recommendations for future work

Methodology

Energy auditing process of six small trawlers consisting of four vessels in Chonburi province in the Gulf of Thailand and the other two boats in Satun province in the Andaman Sea. Several monitoring equipments were installed on these trawlers to measure fuel consumption, engine revolution speed, ship position, ship speed, water current, and wind speed and direction. Measurement period will start at fishing port until the trawler arrived at the landing fishing port for unloading catches. Values on these indicator screens were recorded at real-time by CCTV camera whole operating periods. There are three fuel consumption periods in these data recording activities as starting, trawling, and stopping

period. Starting period is a period that engine was started until otter board launched into water. While trawling period is a period since otter board launched until hauled back onboard. And the last stopping period is a period of otter board onboard until turn off the engine. Not only the previous parameters were recorded, but quantity of catches and revenue from selling these catches were also recorded into the log sheet for estimating economic performance of each trawler.

Results and Discussions

At free trial measurement, these collected data were calculated and plotted into two relationships among engine revolution via fuel consumption and ship speed against engine revolution displayed in **figure 1** a) and b).

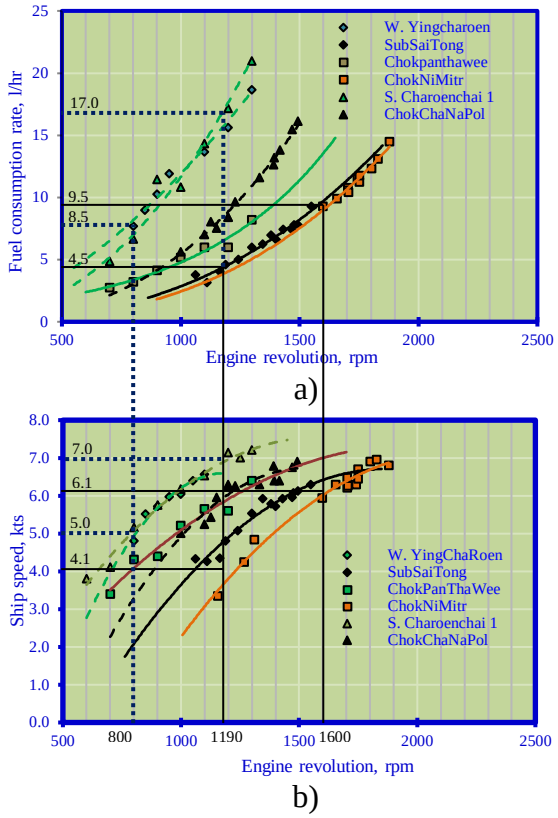

Figure 1 graph presents relationships of a) fuel consumption via engine revolution, and b) ship speed via engine revolution

Six characteristic profiles in figure 1 indicate that each trawler has individual feature line. W. The top lines of Yingcharoen and S. Charoenchai 1 mean that these boats consume the most fuel consumption while Subsaitong and Choknimitr the lowest. Referring some previous work advices to improve fuel efficient use by reducing ship speed one or two knots during steaming, thus two average trend lines of both W. Yingcharoen/S. Charoenchai 1 and Subsaitong/Choknimitr are set up. Assuming that these trawlers decrease ship speed down two knots, that are 7.0 to 5.0 knots of W. Yingcharoen/S. Charoenchai 1 and 6.1 to 4.1 knots of Subsaitong/Choknimitr. Values of fuel consumption will be drop from 17.0 to 8.5 l/hr of W. Yingcharoen/S. Charoenchai 1 and 9.5 to 4.5 l/hr of Subsaitong/Choknimitr. Two calculated percentages of saving fuel are 50.0 of W. Yingcharoen/S. Charoenchai 1 and 52.63 of Subsaitong/Choknimitr.

Exactly, decreasing ship speed of trawlers contributes to reduce fuel consumption but sailing time increased. Skippers have to consider a suitable way to be applied this idea without negative impact to their catch or time. Not only fuel consumption during free trial is evaluated, but fuel consumption all of trips have to be considered and shown in figure 2.
Nevertheless consideration on fishing performance must cover not only energy efficient use but also revenue received from selling catches. A ratio of revenue over unit fuel consumption should be an effective comparison value which shows in table 1. When looking at total fuel consumption, W. Yingcharoen consumes the highest value of 1,862 litter but Choknimitr as 656 litter, which W. Yingcharoen spent more expenditure than Choknimitr. Eventhough W. Yingcharoen paid fuel cost more than Choknimitr but W. Yingcharoen earn the highest revenue per fuel consumption as 72.5 THB/litter whereas the value of Choknimitr as 34.9 THB/litter. With revenue per fuel consumption ratio, earning performance of W. Yingcharoen is better than Choknimitr about two times.

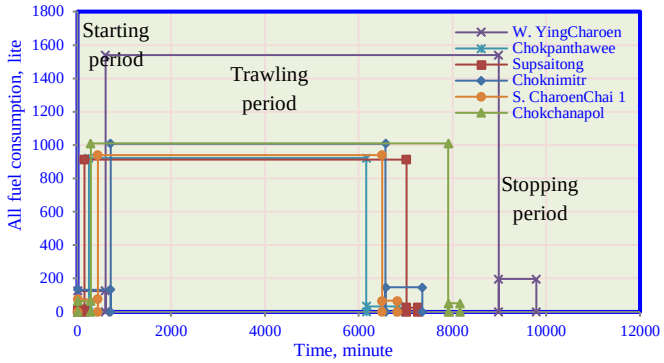

Figure 2 All fuel consumptions in all phases consisting of starting, trawling, and stopping period

Fuel consumption figure of all trawlers are the same. These trawlers consume a lot of fuel during trawling period due to high resistance drag force produced by trawl net/gear. To decrease this resistance force, there are several methods to be done as by remodelling net, or enlarging mesh size of net, or cleaning net after finishing the trips, imrove otter board efficiency, or etc.

Table 1 Economic effort of six investigated trawlers

Name of trawler		Wor YingChaRoen	ChokPanThaWee	SubSaiTong	ChokNiMitr	Sor ChaRoenChai 1	ChokChaNaPol
Duration	minutes	8,381.0	7,094.0	7,256.0	7,356.0	8,159.0	6,820.0
	hours	140.0	118.0	121.0	123.0	136.0	114.0
Total Fuel Consumption	l	1,862.2	978.2	956.3	1,288.8	1,124.7	1,149.4
Total catch	kg	3,249.2	1,179.3	1,190.0	855.0	1,316.0	1,432.1
Fuel consumption per hour	l/hr	13.3	8.3	7.9	10.5	8.3	10.1
Fuel consumption per catch	l/kg	0.6	0.8	0.8	1.5	0.9	0.8
Catch/fuel consumption	kg/l	1.7	1.2	1.2	0.7	1.2	1.2
Revenue	THB	134,961.0	46,589.0	53,797.0	45,000.0	33,002.0	46,000.0
Revenue per fuel consumption	THB/l	72.5	47.6	47.7	34.9	47.7	40.0
Revenue per hour	THB/hr	966.2	394.0	377.2	367.0	394.8	404.7

Therefore specifying efficiency of fishing vessel based on engineering or economic term is complicate comparison because of several variations of ship capacity, displacement, or even plenty of marine resources in each fishing ground, etc. The audit results only describe to amount of fuel consumption rate of each trawler along fuel consumption profile displayed in the previous charts. And also improving efficiency of hull or fishing gear enable to decrease energy used which relate to slightly diminish slope of fuel consumption profile.

Conclusions

Energy audit project proves that it is an important activity in estimating energy efficient use on fishing vessels. Measurement results of fuel consumption characteristic and ship speed enable to make understanding to fishers on fuel consumption rate of their boats to maximize ship performance through the fuel consumption profile chart. One advice technique by reducing ship speed for saving fuel, trawler of W. Yincharoen/S. Charoenchai 1 can drop fuel consumption rate to 50 % while Subsaitong/Choknimitr down to 52.63 %. This study separates three trawling operation periods consisting of starting, trawling, and stopping. Almost diesel oil was burst whilst trawling because of high drag resistance force on surface of trawl net/gear. But hull resistance and engine performance are main factor effecting high fuel consumption during starting and stopping period. In addition to consideration of total fuel consumption of trawlers, earning performance of fishing vessel is an important parameter by using ratio of revenue per fuel consumption. Two values of revenue per fuel consumption of W. Yingcharoen and Choknimitr are 72.5 and 34.9 THB/litter, respectively. W. Yingcharoen generates the highest revenue per fuel consumption in opposite with Chonimitr the lowest earning performance. Although the first project received some auditing results, but it still have more trawlers to be collected their conditional data for more accurate analysis and other improvements which will be done in the second phase.