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Carbon Footprint Estimation for Pole and Line Fishing Vessel According to Its Operation Mode -Study Case at Papua Fisheries-

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ABSTRACT

Carbon Footprint is one of the newest issue that people are concerned about especially on Fisheries business in Indonesia. The ships are growing bigger in terms of number and it makes the environment issue also became more concern for the people's life and wellbeing. In this experiment, those issues will be analyzed with Carbon Footprint on Fishing Ships in Sorong. This experiment will be analyzed using mathematical analysis based on literature that used in order to get the emission factor and also to calculate the carbon footprint emission on site. Those calculations will be used as basic logic calculation using the emission factor multiplied by fuel consumption. The purpose of this experiment is to understanding the Mode of the operation of the fishing ships in order to calculate the emissions. This experiment purpose is to get estimation of the amount of exhaust gas from fishing ships emission and also to get the constant value for each fuel that used for the fishing ships on the experiment site.

KEYWORDS: *Carbon Footprint; Operational Model of the Fishing Ship; Emission Factor.*

1.0 INTRODUCTION

1.1 Background

One of the biggest main causes of ocean pollution in Indonesia waterways is because there are so many fishing vessels who are operated in it. According to the report from the Ministry of Marine Affairs and Fisheries Republic of Indonesia on Number in 2011 [14], data about fishing vessel that registered is about 550.000. All these contemporary ships are very dependent on Fossil fuel for its propulsion, fishing catching activities and also to storage processing of those fish. Because of this dependent about fossil fuel, a certain problem is emerged. Not only a problem on Marine environment but also makes the price of fisheries who is very vulnerable to the price of the fluctuation from world fuel barrel price. [18]

In order to analyze the problem, it is important to do a measurement on fuel consumption on fishing vessel. There are at least 3 main reason to do those things [27] , which are :

1. Environmental Sustainability : a Condition where the needs and supply for this generation (present condition) and future generation are accepted, without destroying or even slightly damaged the environment where the resource is. In other words, the place where the ships are set sail and operating can't disturb the availability of the resources because of the ships that operates in there.
2. Economic Sustainability : Many factors contributes to the economic value and economic ability on Fisheries sector. One of those things are ; Price Market, Investment, Labor price, price of transportation and the most important thing is the price of fossil fuel that's mainly used. The costs for fossil fuel could amount to 30 – 75 % from the production costs.

3. Competitive Advantage : If we can analyze and improve the energy consumption efficiency and the greenhouse gas effect, we could make a certain competitive advantage for our products. We could do these things using a demo and teach the fisherman and fisheries company about the improvement of environment security and availability. We could also tell the consumers about the advantage of choosing the fisheries product whose production process is very green and Eco-friendly

One of the efforts we're trying to ensure those availabilities is using the Ecolabelling on Fisheries Management. Ecolabelling is an instrument especially about based-market economic instrument with a purpose to direct consumer transaction behavior where they no longer oblivious and also take into consideration about other factor for consuming a product rather than just making a decision based on their market price [9]. The factors that we used for Ecolabelling are fair trade, support on micro scale fisheries production, environment and Ecology. One of the most famous fisheries organization in the world – FAO (Food and Agricultural Organization of United Nations) already do these Ecolabelling process on their fisheries product whereas the main point from this is to understand and to protect all potential fisheries resources. One of the fisheries product who have a bright potential is Tuna fish. For those product, there are many type of fishing vessel who specialize on catching and processing those. One of the Tuna fishing vessel is a Fishing vessel called Trawl, Purse Seine and Pole and Line. However since there are a new regulations from Indonesia government (*Peraturan Menteri Kelautan Dan Perikanan Republik Indonesia Nomor 2/Permen-Kp/2015 - Tentang Larangan Penggunaan Alat Penangkapan Ikan Pukat Hela (Trawls) Dan Pukat Tarik (Seine Nets) Di Wilayah Pengelolaan Perikanan Negara Republik Indonesia)* [16], who forbids a certain type of fishing vessel to operate within Indonesia waterways, currently the Pole and Line ships is the most dominant and mostly used to catch Tuna Fish. From those problem and explanation, it became clear that energy measurement is very important and we could analyze those things on one of the most needed vessel in Fisheries process, which is Pole and Line Type.

1.2 Literature Review

According to the book of ***Emission Inventory Guide Book Group 8*** [7], Exhaust gas emission in Marine terms is all leftover emission that came from:

- Marine diesel engines who used as main propulsion and/or auxiliary engines
- Boiler who used as propulsion system for steam turbine
- gas turbines

From all the power unit that used in Ocean transportation industries, Marine Diesel Engine is the most dominant for main propulsion[4]. All those engines are using a certain type of fossil fuel in order to operate, which resulted on a certain Emission Factor for each engine. All exhaust gas emission from Marine Diesel contains Nitrogen, Oxygen, Carbon Dioxide and Water Vapour and also Sulfur. Other than those there are also Hydrocarbon and Particulate Material, Metal and Organic micropollutants that cannot be re-used. The comparison between those pollutants could be seen on the figure 1:

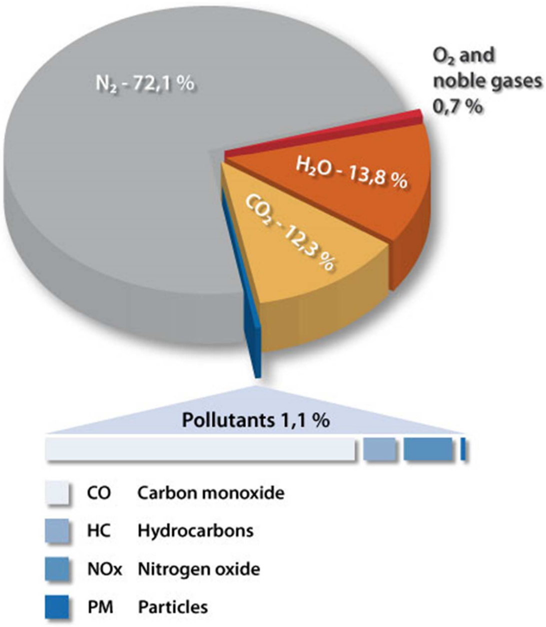

Figure 1: Pollutants Emission.

All those exhaust emission who has a negative effect on environment (greenhouse gas effect) are named Carbon Footprint [10]. Carbon Footprint is measured all the total of greenhouse gas whether it is direct or indirect who produced by a certain type of activities. or those things could also came from the accumulation from a certain production process [27]. Carbon footprint could be divided by 2 types which are Primary Carbon Footprint and Secondary Carbon Footprint. Primary carbon footprint is an emission who came directly from combustion of the fossil fuel, while secondary carbon footprint is the CO_2 emission who came indirectly [10]. The example of secondary carbon footprint is the electricity consumption. All the research from the expert creates a certain facts that there is an escalation of the amount of CO2 at the atmosphere which could be passed the limit. Every day the amount and the concentrates of CO_2 is increasing and it has a correlation between those increase and High activities from the people on Earth. In Marine world itself, the combustion process from the Main Engine is one of the main reasons of Primary Carbon Footprint. In order to solve this problem, an approach based on Consumption behavior could supply an approach based on production that invented by Gas Rumah Kaca Nasional Organization and also agreed on Kyoto Protocol [17]. Carbon Footprint with consumption based could facilitate International Cooperation between developing country and developed country. Other than those purposes, the approach also could make the consumer realize how much greenhouse gas emission that they make because of their lifestyle and indirectly it makes them aware about the emission problems. Carbon footprint usually told not with unit based on territory, but it is measured by unit of mass (kg, ton, etc).

Regulation about the limitation of the emission, specifically about SO2 and NOx is regulated by IMO (International Maritime Organization). NOx emission from the main engines have a limitation for the diesel engines with power more than 130 kW, and for those types here are the limitation values [8]:

$$17 \text{ g/kWh when } n < 130$$
$$45 \times n^{-0.2} \text{ g/kWh when } 130 < n < 2000$$
$$9.84 \text{ g/kWh when } n > 2000$$

For the estimation of emission calculation, there are a few methods that we can be used. However from all those method, the most basic method to calculate the exhaust gas emission is shown in the equation (1):

$$Emission = Fuel\ sold \times Emission\ factor \quad (1)$$

Where the value of Fuel sold could be separated into two parts which are Residual Bunker Fuel Oil or more common known as Heavy Fuel Oil (HFO) and Distillate Fuel or more commonly known as Marine Diesel Oil (MDO) even though that for certain country there are another type of fuel that they're using on. In Practice, every ships have its own specification, engine power, speed and gross tonnage according to each function.

1.3 Purpose of Study

Because of new regulations from Indonesia government for Fishing vessel that could operate, the growth of shipping activity and more exploitation on marine resources, and also the limitation for exhaust gas emission both from IMO and from government itself (*Peraturan Menteri Lingkungan Hidup Republik Indonesia Nomor 7 Tahun 2014 Tentang Kerugian Lingkungan Hidup Akibat Pencemaran Dan/Atau Kerusakan Lingkungan Hidup)* [13], it resulted in a certain unanswered scientific questions. Those questions are how the Operation Mode from the fishing vessel when they're about to catch the fish? How it will affect the emission? How much for the estimation of exhaust gas for fishing vessel that came from Main Engine? And how is the ratio between exhaust gas emission estimation value with Fisheries production estimation?

The purpose of this paper is to obtain the detailed data and information about the Operation Mode from fishing Vessel, Fuel oil consumption, the value of ship emission who could take effect on marine environment, and also to obtain the constant value and also the method to calculate Carbon Footprint on Fishing Vessel. With all these obtained information, it's expected to help the authority of Indonesia Government work better, especially on The Ministry of Marine Affairs and Fisheries of Republic Indonesia which resulted as a reference for alternate policy to get the business of fish catching (especially on Tuna Cakalang Tongkol – TCT Production) more Eco-friendly, low fuel oil consumption, and low CO according to the goal from Indonesia Government Program

1.4 Research Location

The Location for this research is at Waterways on Sorong region. For Fishing Port is located on Cakalang (Kuda Laut)Sorong, Desa Kampung Baru, Kec. Sorong Barat. This port has 2 docks, revetment and open drainage in order to facilitate the fisherman to do catching activities. This port is quite closed to the Sorong central activities. This port also manage and supervise other location such as : Kota Sorong, Kabupaten Sorong, Kabupaten Raja Ampat, Kabupaten Sorong Selatan, Kabupaten Maybrat, Kabupaten Tambrauw, Kabupaten Bintuni/Wimro.

The data obtained from Pelabuhan Indonesia IV Office Branch is told that the wind speed is on 7 knot/hour on September and December. While the data about the tidal is :

- High high Water Spring (HWS) : 1,50 m LWS
- Low Low Water Spring (LWS) : 1,00 m LWS.

From each month there are fluctuation on wave height because it's all depends on the season which is influence the wind blows. The wave on site could go up to 3 meter depends on what season it'll be. The location of this research could be seen in Figure 2 and Figure 3 for the docks at the fishing port :

Figure 2: Sorong Region

Figure 3: One of the docks from Fishing Port at Sorong

For the fishing season division, usually it is associated with the sea breeze or onshore breeze in the location. The peak season usually start in October until April (Musim angin barat), and for the transition (not so much fish to catch) is on May until August (Musim angin timur). In the transition season, all the catching effort and activites will be decreased drastically. Detail about the season of fish catching is shown in the figure 4:

Waktu tangkap		Puncak				Paceklik				Sedang			
	Bulan	Sep	Okt	Nov	Des	Jan	Feb	Mar	Apr	Mei	Jun	Jul	Ags
Musim angin		Barat				Peralihan1			Timur			Peralihan2	

Figure 4: Graph of fishing ships season on Pole and Line Vessel

2.0 METHODOLOGY

2.1. Framework and Data Collection

Exhaust gas emission frol the fishing vessel is very dependent on what type of operation from those ships in a certain region. In this paper, the sample is obtained when the fishing vessel with pole and line type is point the catching activities in Sorong waterways. According to the data of location geography, here is the figure on the maps of catching activities as shown in figure 5:

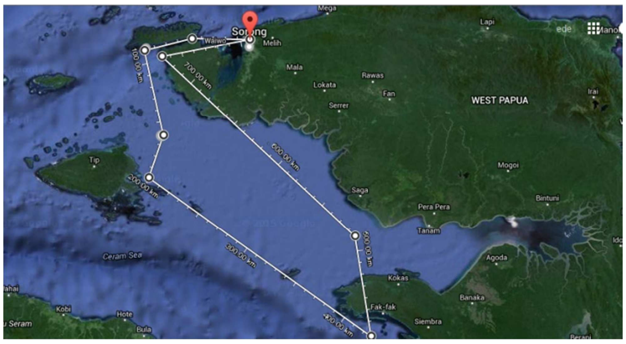

Figure 5: Catching Activities

During the process for catching the fish, we could obtain these data in order for the next analysis:

- RPM Engine
- Time of Sailing
- Process and activities that's been doing / Operation Mode
- Longitude – Latitude
- Fuel Oil consumption on certain activities at certain time of sailing.

2.2. Fuel Oil Consumption and Emission Factor

In the exhaust gas emission calculation, we need to understand and obtain the data about the amount of fuel oil that used for the activities. According to the data observation from the fish catching activity, we obtained the amount of fuel oil consumption in a certain Operation Mode that can be seen in the table 1:

Table 1: Fuel Oil Consumption

Used Engine	Fuel Oil Consumption (Ltr/Day)	Operation Mode
Main Engine 330 PK	143.52	Warm Up
	1348.94	Goes to Quay
	1119.29	Goes to Fishing Ground
	463.05	at Fishing Ground
	312.59	Back to the Docks.

According from those data, for the next step we could estimate the emission value. However in order to know the exact value we also need the data about the emission factor for an emission. The value from those emission factors are obtained and shown in the table 2 down below:

Table 2: CO_2 Emission Factor

Fish Catching	NOx	SO2	CO2	HC	PM	sfc	Nox	SO2	CO2	HC	PM
	in g/kWh						in kg/tonne fuel				
At Sea	13.9	11.5	685	0.5		215	65	53	3179	1.9	
In Port	13.4	12.2	722	0.4	0.5	227	59	54	3179	1.5	3.6
Manouvering	13	12.2	725	0.6	1.1	225	57	54	3179	2.6	4.6

Fish Catching	NOx	SO2	CO2	HC	PM
	Kg/Ton	Kg/Ton	Kg/TJ	Kg/Ton	Kg/Ton
At Sea	11	19	74100	26	2.4
In Port	10.5	20	74100	24	2.4
Manouvering	10.1	20	74100	28	3.4

2.3. Emission Calculation

Method that is used for the analysis of the estimation of fishing vessel emission is based on observation of fuel oil consumption from fish catching activity. Based on those results, we compare the result with Methodological standard of Europe where these standard already adopted on a research conducted by oleh **Carlo Trozzi and Rita Vaccaro** in their paper: ***Methodologies for Estimating Air Pollutant Emissions from Ships*** [26]. These researches are executed on Uni-Europa region with a purpose to obtain the method to estimate fuel oil consumption and also its emission value using the statistic for each ship traffic in European region. The type of the pollution that is used and analyze in those research is the pollution from combustion process. In those papers, the author combine twelve type of ships where the data of emission factor, type of engine, shipping conditions and fuel oil consumption is obtained. That standard is finally called as the MEET Framework standard

For the emission calculation method using MEET Framework standard, here is the formula that used for the calculation as shown in equation (2) for Total Emission and equation (3) for Total Emission from a certain type of pollutant, fuel oil, ships and engine:

$$E_i = \sum jkl\ E_{ijkl} \quad (2)$$

Where :

$$E_{ijkl} = S_{jk}\ (GT)\ x\ t_{jkl}\ x\ F_{ijl} \quad (3)$$

Where :

Ei = Total Emission from a certain pollutant

Eijkl = Total Emission from a certain pollutant who came from using a certain type of fuel oil, on a certain class of ships and also a certain type of engine.

Σjkl = where; i = pollutant, j = fuel, k = class of ship for consumption class, l = class type engine for emission factor characteristics,

Sjk (GT) = Fuel oil consumption in a certain class of ships (Units in Gross Tonnage)

tjkl = amount of days for ships navigation on a certain class

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of ships that used certain type of engine and also certain type of fuel oil

Fijl = Emission factor from a certain pollutant on a certain fuel that came from a certain type of

However, one of the weaknesses from this equation is inability to project the result on a real time and according to its real condition. In order to obtain the result as close to the real condition in practice, we need more detailed methodology that needs several more data:

- Navigation statistics, also the data from ships gross tonnage and the type of fuel that is used and also the mean time of consumption, who are distributed according to the ships class.
- Statistics of the movement of the ships in order to obtain the detailed mission estimation.

  Or we could use :
- Ships distribution and general statistics of ships movement in order to get the emission estimation.

From those information, we could obtain a number of days from a different ships operation mode. From those data, we finally could obtain the more detailed emission calculation formula as shown in equation (4) and equation (5):

$$E_i = \sum jklm \ E_{ijkl} \quad (4)$$

where :

$$E_{ijklm} = S_{jkm}\,(GT)\ x\ t_{jklm}\ x\ F_{ijlm} \quad (5)$$

3.0 RESULT AND DISCUSSIONS

3.1. Exhaust Gas Emission Calculation

From the research that we are conducting, we get the result of fuel oil consumption in Table. 1. From those researches, we obtained the value of the Fuel Sold that we needed for the Formula 1. The next thing we are doing is multiply those values with the emission factor in Table 2. And from those calculations, we get the result. Table 3 is for the result of emission of CO_2 per trip:

Table 3: Result of Emission of CO_2 Per Trip

Used Engine	Fuel Oil Consumption (Kl)	Calorific Value (TJ/Kl)	Operation Mode	Emission Factor (Kg/TJ)	Emission CO_2 (Kg)
Main Engine 330 HP	0,143	0,000036	Warm Up	74100	0,2753
	0,463	0,000036	Goes to Quay	74100	3,6077
	1,119	0,000036	Goes to Fishing Ground	74100	2,9276
	0,312	0,000036	Fishing Ground	74100	1,2981
	1,348	0,000036	Back to the Docks	74100	0,8339
Total	3,38			Total	8,9425

Table 4 is for the result of emission of NOx per trip as shown in table below:

Table 4: Result of Emission NOx Per Trip

Used Engine	Fuel Oil Consumption (Kl)	Operation Mode	Emission Factor (Kg/Ton)	Emission NOx (Kg)
Main Engine 330 HP	0,143	Warm Up	10,5	1,2646
	0,463	Goes to Quay	11	12,0354
	1,119	Goes to Fishing Ground	11	10,0475
	0,312	Fishing Ground	10,1	4,3455
	1,348	Back to the Docks	11	2,8883
Total	3,38		Total	30,5813

For the result of emission on SO_2 per trip, it is shown on Table 5

Table 5: Result of Emission SO_2 Per Trip

Used Engine	Fuel Oil Consumption (Kl)	Operation Mode	Emission Factor (Kg/Ton)	Emission SO_2 (Kg)
Main Engine 330 HP	0,143	Warm Up	20	1,9192
	0,463	Goes to Quay	19	21,0393
	1,119	Goes to Fishing Ground	19	17,5695
	0,312	Fishing Ground	20	8,0423
	1,348	Back to the Docks	19	4,9889
Total	3,38		Total	53,5591

For the result of emission on the emission of Hidrocarbon (HC) per trip, it is shown on Table 6 :

Table 6: Result of Emission HC Per Trip

Used Engine	Fuel Oil Consumption (Kl)	Operation Mode	Emission Factor (Kg/Ton)	Emission HC (Kg)
Main Engine 330 HP	0,143	Warm Up	24	2,3992
	0,463	Goes to Quay	26	28,2882
	1,119	Goes to Fishing Ground	26	23,8832
	0,312	Fishing Ground	28	10,2015
	1,348	Back to the Docks	26	6,8270
Total	3,38		Total	71,5990

For the result of emission on the emission of Particulate Matter (PM) per trip, it is shown on Table 7 :

Table 7: Result of Emission PM Per Trip

Used Engine	Fuel Oil Consumption (Kl)	Operation Mode	Emission Factor (Kg/Ton)	Emission PM (Kg)
Main Engine 330 HP	0,143	Warm Up	2.4	0,2428
	0,463	Goes to Quay	2.4	2,6789
	1,119	Goes to Fishing Ground	2.4	2,2504
	0,312	Fishing Ground	3.4	1,0126
	1,348	Back to the Docks	2.4	0,6302
Total	3,38		Total	6,8148

And for the emission calculation of CO is shown on Table 8 :

Table 8: Result of Emission CO Per Trip

Used Engine	Fuel Oil Consumption (Kl)	Operation Mode	Emission Factor (Kg/Ton)	Emission PM (Kg)
Main Engine 330 HP	0,143	Warm Up	-	-
	0,463	Goes to Quay	43.5	39,9554
	1,119	Goes to Fishing Ground	43.5	35,6912
	0,312	Fishing Ground	-	-
	1,348	Back to the Docks	43.5	11,4220
Total	3,38		Total	87,0686

From all those data, we could conclude it and find the whole total emission that occured and it shown on Table 9 :

Table 9: Result of Total Emission

Total Emission						
Moda	Total CO2 (Kg)	NOx	SO2	HC	PM	CO
Warm Up	0,2753	1,26	1,91	2,39	0,24	-
Goes to Quay	3,6077	12,03	21,03	28,28	2,67	39,95
Goes to Fishing Ground	2,9276	10,04	17,56	23,88	2,25	35,69
Fishing Ground	1,2981	4,34	8,04	10,20	1,01	-
Back to the Docks	0,8339	2,88	4,98	6,82	0,63	11,42
Total (Kg)	8,9425	30,58	53,55	71,59	6,81	87,06
Total Emission (Kg)	258,56					
Total Emission 4 Ships	1034,26					
Annual Total Emission (20 Trip)	20685,23					
Total Emission (Ton)	20,68					

3.2. Method Comparison

In order to find the margin defisit between the experiment result and the MEET Framework, we can compare the result of exhaust gas emission using both method to calculate it and find the deficit margin. However, before we can calculate the result of the Carbon Footprint, we need another data which is the sample Fish Product Production for Pole and Line at Sorong. Data about monthly production for Pole and Line ships at Sorong region is shown from the figure 6:

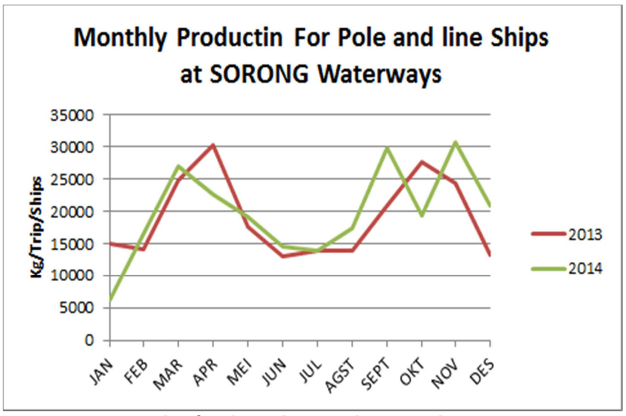

Figure 6: Graph of Pole and Line Ships Production at Sorong

The data about calculation result and comparison method for exhaust gas emission with fisheries production could be seen in these graphs. on figure 7 it is shown the graph of CO_2 Carbon Footprint:

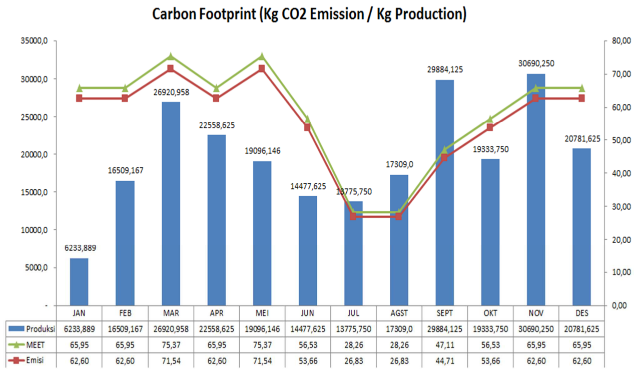

Figure 7: Graph of Carbon Footprint CO_2

Figure 8 is for the result of Carbon Emission NOx :

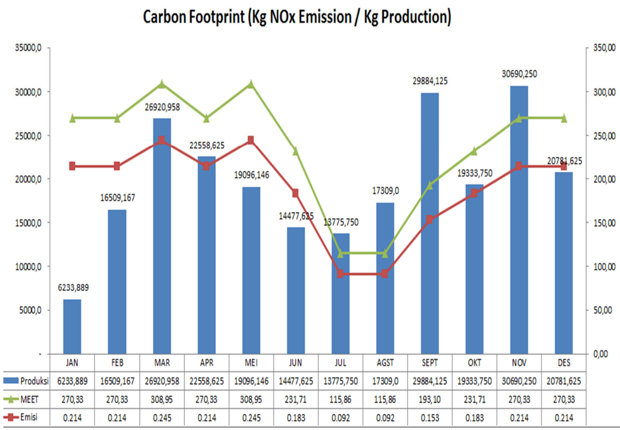

Figure 8: Graph of Carbon Footprint NOx

On Figure 9, is shown the graph of carbon footprint of SO_2

emission

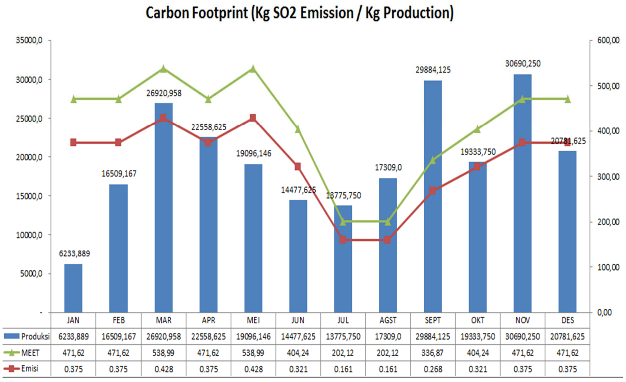

Figure 9: Graph of Carbon Footprint SO_2

For the result of carbon footprint on Hidrocarbon (HC) emission, it is shown on Figure 10 :

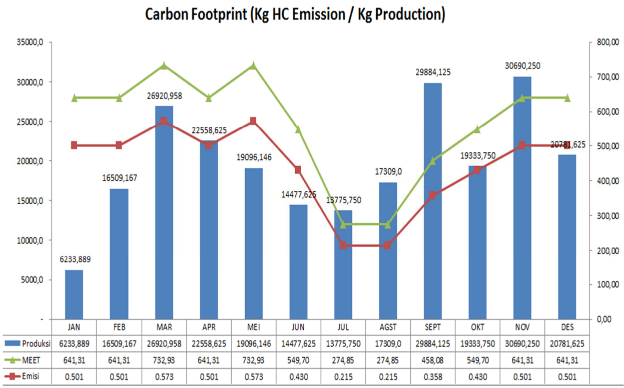

Figure 10: Graph of Carbon Footprint HC

For the result of carbon footprint on of Particulate Matter (PM) emission, it is shown on Figure 11 :

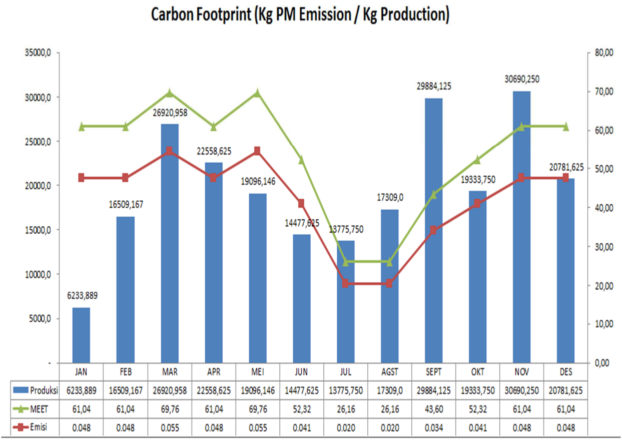

Figure 11: Graph of Carbon Footprint PM

And for the result of carbon footprint on of CO emission, it is shown on Figure 12 :

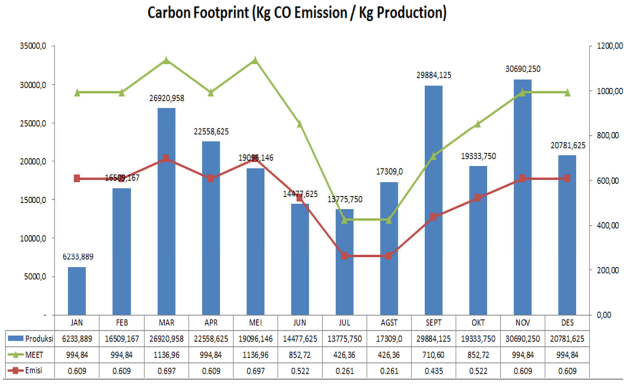

Figure 12: Graph of Carbon Footprint CO

And for the margin deficit between the experiment calcualtion and MEET Framework calculation is shown in the table 9:

Table 9: Percentage different

Percentage of Comparison					
CO2	NOx	SO2	HC	PM	CO
3%	**12%**	**11%**	**12%**	**12%**	**24%**

3.3. Rules and Regulation

According to the regulation from the Ministry for the Environment (*Peraturan Menteri Lingkungan Hidup Republik Indonesia Nomor 7 Tahun 2014 Tentang Kerugian Lingkungan Hidup Akibat Pencemaran Dan/Atau Kerusakan Lingkungan Hidup*) [13] stated that there are the limit value for each air pollution for each polluting unit. According to the accumulation of each polluting unit value and also takes into consideration about the diversity of the industries with the different type and parameter of pollution unit, we could calculate the damage of the environment based on single unit of contaminant / pollution for each parameter.

The air or gas emission parameter or even liquid waste parameter that used to calculate the pollution for each value of contaminant is shown in the Table 10:

Table 10: Pollution Unit Values for Various Parameters Air Emissions / Gas

Parameter	Air Pollution Index
NON LOGAM :	
Ammonia (NH3)	350 g
Chlorin (Cl2)	7 Kg
Hidrogen Chlorida (HCl)	4 Kg
Hidrogen Fluorida (HF)	7 Kg
Carbon Monoksida (CO)	400 Kg
Nitrogen Oksida (NOx)	200 Kg
Sulfur Oksida (SOx)	200 Kg
Batubara (Coal)	250 Kg
Minyak (Oil)	150 Kg
Semen (Cement)	100 Kg
Particulate Matter	250 Kg
Total Sulfur Tereduksi (H2S)	25 Kg
Metal :	
Arsenic (As)	4 g
Antimony (Sb)	10 g
Cadmium (Cd)	10 g
Lead (Pb)	10 g
Mercury (Hg)	4 g
Zinc (Zn)	40 g

These are the result between each method that are used with the rules and regulations from Indonesia Government and it is shown on the Table 11:

Table 11: Compliance with Rules and Regulations

Parameter	Air Pollution Index	Using Calculation From Experiment	MEET Framework Calculation	Acc/No
NON METAL :				
Ammonia (NH3)	350 g			
Chlorin (Cl2)	7 Kg			
Hidrogen Chlorida (HCl)	4 Kg			
Hidrogen Fluorida (HF)	7 Kg			
Carbon Monoksida (CO)	400 Kg	87,07 Kg	142,12 Kg	Accepted
Nitrogen Oksida (NOx)	200 Kg	30,58 Kg	38,62 Kg	Accepted
Sulfur Oksida (SO2)	200 Kg	53,56 Kg	67,37 Kg	Accepted
Batubara (Coal)	250 Kg			
Minyak (Oil)	150 Kg			
Semen (Cement)	100 Kg			
Particulate Matter	250 Kg	6,81 Kg	8,72 Kg	Accepted
Total Sulfur Tereduksi (H2S)	25 Kg			
METAL :				
Arsenic (As)	4 g			
Antimony (Sb)	10 g			
Cadmium (Cd)	10 g			
Lead (Pb)	10 g			
Mercury (Hg)	4 g			
Zinc (Zn)	40 g			

4.0 CONCLUSION

Sorong region as one of the most common place for Papua region fisheries activities have so much ships. All thoses ships mainly uses Diesel Engine and certain fuel oil and therefore they produce a lot of emission. Those thing will influenced the Eco-Labelling that's planned to do in Indonesia fisheries. In this research we try to give an explanation how big for the influences for a certain type of fishing ships (pole and line) can contribute to the pollution at sea. From this research is is foundtThere are 5 things / 5 activities on Operation Mode of Pole and Line fishing ships in Indonesia region, those things are Goes to Quay, Goes to Fishing Ground, at Fishing Ground, and Back to the Docks. All this five operation mode is obtained based on survey by *Kementrian Kelautan dan Perikanan* in Indonesia waterways.

All those five operation mode also have the different CO_2 emission value, which are :

- Warm Up : 0,27 Kg
- Goes to Quay : 3,60 Kg
- Goes to Fishing Ground : 2,92 Kg
- at Fishing Ground : 1,29 Kg
- Back to the Docks : 0,83 Kg

These could happen because the fuel oil consumption and emission factor is different for each operation load which resulted in a different value of exhaust gas emissions.

The result of total exhaust gas emission also has different value between the experimental one and MEET Framework standard. The percentage deficit is approximately on 3% to 12 % based on the type of the emission. That result is because there are simplification on MEET Framework where they only assuming the fuel consumption based on ships gross tonnage. Other than those, the amount of day for ships at a certain operation mode is also have a huge contribution between mismatch on the calculation and in practices. However, based on the calculation all the types of emission is below the limit from the regulations of Indonesia Government and Authority

From all of those calculations, we could also conclude that each year Pole and Line ships could do a trip until 20 times and also could obtain:

- **179 Kg CO_2 emission / 61.260 Kg Fish**

For each CO2 emission that resulted form combustion process of Pole and Line ships is resulted on the productions of fisheries:

- **29 g Emisi CO_2 / 1 Kg Fish**

These results are shown to us that the catching process using Pole and Line type of the Fishing Vessel is one of the catching tools who is very Eco-Friendly compared to the other type of the fishing vessels like Trawl and Purse Seine and the emission resulted from Pole and Line catching activity is one of the lowest in all of the fishing vessel.

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