STRATEGY OF ACCELERATE THE APPLICATION BIODIESEL IN KRI KOARMADA II TO INCREASE ALUTSISTA COMBAT READINESS

Heru Prasetia[1], Okol Sri Suharyo[2], Udi Subakti C.M[3]

[1,2]Indonesian Naval Technology College,Bumimoro-Morokrembangan, Surabaya 60187, Indonesia
[3] Industrial Engineering Department, Institut Teknologi Sepuluh Nopember, Surabaya, Indonesia
E-mail: Heruj7prime@gmail.com

ABSTRACT

Through Presidential Regulation No. 5 of 2006 on National energy policy and Esdm Ministerial Regulation No.32 of 2008, the Government encourages the use of biodiesel in all aspects. In KRI, the use of biodiesel is only for KRI with machines that are still conventional or have not used a common rail system. Until 2020 KRI that has migrated to biodiesel is 32.5% of 40 KRI. Switching to biodiesel is not an easy matter, this is due to the complexity of the problems in KRI, both in terms of the limited budget, material components that do not support biodiesel, maintenance, and operations. Therefore, the writing of this journal aims to formulate a strategy to accelerate the application of biodiesel in KRI in Koarmada II by using the TOWS method (Threats, Opportunities, Weakness, Strength). The results of the analysis based on TOWS analysis obtained quadrant strategy is in quadrant III which is a Turn-around strategy that means making a strategy by suppressing weaknesses by utilizing existing opportunities. The development of the strategy resulted in 7 relevant sub-strategies to be used as an effort to accelerate the application of biodiesel to KRI in the Koarmada II.

Keywords: Renewable energy, Biodiesel, KRI, TOWS.

1. INTRODUCTION

In the third quarter of 2018, the Goverment expanded the policy of using Biodiesel 20 not only for public Service obligation (PSO) but expanded to non-PSO which covering heavy equipment, industry, and shipping. Biodiesel or Fatty Acid Methyl Ester (FAME) is a fuel produced from vegetable oils or animal fats, through a chemical process called transesterification. Biodiesel with a percentage of 0-100%, through little or no modification to the engine. The term B20 means fuel which is a mixture of 20% FAME and 80% HSD.

The government's policy encouraged the Navy to adjust and migrate from hsd to biodiesel. In general, the application of biodiesel in KRI requires adjustment of materials (pipes, plates, hoses, seals, gaskets, etc.) that support biodiesel and the need for fuel treatment before entering the combustion chamber. However, due to the variety of technology in the engine used by KRI, and the characteristics of biodiesel and taking into account all aspects, performance, maintenance, and durability in the use of biodiesel, the application of biodiesel is intended for ships with engines that are still conventional in terms of combustion technology, while ships with engines that are already based on common rail and turbines still use Hsd (Slogal, 2020, P.6).

KRI owned by koarmada II is 65 KRI, while the eligible in the use of biodiesel amount of 40 KRI (Slog Koarmada II, 2021). Until 2020, KRI that has migrated to biodiesel reaches 13 KRI (Disbeka, 2020, P.1). It means that those who have migrated to biodiesel are 32.5%, while 67.5% still have not switched to biodiesel.

Table 1. KRI Koarmda II that already uses Biodiesel

NO	KRI
1	YOS-353
2	OWA-354
3	AHP-355

4	KST-356
5	USP-372
6	LAM-374
7	HIU-634
8	AJK-653
9	PDG-801
10	TKL-813
11	SKU-842
12	KKP-811
13	BDU-841

Source : Disbekal, 2020

On another occasion, President Joko widodo (2018) affirmed:

> *"The use of B20 Biodiesel must be forced and there is no bargaining anymore because it concerns a big and important issue, namely trade balance, foreign exchange needs, and savings".*

So that with the mandate directly by the President that is strengthened by the regulation of the Minister of Energy and Mineral Resources No. 32 of 2018 on the Provision, Utilization and Commercial Governance of Biofuels as Other Fuels, then as an effort to accelerate the use of biodiesel in KRI, a special strategy is needed.

The writing of this journal aims to formulate a special strategy taken in accelerating the application of biodiesel on KRI to improve the combat readiness of Alutsista faced with existing problems. Pointing out the above problems, the author tries to create a strategy using the TOWS approach (Threats, Opportunities, Weaknesses, Strengths,).

2. MATERIAL / METHODOLOGY

2.1. Indonesian Biodiesel Policy

Through Presidential Regulation No. 5 of 2006 on National energy policy and Regulation of the Minister of Energy and Mineral Resources No.32 of 2008 on the Provision, Utilization and Commercial Administration of Biofuels as another fuel, the government strives to develop renewable energy that can meet the needs of the community cheaply and affordably.

Basically, biodiesel usage policy has 5 main objectives (Dirjen EBTKE, 2018, P.1) including: 1) Supporting national energy security; 2) Support domestic economic growth; 3) Reduce greenhouse gas emissions and improve environmental quality; 4) Increase economic added value; 5) Reduce the consumption of imports and fossil fuels.

The government targets until 2025, biodiesel usage should reach 30%. Here's the table of the mandatory phasing of vegetable fuel utilization

Tabel 2. Mandatory utilization of Biofuels

SEKTOR	2015	2016	2020	2025
Transportation, and Public Services (PSO)	15 %	20%	30%	30%
Transportation, and NON-PSO	15 %	20%	30%	30%
Industrial and Commercial	15 %	20%	30%	30%
Power plant	25%	30%	30%	30%

Source : Minister of ESDM, 2018.

2.2. Characteristics of Biodiesel

According to (Slogal, 2020) biodiesel characteristics (FAME) that need to be known are: 1) solvent; 2) Hygroscopic; 3) Easily contaminated microbes; 4) Reactive to bronze, copper, lead, lead, zinc, and seal/gasket materials made of Nitrile Rubber Compound, Polypropylene, and Polyvinyl.

While some types of Alutsista KRI / Alpung are not allowed to use B+ (according to the relaxation criteria of the Ministry of Energy and Mineral Resources) namely:

a. That uses a common rail system;
b. That uses gas turbines;
c. Submarines;
d. Aircraft; and.

e. Has fuel specification requirements that are not the same as biodiesel specifications issued by the Ministry of Energy and Mineral Resources.

2.3. Biodiesel Studies

Before the implementation of B20 in 2014 and 2015 the Ministry of Energy and Mineral Resources (EBTKE, LEMIGAS), GAIKINDO, APROBI, BPPT, BPDS, PERTAMINA, and ITB conducted an assessment of the durability of diesel vehicles (Toyota, Mitsubishi Hino, Ford, and Chevrolet) up to 40,000 km. The final result in general is very satisfactory and the biodiesel program can be continued. This is also reinforced by JAMA's statement that allows the mixing of biodiesel in fuel not exceeding 20%.

In addition to cars, the Ministry of Energy and Mineral Resources also conducted performance tests on EMD CC205 and GE CC206 trains for 6 months with the result that the train could still reach maximum power and lower exhaust emissions.

2.4. TOWS Theory

TOWS analysis is a process that requires management to think critically about its operations. TOWS analysis is an analysis that prioritizes studying and investigating the opportunities of external factors because it is considered more dynamic and competitive, after which it continues to analyze internal factors. By identifying multiple action plans that can improve the position of the organization's objectives, TOWS analysis allows management to select some of the most effective strategies and take advantage of available opportunities.

TOWS analysis shows the right strategy in four categories (TW, TS, OW, OS). Threat-Weakness (TW), this strategy identifies threats to correct existing weaknesses. Threat-Strength (TS), this strategy identifies threats to develop a strength strategy. The Opportunity-Weakness (OW) strategy is used to identify opportunities to correct weaknesses. Finally, the Opportunity-Strength (OS) strategy is used to identify opportunities to develop strength strategies.

2.5. Differences between TOWS and SWOT

SWOT analysis and TOWS analysis are two analyses that have different analytical focuses. Here's the focus difference between SWOT and TOWS analysis:

a. SWOT analysis emphasizes more on internal condition and situation factors, namely strengths and weaknesses of yourself or company (SW). After that just studied and taken into account external factors, threats, and opportunities (OT).

b. TOWS analysis first studied and investigated several external factors, because it is considered more dynamic based on external factors, namely opportunities and threats (OT). After obtaining external information, then made some adjustments to the improvement of internal potential strengths and weaknesses of the organization (SW).

In the context of the Strategy to Accelerate the Application of Biodiesel In KRI Koarmada II To Improve Alutsista Combat Readiness, the TOWS analysis will be more appropriate and precise. The preparation of the strategy requires an investigation in advance related to external factors, namely current opportunities, and threats (O-T). Furthermore, based on the identification of external aspects, it can be continued evaluation and preparation of the needs of internal factors, namely strengths and weaknesses (S-W) following the vision, mission, and goals achieved, namely the use of biodiesel in KRI.

Table 3. Matrik TOWS

	WEAKNESS (W)	**STRENGTHS (S)**

EKSTERNAL/INTERNAL FAKTOR	Negative internal aspects can be controlled and can be improved in planning.	Positive internal aspects can be controlled and can be strengthened in planning.
THREATS (T)	**STRATEGY (T-W)**	**STRATEGY (T-S)**
Negative external conditions that cannot be controlled and may be minimized in impact.	Identify threats to correct weaknesses	Identify threats to develop a strategy of strength
OPPORTUNITY (O)	**STRATEGY (O-W)**	**STRATEGY (O-S)**
Positive external conditions that cannot be controlled and can be taken advantage of.	Identify opportunities to correct weaknesses	Identify opportunities to strategize strengths

2.6. Research Methodology

This research is conducted in four stages, namely the preliminary stage, data collection, data processing, analysis and the last is the conclusion and suggestion stage. Shown in the flow chart as follows:

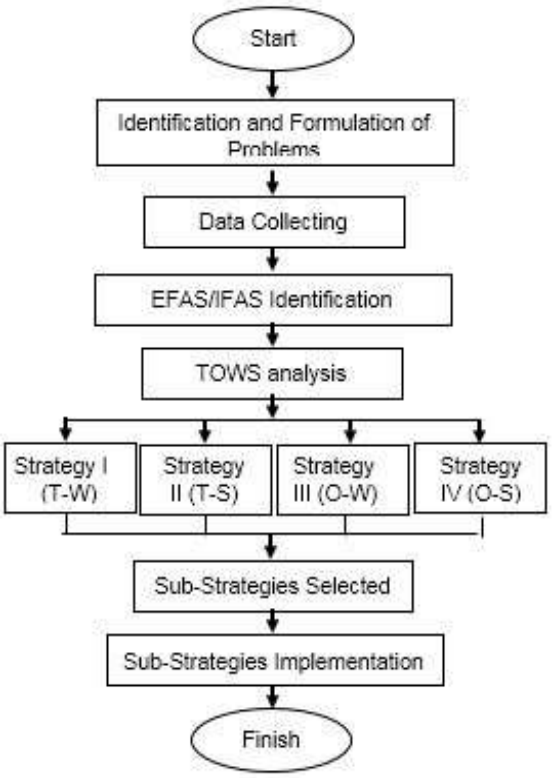

Figure 1. Flow Chart Research Method

The preliminary stage consists of the identification of the problem, the determination of goals. The stage of data collection is carried out through interviews and library studies to determine the EFAS and IFAS factors. At the stage of data processing is carried out matrix calculation steps by giving weight value and rating first. At the stage of data analysis is carried out an analysis of the calculation that has been contained in the quadrant will be used as an option of the strategy. At the conclusion stage, conclusions were drawn from the research that has been done as well as suggestions for further research related to this research.

3. RESULT AND DISCUSSION

Analysis strategy acceleration of biodiesel application in KRI to improve the readiness of combat Alutsista using TOWS (threats, opportunity, weaknesses, strengths) is by minimizing weaknesses and threats while maximizing strength and opportunity.

EFAS and IFAS factors that will be used as the basis in calculating weight, rating, and score, can be described as follows:

a. Opportunity and threat factors as external factors (EFAS)

1) Threat factors:

a) Limited HSD depots in the area of operation

b) The nature or character of biodiesel that is reactive to some materials

c) Potential damage to engine components due to biodiesel use.

2) Opportunity factors :

a) Biodiesel is a renewable alternative energy

b) Some engine makers allow the use of biodiesel

c) Biodiesel depots are already many outside the base

b. Strength and weakness factors as internal factors (IFAS)

1) Weakness factors :

a) Periodic filter replacement and maintenance will be faster.

b) Potential blockage of the fuel injection system.

c) Biodiesel is abrasive to some materials or components

d) the amount of KRI owned by Koarmada II is quite a lot.

2) Strength factors :

a) Conventional engine technology is easier in the application of biodiesel.

b) Aslog KSAL policy in the use of biodiesel in the NAVY

c) Professional human resources 3rd

d) Some advantages of biodiesel that HSD does not have.

The next step is to carry out weighting against internal and external factors, the value weight is obtained using data retrieval by experts in the Navy concerning biodiesel. The results of weighting against TOWS factors are as follows:

Table 4. Threat Factors

Threat factor	Weight	Rating	Weight x Rating
Limited HSD depots in the area of operation	0,28	3	0,84
The nature or character of biodiesel that is reactive to some materials	0,36	2,4	0,864
Potential damage to engine components due to biodiesel use.	0,36	3,4	1,224
			2,928

Table 5. Opportunities Factors

Opportunities Factors	Weight	Rating	Weight x Rating
Biodiesel is a renewable alternative energy	0,44	2,4	1,056
Some engine makers allow the use of biodiesel	0,36	3,4	1,224
Biodiesel depots are already many outside the base	0,2	3,6	0,72
			3

Table 6. Weakness Factors

Weakness Factors	Weight	Rating	Weight x Rating
Periodic filter replacement and maintenance will be faster.	0,3	3,4	1,02
Aslog KSAL policy in the use of biodiesel in the NAVY	0,225	2,4	0,54

Biodiesel is abrasive to some materials or components	0,25	2,8	0,7
the amount of KRI owned by Koarmada II is quite a lot.	0,225	2,6	0,585
TOTAL	**1**	**-**	**2,845**

Table 7. Strenght Factors

Strenght Factor	Weight	Rating	Weight x Rating
Conventional engine technology is easier in the application of biodiesel.	0,325	3,2	1,04
Aslog KSAL policy in the use of biodiesel in the NAVY	0,3	2,8	0,84
Professional human resources 3rd	0,225	3	0,675
Some advantages of biodiesel that HSD does not have.	0,15	1,6	0,24
TOTAL	**1**	**-**	**2,795**

Table 8. Qudrant calculation

Eksternal (Y)	Value	Internal (X)	Value
Opportunities	3	*Strengths*	2,795
Threats	2,928	*Weakness*	2,845
Value Y	0,072	**Value X**	-0,05

Figure 2. TOWS Diagram

Based on the calculation results and quadrants of TOWS above can be seen that the right strategy is in quadrant III which is a Turn-around strategy which means to reduce weakness by utilizing opportunities to develop a strategy.

So to accelerate the application of biodiesel in KRI to improve the combat readiness of alutsista in Koarmada II, special strategies are needed including:

a. Refocusing of budget for accelerated biodiesel application on ships with conventional engines (W4, O2).

b. Calculation of the need for replacement materials (W4, O3)

c. Replacement of reactive material to biodiesel (W3, O1).

d. Modification of the fuel system onboard (W1, O1).

e. Education standard operating procedure (SOP) use of biodiesel to crew (W4, O1).

f. Procurement of more filters and accelerate periodic filter replacement (W1, O2).

g. Periodic evaluation (W1, W2, O2).

To realize the above 7 (seven) sub-strategies, concrete efforts are needed including:

a. Strategy 1

The application of biodiesel in KRI requires considerable costs, so the need to refocus the budget, through focusing and

diverting other KRI maintenance budgets for the implementation of changes to the fuel system. Unless it is urgent, then refocusing does not apply.

b. Strategy 2

Strategy 2 is the calculation of material that needs to be replaced, the effort is to record all equipment or materials to be replaced. As already conveyed by Aslog Ksal, that the characteristics of biodiesel are different from Hsd, so the equipment onboard needs to be adjusted

c. Strategy 3

Biodiesel has a characteristic that is reactive to some materials such as (pipes, plates, hoses, seals, gaskets, etc.), so before application, materials that are reactive need to be replace.

d. Strategy 4

Biodiesel also has more deposits than hsd and has a viscosity that is thicker than hsd, so the need for treatment before use. Treatment is 2 kinds, the first is treatment on the main tank through fuel circulation and the second is the installation of heaters on the fuel pipe before entering the engine, it aims to avoid clumping biodiesel in the fuel capillary pipe and help to occur perfect combustion in the fuel room.

e. Strategy 5

Biodiesel has its character so in its implementation the need for a deep understanding of the character of biodiesel by crews.

f. Strategy 6

In this strategy 6 is the procurement of a lot of fuel filters, this is due to the character of biodiesel that tends to have a lot of deposits. This precipitate will be very dangerous for the machine if filtering is not carried out

g. Strategy 7

Strategy 7 is the conduct of periodic evaluation, this is to know the implications resulting from the use of biodiesel. This evaluation includes filter replacement, engine parameters, performance, maintenance, and damage caused.

4. CONCLUSION

Based on TOWS analysis, it is known that:

a. Known efas weight (external factor) i.e. threat factor is 2,928, while the chance factor is 3.

b. IFAS weight (internal factor) is the weakness factor of 2,845, while the strength factor is 2,795.

c. In quadrant calculation, it is produced in quadrant III, i.e. using the Turn-around strategy.

d. In the processing process, 7 sub-strategies are produced, including:

1) Refocusing of budget for accelerated application of biodiesel on ships with conventional engines.
2) Calculation of the need for replacement materials.
3) Replacement of reactive material to biodiesel.
4) Modification of the fuel system onboard
5) Education sop use of biodiesel to members.
6) Procurement of more filters and speed up periodic filter replacement.
7) Periodic evaluation

REFERENCE

Dirjen EBTKE. (2018). *Kebijakan dalam Implementasi Biofuel Tujuan Program Mandatori Biofuel / Bahan Bakar Nabati* (Issue September).

Disbekal. (2020). *Data KRI, KAL Biodiesel September 2020*.

Heyko, E. (2011). Strategi Pengembangan Energi Terbarukan (Biofuel) di Indonesia. *Jurnal Ilmiah Mahasiswa FEB Universitas Brawijaya*, *2*, 2–15.

Kimia, T., & Semarang, U. N. (2019). Proses Treatment Marine Fuel Oil (Mfo) Sebagai Bahan Bakar Pada Mesin Diesel. *Jurnal Kompetensi Teknik*, *11*(1), 30–35. https://doi.org/10.15294/jkomtek.v11i1.19749

Luhman, N. (2006). Perpres No 5 Tahun 2006 Tentang Kebijakan Energi Nasional.

Mulyatno, I. P. (2010). *Kajian teknis kinerja sistem penggerak kapal dengan menggunakan bahan bakar biodiesel pada kapal km. laboar*. 56–63.

Nurhadi, I. (2015). *Pengaruh Penggunaan Biodiesel Terhadap Performa dan Komponen Utama Pada Motor Pokok KRI Weling-822*.

Ramadhan Sudrajat, P., Hidayad, N., Mutiyoso Gunawan, B., & Ketut Daging, I. (2019). Analisa Penggunaan Biosolar (B20) Dalam Kinerja Sistem Bahan Bakar Di Kapal Pengawas (Kp) Orca 02. *Buletin JSJ*, *1*(2), 88–101. http://ejournal-balitbang.kkp.go.id/index.php/JSJ/index

Sitolonga, J.A, Widodo, P, Achmad, I. (2016). Analisis Kebijakan Biodiesel B20 Sebagai Bahan Bakar Nabati Dalam Mendukung Ketahanan Energi DI Indonesia. *Ketahanan Energi*, *6*, 61–79.

Slogal. (2020). *Pedoman Implementasi Penggunaan Biodiesel Di Lingkungan TNI Angkatan Laut*.