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Effect Fluctuations in MFO and HSD Fuel Prices Against Current Indonesian Sea Freight Passengers and Cargo (April 2023 – April 2024)

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Abstract : This research aiming For analyze impact fluctuation price material burn to the volume of goods transported through transport sea , with approach descriptive quantitative . Data obtained from report operational company shipping and publication price material burn in period five years time last . Introduction explain importance efficiency cost operational in increase Power competition transport sea . Methodology study covers secondary data collection and analysis regression For measure connection between price material fuel and volume of goods transported . Research results show that increase price material burn , like *High-Speed Diesel* (HSD) and *Marine Fuel Oil* (MFO), contribute significant to improvement cost operational , which has an impact on reducing the volume of transportation goods . On the other hand , the decline price material burn influential positive to increase in transport volume sea . Discussion underline factor external , such as price world oil and policy domestic , which also influence stability operational voyage . The conclusion suggests importance implementation policy adaptive and management operational based on efficiency For guard stability sector transportation sea in face dynamics price global energy . This research give contribution to planning strategic in the sector maritime , especially in mitigation risk consequence fluctuation price material burn.

Keywords: Fuel Price Fluctuation, Sea Transportation, Cargo Volume, Operational Efficiency, Adaptive Policy

INTRODUCTION

Container transportation is an important element in international trade and plays an important role in supporting the distribution of goods and goods in Indonesia. As an archipelagic country that actively carries out logistics activities, the sustainability of container transportation flows is highly dependent on various factors, such as fluctuations in transportation fuel prices. *Marine Fuel Oil* (MFO) and *High-Speed Diesel* (HSD) are the main components of ship operating costs, which have a direct impact on shipping rates, logistics efficiency, and goods traffic at Indonesian ports.

In recent years, fuel price fluctuations have become one of the important issues faced by shipping sector in Indonesia. Fluctuating prices can affect ship operating costs, disrupt shipping flows, and reduce container shipping efficiency. Increasing fuel prices can lead to increased transportation costs, reduced competitiveness, and increased risk of reduced shipping volumes. On the other hand, decreasing fuel prices can reduce operating costs, increase national logistics competitiveness, and encourage cargo volume growth.

This study attempts to analyze the relationship between fuel price fluctuations and container shipping volumes in Indonesia for the period April 2023 to April 2024. This study aims to identify patterns, trends, and impacts on the volume and efficiency of fuel price fluctuations using MFO and HSD price data and shipping volume statistics for the same period. Using a descriptive statistical approach will show how changes in fuel prices affect freight costs and the flow of goods at ports.

In addition, this analysis investigates how external factors such as global market demand, energy policies, and geopolitical conditions affect container shipping dynamics. Fluctuations in market conditions and geopolitical uncertainties can increase the impact of fuel price fluctuations on the shipping sector in Indonesia. By understanding the relationship between fuel price fluctuations and container traffic volumes, this study provides guidance to logistics industry stakeholders, port operators, and policy makers to develop adaptation strategies to deal with fuel price fluctuations.

The results of this study aim to better understand how changes in MFO and HSD fuel prices affect maritime passenger and cargo flows in Indonesia. This information is expected to enable industry players to develop more efficient strategies in facing the challenges of fuel price fluctuations while increasing national logistics competitiveness.

METHOD

This research aiming For analyze impact change price Marine Fuel Oil (MFO) and High-Speed Diesel (HSD) against current passengers and cargo sea in Indonesia for the period April 2023 to April 2024. Type of research This nature descriptive quantitative . Data usage is limited to statistics. price material burn and flow goods and passengers maritime .

This research done with collect secondary data from source official like report government , Maritime Statistics Agency , and agencies related . Data processing is carried out with use device soft data analysis such as Microsoft Excel For describe patterns and trends connection between price material burn with current passenger and transportation sea . Research results This expected can give outlook for stakeholders interest industry logistics in develop adaptation strategies to change price material burn .

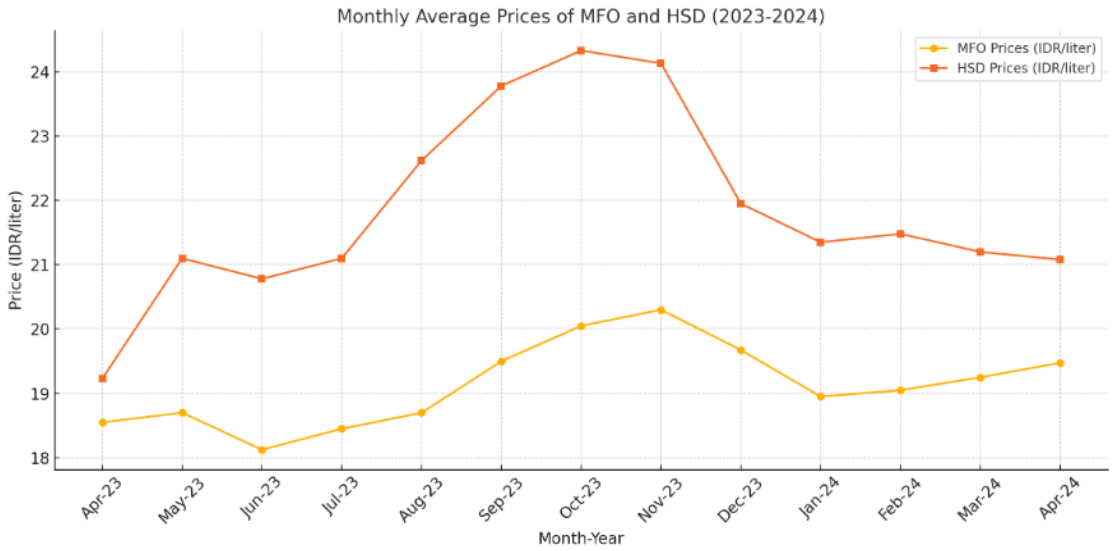
RESULTS AND DISCUSSION

Fuel Price Analysis: *High-Speed Diesel* and *Marine Fuel Oil* (April 2023 - April 2024)

High-Speed Diesel (HSD) and Marine Fuel Oil (MFO) are two type material fuel used in industry transportation and maritime . High-Speed Diesel (HSD) is two type material fuel used in industry transportation and shipping . High-Speed Diesel (HSD) is material regular diesel fuel used on machines vehicle land like trucks and vehicles electricity others . HSD more light and burning more fast compared to material other diesel fuels . On the other hand , Marine Fuel Oil (MFO) is a material fuel used in the engine boat big , especially boat commerce . MFO has higher viscosity high and higher sulfur content tall compared to HSD so that suitable used on ships with machine big in need material burn energetic tall (Unm et al., 2019)

Fluctuation price second material burn These , HSD and MFO, are influenced by many factors that can influence supply energy , including fluctuation price global oil , policy subsidy energy , tension geopolitics , and disruption chain supply . Difference Regional prices also

affect determination price sell HSD and MFO in the domestic market . Chart below This show change HSD and MFO prices from April 2023 to April 2024.



Source : Researcher Research Results (2024)

Figure 1. Graph MFO and HSD Fuel Price Changes (April 2023 - April 2024)

1. Price Changes
   a. *High-Speed Diesel* (HSD) : Price is stable at IDR 18,610/liter from April 2023 to August 2023. Starting from September 2023 onwards, it will increase significantly until it reaches a peak of IDR 24,400/liter in Regions 1 and 2 in October 2023. After that, the price will start to decrease to IDR 15,500/liter in November 2023 and will be stable until April 2024.
   b. *Marine Fuel Oil* (MFO) **:** Prices range from IDR 18,100/liter to IDR 20,300/liter with an increase starting in August 2023, reaching a peak in October 2023 (IDR 20,300/liter), then decreasing to IDR 19,600/liter in April 2024.
2. Interperiod Comparison
   a. April-August 2023 : Prices are relatively stable, allowing for easier operational cost planning.
   b. September-October 2023 : The price spike puts huge pressure on companies, especially those that depend on large amounts of fuel.
   c. November 2023-April 2024 : Price reductions have a positive impact, but require a strategy to utilize momentum for long-term efficiency.

Analysis of Sea Freight and Passengers

Sea transportation plays a very important role in the distribution of goods and passenger mobility in Indonesia, considering its geographical condition as an archipelago with more than 17,000 islands. Sea transportation not only connects domestic regions, but also supports international relations, both for the transportation of goods and passengers.

Sea Freight Goods

Transport goods the sea in Indonesia includes various type Items shipped between island or between countries. Sector This divided become a number of type services :

1. Domestic Sea Transportation: Serves inter-island transportation of goods within Indonesia, including consumer goods, industrial raw materials, and other goods that are important to meet domestic needs.

2. International Sea Transportation: Connecting Indonesian ports with international ports for international trade. Goods transported usually include export and import commodities, such as agricultural products, manufactured goods, and industrial raw materials.
3. Special Sea Transport: Used for specific purposes, such as transporting large quantities of goods by certain companies that require special transport, for example fuel or mining products.

Efficiency transportation goods are greatly influenced by factors like quality and capacity port , cost operations that include price material burn , and regulations that govern sector shipping . Improvement infrastructure ports and supporting policies efficiency operational can increase the volume of goods transported with more costs affordable.

Sea Transportation Passengers

Apart from goods , transportation the sea also serves mobility passenger between island , good For needs transportation daily , tourism , or journey service . There is a number of type transport passenger sea :

1. Domestic Shipping: Connecting various islands in Indonesia, providing transportation services for residents living in coastal areas or remote islands.
2. International Shipping: Providing transportation services for passengers traveling between countries, especially for tourism or business purposes.

Improvement amount passenger transport sea often relate with factors like level economy area , policy subsidy tickets , as well as development facilities and infrastructure that make journey become more safe and comfortable . In addition , the request to transport sea For passengers are also influenced by trends tour sea and convenience accessibility to various destination .

With development supporting infrastructure Good For goods and also passengers , sector transport Indonesian sea is expected can Keep going contribute to growth economy and mobility public in a way efficient . Here is chart growth goods transport sea and passengers transport sea during period April 2023 – April 2024

Source : Researcher Research Results (2024)

Figure 2. Graph Growth Passenger Maritime Transport and Growth of Maritime Freight (April 2023 - April 2024)

Analysis Results Sea Freight Chart

Data shows the volume of goods transported through sea during period April 2023 to April 2024 with trend as following :

a. Increase : The volume of goods transported increased significantly from April 2023 (26.20 tons) to July 2023 (34.19 tons). The peak was reached in July 2023.
b. Decline and Stability : After July 2023, the volume of goods decreased gradually to reach 29.21 tons in December 2023. Subsequently, there was a small fluctuation from January to April 2024, with an average volume of around 28 tons.
c. Seasonal Pattern : Seasonal fluctuations are seen, with an increase in volumes in the middle of the year possibly related to high trade or project activity during that period.

Analysis Results Chart Passenger Sea Transportation

a. Passenger data show pattern different seasons from goods , with change following :
b. Increase in Passengers at Year-End and Major Holidays : The number of passengers peaked in December 2023 (1.88 million) and April 2024 (2.07 million), which coincided with the holiday and religious seasons.
c. Decline in Early Months of the Year : After December 2023, passenger numbers declined until reaching their lowest point in February 2024 (1.51 million).
d. Rebound in March-April 2024 : There was a significant increase from February 2024 to April 2024, reflecting a consistent seasonal pattern.

Discussion

1. The Impact of Fuel Price Fluctuations on Passenger Flow

Data shows existence fluctuation significant seasonality in the amount passenger transport Indonesian sea , which seems influenced by several factors , including price material burn that affects rates and availability service transportation .

a. Improvement Passengers at the End of the Year and Major Holidays : In the month of December 2023 and April 2024, the amount passenger transport sea reach peak , with 1.88 million passengers in December 2023 and 2.07 million passengers in April 2024. Peak amount passenger This coincide with season holiday end year and day raya , which causes request journey sea increase in a way significant . In the period this , society generally do journey between island For celebrate holiday together family or For back to hometown. Improvement This Can influenced by the presence of policy subsidy government to price tickets , which can reduce impact fluctuation price material burn to cost journey .
b. Decline in Early Months of the Year **:** After the period peak in December 2023, the number passenger down drastic , reaching point lowest in February 2024 with only 1.51 million passengers . Decrease This can caused by the reduction request journey after season holidays and days raya , which tends to decreased in the months beginning years . In addition , the factor price material burn that tends to more tall after holiday long , consequences increase MFO and HSD prices , can influence cost operational transport sea , so that cause decline amount the journey that can accessible to the community .
c. increase in March-April 2024 **:** Improvement significant happen Again from February 2024 to April 2024, which reflects pattern consistent seasonal increase . This often triggered by factors need journey during holiday national , such as leave together or holiday end year teachings , and influenced by policy supportive tariffs and subsidies improvement travel in the seasons certain .

2. The Impact of Fuel Price Fluctuations on the Flow of Goods

Temporary current passenger show pattern clear seasonality , currents goods experience more fluctuations influenced by factors economy macro , tension geopolitics , as well as price material burn .

a. Fuel Price Hike and Its Impact on Costs Transportation : Fluctuations MFO and HSD prices influence cost operational transport the sea , which in turn can influence rates transportation goods . Increase price material burn increase cost transportation , which has the potential raise cost distribution goods . This is can impact on prices the final item until to consumers and influence pattern trade , good domestic and also international .
b. Seasonal Patterns in Freight Transport : Same as passengers , flow goods tend increased in periods certain seasons , especially in harvest or approaching day raya big , when request goods increase . Increase cost transport caused by fluctuations price material burn can add burden logistics , which leads to adjustments price goods and potential affect the volume of transport .

3. The Impact of Fuel Price Increases on Goods Volume

One of impact direct from increase price material fuel , either MFO (Marine Fuel Oil) or HSD (High-Speed Diesel), is improvement cost operational ship . When the price material burn increased , ship operator need raise rates transport sea For to balance more costs high . This is will influence Power pull delivery goods through transport sea , especially For items that require cost more shipping low For still competitive in the market. For example , to goods commodities that have a higher profit margin small , increase rates This can reduce the volume of shipments , especially for businessman small or merchants who rely on affordable rates .

Improvement price material burn also can influence decision shipping , where the company logistics Possible will choose more routes efficient or reduce amount delivery in period with cost material burn more high . This is can result in decrease in the volume of goods transported , as seen in the period after peak increase price material burn , which causes the volume of goods decrease.

4. Fuel Price Decline and Its Impact on Goods Volume

On the contrary , the decline price material burn give impact positive to cost operational ship , which finally can lower rates transport sea . With higher rates low , cost transportation goods also become more affordable , which drives shipping volumes increased . In the context of this , the decline price material burn can stimulate growth trading domestic and international , because company logistics and entrepreneurs will more interested For send goods through transport sea with more costs low . This is can increasing the volume of goods transported , which is reflected in increase in transport volume sea on some period , as occurs in the month July 2023.

However , even though decline price material burn can spur increase in volume of goods , fluctuations price material burn that is not stable can influence planning term length and decision delivery . Dependence on materials burn with fluctuating prices cause uncertainty in cost operational , which ultimately can influence decision company logistics and entrepreneurs about transport goods sea.

5. Seasonal Fluctuations and Their Impact on Exports and Imports

Before use formula For identify fluctuation price material burn , need understood that fluctuation the influenced by factors like price world oil , policy government , and conditions supply as well as request . With analyze price data material burn in period certain , we can

measure change price in a way percentage or its volatility For know how much big instability the price that occurs .

previous data increase significant HSD prices in Regions 1 and 2 reflect dynamics complexes affected by fluctuations price global oil , policy domestic , and disparities cost distribution interregional . Increase This No only burdensome cost operational sector transport sea but also influences Power competition logistics national in a way overall . For understand scale impact increase This in a way quantitative , done calculation based on available price data .

$$\text{Persentase Perubahan Harga} = \frac{(H_t - H_{t-1})}{H_{t-1}} \times 100$$

Keterangan:

- H_t = Harga bahan bakar pada periode t.
- H_{t-1} = Harga bahan bakar pada periode sebelumnya.

Source : Basic Concept of Percentage Change in Mathematics and Economics

Figure 3. Formula Fuel Price Fluctuations

HSD price for regions 1 and 2 (April 2023) : IDR 18,610/liter
HSD price for regions 1 and 2 (October 2023) : IDR 24,400/liter

$$\text{Percentage Change Price} : \frac{24{,}400 - 18{,}610}{18{,}610} \times 100\% = 31.06\%$$

So, the price of HSD has experienced increase by 31.06% between April 2023 and October 2023.

HSD prices is quite significant, especially between April 2023 and October 2023, reaching more than 30%. This indicates the potential for strong influence from external factors, such as world oil prices or domestic policies, on sea transportation operations in the region.

Based on the analysis data , it can be seen existence fluctuation significant seasonality in the volume of goods transported through sea . Significant increase in the volume of goods in the month July 2023, with reach peak 34.19 tons, possibility big influenced by the height activity trade and projects , which are generally happened in the middle year . Increase this is also possible influenced by the season harvest , where demand goods certain increase along with high production . At the time this , ship operator tend increase frequency shipping , good For goods domestic and also exports , which in turn increase the volume of transport sea .

However , after July 2023, volume of goods start decrease in a way gradually until reach 29.21 tons in December 2023. The decrease This Can caused by several factors , including influence fluctuation price material burn that may cause increase cost operational and tariff transport sea . In addition , a decrease in the volume of goods can also affected by the decline request after period peak activity trade , which was followed with more fluctuations small in January to April 2024, with an average volume of around 28 tonnes.

Visible seasonal patterns in transportation data sea This show existence close connection between fluctuations in the volume of goods and activities trade that is influenced by the seasons . In addition , fluctuations price material frequent burning occurs throughout year can to worsen uncertainty in cost transportation , which can impact on decisions delivery goods in amount big , good That export and also import . In some period , such as in the months after season holiday and after improvement price material burn , company Possible choose For postpone delivery or look for alternative more transportation cheap.

Factors That Influence

1. Global

Fluctuation price oil raw world, especially *Brent Crude* , has impact significant to price material burn like *High-Speed Diesel* (HSD) and *Marine Fuel Oil* (MFO). The increase price oil global raw direct influence cost production and distribution of HSD and MFO, which in turn increase price sell it in the domestic market .

Oil prices world raw fluctuates consequence various factors , including dynamics global supply and demand , OPEC policy , and condition geopolitics . The rise price oil raw increase cost production and distribution of HSD and MFO, because second type material burn This produced from oil raw . As a result , the prices of HSD and MFO in Indonesia tend to increase along with increase price oil raw world.

Study conducted by (Nizar, 2012) show that fluctuation price world oil impacts on the Indonesian economy , including sector energy . Increase price world oil can cause improvement price material burn domestic , which affects cost operational sector transportation and industry.

Tension geopolitics , such as conflict in the Middle East, can bother supply oil global raw Disruption This cause uncertainty supply and potential decline production , which in turn increase price oil raw . For example , escalation tension between Iran and Israel can trigger increase price commodities , including oil raw , and disturbance chain supply and rise cost cargo.

In addition , the conflict like Russia- Ukraine war can cause disturbance in chain supply global energy and food , which has an impact on increasing price and market instability . Disturbance in chain supply This influence availability and prices material burn such as HSD and MFO. Limitations supply material standard and distribution can cause scarcity and increase price material fuel in the domestic market .

In general overall , fluctuation price oil raw world and tension geopolitics that cause disturbance chain supply own impact direct to HSD and MFO prices in Indonesia. The increase price oil global raw and disruption supply trigger increase price material burn domestic , which in turn influence cost operational sector transportation , industry , and housing ladder.

2. Domestic

Policy Fuel oil (BBM) subsidies in Indonesia have impact significant to determination fuel prices in various regions, which are reflected in variation price interregional . Differences price This influenced by factors like cost distribution , logistics and policies subsidies applied government .

Policy fuel subsidies are aimed at For guard accessibility price material burn for society . However , the implementation subsidy often not evenly distributed throughout the region, causing variation price inter-regional . For example , the area with infrastructure under distribution develop or cost high logistics Possible experience higher fuel prices tall compared to with areas that have more infrastructure Good .

Price variations between regions in sea freight occur due to various factors that affect shipping costs, such as fuel price fluctuations, distance traveled, port congestion, and local tariff policies. These factors impact operational costs and transportation service prices, which can vary between regions. Variation inter-regional fuel prices in Indonesia can classified become four main areas :

a. Region 1 (Java, Bali, and Nusa Tenggara): This region usually own higher fuel prices stable and tend to more low Because infrastructure good distribution and proximity with center distribution .
b. Region 2 (Sumatra): Although own adequate infrastructure , some areas in Sumatra are experiencing higher fuel prices tall consequence cost more distribution big and limited infrastructure in the area isolated .

c. Region 3 (Kalimantan): This region often face challenge in fuel distribution because condition limited geography and infrastructure , causing higher fuel prices tall compared to other regions.
d. Region 4 (Sulawesi, Maluku, and Papua): This region often experience the highest fuel prices Because cost very large distribution , limitations infrastructure , and long distances from center distribution main .

Difference price This reflect cost distribution and logistics are different in each region. For example , the area with infrastructure bad transportation or remote location will experience cost more distribution high , which in turn increase fuel prices in the area.

3. Impact Variation in fuel prices against Regional Economy

Variation inter-regional fuel prices influence Power buy society and costs operational sectors economy local . Area with higher fuel prices tall can experience higher inflation high , which has an impact on spending consumption House stairs . Research in the District The city of Tulungagung show that increase subsidized fuel prices influential significant to expenditure consumption House stairs , with coefficient determination by 74.7%. (Marchelia Putri Az Zahra et al., 2024)

In addition , variations fuel prices can influence perception public to fuel consumption and selection fashion transportation . Policy fuel subsidies that are not evenly can cause difference behavior consumption in various regions, which in turn influence pattern transportation and consumption energy in a way overall .

In general overall , policy fuel subsidies and variations price interregional reflect complexity in distribution energy in Indonesia. Factors like infrastructure , costs logistics , and policies subsidies that are not evenly contribute to the difference fuel prices in various regions, which in turn influence economy local and behavior consumption public.

4. Impact on Operations
   a. Increase (April - October 2023)
      Cost operational increasing , especially in the sector shipping and logistics . The company switched to efficiency strategies , such as use technology economical material burn and optimize route . This is help company For still maintain performance finance although more costs high , but still face challenge in maintain price competitive service .
   b. Price Reduction (November 2023 - April 2024)
      Lower cost operational , enabling company reduce rates services and improve Power competition and profit margins . With higher price low , company can interesting more Lots customers and expand market share , but also must be careful not to decrease price No impact negative to quality services provided .

5. Prospects To Front
   a. Stability or Fuel Price Reduction and Efficiency Operational .
      If the price material burn still stable or experience decline , company cruise can utilise savings cost This For do investment in technology that can increase efficiency operational . One of the steps that can be taken taken is renew the fleet with technology the latest more efficient in use material burn . In addition , adoption system management material burn more sophisticated , such as system monitoring and control consumption material burn in a way *real-time* , can optimize operational ships . Companies can also optimize route cruise For reduce distance travel and time journey , which has the potential lower consumption material burn and reduce emissions . With savings costs incurred from steps this , company can more focus on innovation technology that improves Power compete in the market, while reduce

impact negative fluctuation price material burn that is not stable . This strategy No only will lower cost operational in term long , but also strengthening position competitive companies in the increasingly global shipping market strict .

b. Subtraction Fossil Fuel Dependence and Transition to Energy Alternative . Shipping company need speed up transition from dependence on materials burn fossil with adopt source energy a better alternative sustainable and affordable . One of the increasingly alternative popular is *Liquefied Natural Gas* (LNG), which offers emission more carbon low compared to with material burn fossil conventional , as well as potential stability higher price Good Because its greater availability more area and price competitive in the global market. In addition to LNG, the use of blended biofuels and systems propulsi hybrids also become promising choice For reduce footsteps carbon and fulfill standard regulation an increasingly environment strict , as determined by the organization international such as IMO *(International Maritime Organization).* Transition This must done in a way gradually , with consider factors like infrastructure , costs conversion ships , and support policies and incentives government . With adopt energy alternative , company No only reduce risk fluctuation price material burn fossils , but can also strengthen image as pioneer sustainability and innovation in industry voyage , while ensure continuity more operational stable and friendly environment in the future .

CONCLUSION

Fluctuation price *High-Speed Diesel* (HSD) and *Marine Fuel Oil* (MFO) in the period from April 2023 to April 2024 show influence significant from various factor domestic and global. HSD prices are more under control Because existence policy subsidy government and stability request domestic . On the other hand , MFO prices are more prone to to global market dynamics , including fluctuation price oil raw , tension geopolitics , and implementation regulation an increasingly environment strict to industry shipping .

Ascension price material burn impact straight to the upgrade cost operational company voyage , which then translated to in increase rates tickets and fees logistics . This is contribute to decline current passengers , especially from sensitive segment to change price , and reduce the volume of goods transported consequence increasing burden cost distribution . On the other hand , the decrease price material burn give opportunity for company For lower rates service , improve Power compete , and encourage growth amount passenger and volume of goods .

In general overall , fluctuation price material burn own significant implications to sustainability operational sector transportation sea . Stability Prices are highly dependent on policy energy domestic , international market dynamics , and adaptation industry to development technology as well as regulation . In the long term long , transition going to use energy alternatives , such as LNG or next-generation biodiesel new , become step strategic For reduce impact fluctuation price and ensure sustainability operational sector Indonesian shipping .

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