



# Green Shipping Expansion Strategy as A Catalyst For Maritime Industry Transition In Indonesia

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**Abstract.** As the world's largest archipelagic nation, Indonesia's maritime industry is crucial to its economy, but it also faces significant environmental challenges, particularly related to greenhouse gas emissions. The global shipping industry accounts for around 2-3% of total emissions, and Indonesia is a contributor. This study explores the potential of adopting green shipping practices, particularly the use of liquefied natural gas (LNG) as an alternative fuel, to drive Indonesia's maritime industry towards sustainability. By comparing Indonesia's progress with that of South Korea, a pioneer in green shipping, the research highlights the need for comprehensive policy reforms, infrastructure development, and human resource investment in Indonesia. South Korea's Green Ship-K policy and LNG refueling infrastructure provide a model for Indonesia to follow. The findings suggest that, although still in the early stages of adoption, Indonesia has the potential to lead in green shipping through strategic investments, regulatory frameworks, and collaboration between the government, industry, and academia.

**Keywords:** Green Shipping Expansion, Maritime Industry Transition, LNG as Alternative Fuel.

## 1 Introduction

### 1.1 Background

As the largest archipelagic country in the world, Indonesia's maritime industry plays a crucial role in the nation's economy. With over 17,000 islands and 95,181 kilometers of coastline, Indonesia's maritime industry is not only the lifeblood of domestic and international transportation but also plays a vital role in trade, fisheries, and the exploitation of marine resources. However, despite its great potential, Indonesia's maritime industry also faces serious challenges related to environmental impact. The global shipping industry contributes around 2-3% of global greenhouse gas emissions. Given the continued growth of global trade, this figure is expected to increase significantly if no action is taken. In Indonesia, as a maritime country, the industry's contribution to national emissions is also substantial.

In this context, the concept of green shipping emerges as a potential solution. Green shipping refers to practices and technologies aimed at reducing the environmental impact of ship operations and other maritime activities. The adoption of green shipping in Indonesia has become increasingly urgent, in line with global commitments to reduce greenhouse gas emissions, as outlined in the Paris Agreement and the International Maritime Organization's (IMO) targets.

Compared to countries like South Korea, Indonesia is still in the early stages of adopting environmentally friendly shipping practices. South Korea has taken significant steps, including large investments in green technology and the development of alternative-powered ships. They have also built an ecosystem that supports green shipping innovation through close collaboration between the government, industry, and research institutions. Additionally, the implementation of environmentally friendly shipping opens up new economic opportunities. Green technology innovation can create new jobs, improve operational efficiency, and provide access to global markets that increasingly demand sustainable business practices. This aligns with the Indonesian government's vision to make the country the world's maritime axis.

However, the transition to green shipping is not without its challenges. Significant investment in infrastructure, technology, and human resource development, as well as supportive regulations, financial incentives, and collaboration between government, industry, and academia, are also key factors in achieving this transformation.

Therefore, Indonesia must develop a comprehensive and integrated green shipping expansion strategy. This strategy is expected to catalyze to drive Indonesia's maritime industry toward more sustainable, efficient, and globally competitive practices. In doing so, Indonesia can maximize its maritime potential while contributing to global efforts to mitigate climate change and protect the marine environment.

## **2 Methodology**

This research uses a qualitative approach with a comparative case study method between Indonesia and South Korea. Data was obtained from secondary sources such as national policy reports, academic studies, and industry reports related to green shipping. The analysis was conducted by comparing the policies, technologies, and implementation of green shipping in both countries.

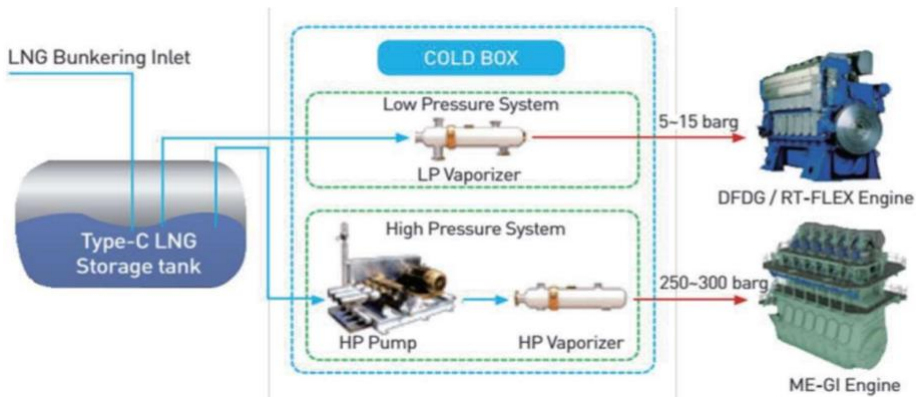
## **3 Discussion**

The global shipping industry is undergoing a significant transformation toward more environmentally friendly practices. Amidst this shift, the use of gas fuels, particularly liquefied natural gas (LNG), has emerged as a key focus as a potential solution for realizing green shipping. Two major Asian countries in the maritime industry, Indonesia and South Korea, display striking differences in their approaches and progress in adopting this alternative fuel.

**Table 1.** Differences in LNG Fuel Management:

Category	Indonesia	South Korea
Policies and Regulations	<p>Still in the process of developing specific policies for the use of LNG as fuel in ships.</p> <p>There are currently no specific regulations or policies for the adoption of gas fuels in the maritime sector.</p> <p>(Ministry of Transportation Indonesia, 2022)</p>	<p>Has the "Green Ship-K" policy that promotes the construction of environmentally friendly ships, including those powered by LNG.</p> <p>Offers financial incentives for the construction and operation of LNG-powered ships.</p> <p>(Ministry of Oceans and Fisheries Korea, 2021)</p>
Supporting LNG Infrastructure	<p>The LNG bunkering infrastructure is still limited.</p> <p>Several major ports are planning to establish LNG bunkering facilities.</p> <p>(Purnomo S., 2021)</p>	<p>Has LNG bunkering facilities at major ports such as Busan and Ulsan.</p> <p>Developing a comprehensive LNG bunkering network at each port.</p> <p>Ongoing training for human resources related to LNG bunkering risk management.</p> <p>(Lee H., 2020)</p>

South Korea has made significant strides in implementing LNG as a ship fuel. The country has launched the "Green Ship-K" initiative, a program that promotes the construction of environmentally friendly ships, including those powered by LNG. Government support in the form of financial incentives has encouraged shipping companies to transition to LNG-powered fleets. As a result, South Korea is now a pioneer in LNG ship technology, with prominent shipbuilding companies such as Hyundai Heavy Industries Co., Ltd. (HHI) and Samsung Heavy Industries Co., Ltd. (SHI) actively producing LNG-powered vessels for the international market.



**Fig. 1.** The Use of Gas (LNG) as Fuel on Ships. Source: CYROS: 2024

In terms of infrastructure, South Korea has established LNG refueling facilities at its major ports. They are also developing a comprehensive LNG distribution network

along the coastline, facilitating a widespread transition to the use of LNG in the shipping sector. Although dependent on LNG imports, South Korea has successfully built an efficient distribution system for various sectors, including maritime. Additionally, they continue to develop human resource potential regarding the use of LNG as a primary fuel on ships.

In contrast, Indonesia is still in the early stages of adopting gas fuels for its shipping industry. Despite having abundant natural gas reserves, this archipelagic country faces challenges in developing supporting infrastructure, although several major ports are beginning to plan for its establishment. Specific policies and regulations to encourage the use of LNG in ships are also still under development, with no specific incentives for the adoption of gas fuels in the maritime sector. Furthermore, there has been a lack of human resource development, particularly in this renewable technology, and the implementation of IGF CODE training at the Ministry of Transportation's training center has not been widespread.

In terms of ship technology, the majority of Indonesia's fleet still relies on conventional fuels. Some pilot projects for LNG vessels are indeed being planned, but they are far behind South Korea, which has launched various types of LNG-powered ships that have been exported to major companies in mainland Europe. Investment in research and development of LNG ship technology in Indonesia is also minimal, unlike South Korea, which has allocated substantial funds for innovations in environmentally friendly ships. The main challenges for Indonesia in adopting LNG as ship fuel include limited infrastructure, insufficient funding for initial investments, and low industry awareness, as well as inadequate human resource development in this field. Meanwhile, South Korea faces challenges such as high costs for new technologies and reliance on LNG imports.

Nevertheless, Indonesia has great potential due to its abundant natural gas reserves. If optimally utilized, this could become a competitive advantage in the development of LNG-based green shipping. To catch up, Indonesia needs to formulate more progressive policies, increase investments in infrastructure, technology, and human resources, and strengthen collaboration between the government, industry, and academia in developing green shipping solutions.

**Table 2.** Republic of Korea's Efforts for Safe Use of Alternative Fuel in IMO (2 Years).

Source : Korean Register: 2024

Fuel Type	Status	Title	Role	Purpose
LNG	Complete	Allowing Suction Well	Lead	Safety Assurance, Regulatory Innovation
	Progress	LNG fuel tank on Cargo area in OIL Tanker	Lead	Safety Assurance, Regulatory Innovation
	Progress	1 Ship 1 Code	Lead	Safety Assurance, Regulatory Innovation
	Complete	High Manganese	Lead	New material

Fuel Type	Status	Title	Role	Purpose
<b>LPG</b>	Complete	Safety use of LPG fuel	Lead	Safety Assurance
	Complete	Safety use of LPG Cargo as fuel	Lead	Safety Assurance
	Complete	Ammonia Cargo use as fuel	Co-sponsor	Starting Point for the Use of Ammonia Cargo as Fuel Safety Assurance, Environment
<b>AMMONIA</b>	Complete	Ammonia Effluent	Lead	Protection, Regulatory Innovation
	Complete	Ammonia Guideline	Participant	Safety Assurance
	Complete	High Manganese	Lead	Safety Assurance, Promotion of Alternative Fuel
<b>HYDROGEN</b>	Progress	Hydrogen Carrier	Lead	Promotion of Alternative Fuel Dissemination
	Complete	High Manganese	Lead	New material

South Korea's efforts highlight the country's significant role in promoting innovation and regulations for the use of alternative fuels in the global maritime industry. Projects involving LNG, LPG, ammonia, and hydrogen directly support operational safety, environmental protection, and the development of new, stronger, and safer materials. Below is the data corresponding to the table above:

### 1. LNG (Liquefied Natural Gas)

- a. Status: Several projects have been completed while others are still in progress.
- b. Key Projects: Completed projects have enabled the use of suction wells and the use of high manganese steel as a new material. Ongoing projects include the use of LNG storage tanks in cargo areas of tankers and the development of regulations for ships operating with LNG.
- c. Objectives: All LNG projects aim to enhance safety assurance and regulatory innovation for the use of LNG as an alternative fuel.

### 2. LPG (Liquefied Petroleum Gas)

- a. Status: All LPG-related projects have been completed.
- b. Key Projects: Completion of projects related to the safety of using LPG as fuel and cargo.
- c. Objectives: The main focus is on safety assurance in the use of LPG, both as ship fuel and cargo.

### 3. Ammonia

- a. Status: All ammonia-related projects have been completed.

- b. Key Projects: The use of ammonia as cargo and fuel has been initiated, with participation in the development of guidelines for ammonia usage and the use of high-manganese steel as a material.
  - c. Objectives: These projects focus on safety assurance, environmental protection, and regulatory innovation, given ammonia's potential as a low-emission sustainable fuel.
4. Hydrogen
- a. Status: One project is still ongoing, while another has been completed.
  - b. Key Projects: Development of hydrogen carrier ships is in progress, as well as the use of high-manganese steel as a new material to facilitate the storage and distribution of hydrogen.
  - c. Objectives: To ensure safety in the use of hydrogen as an alternative fuel and to promote the widespread adoption of this fuel.

**Table 3.** Indonesia's Expansion Strategy for the Use of LNG as Fuel for Green Shipping

Aspect	Strategy	Description
<b>Regulations &amp; Policies</b>	- Strengthening the regulatory framework based on IMO standards.	Regulations should include safety standards, certification, and technical guidelines for using LNG as ship fuel.
	- Encouraging policy innovation to support LNG infrastructure at ports.	Regulatory innovations related to LNG tank installations, operational standards, and ship safety.
<b>LNG Infrastructure</b>	- Developing LNG terminals at major ports such as Tanjung Priok and Belawan.	LNG terminals are necessary for fueling and storing LNG at strategic ports.
	- Upgrading shipyards to build and modify LNG-powered vessels.	Shipyards must be equipped with technology and facilities to meet the standards for LNG-powered ships.
<b>Human Resources</b>	- Training crew and technicians regarding the use and maintenance of LNG-powered vessels.	Focus on safety, operational efficiency, and internationally recognized workforce certification.
	- Collaborating with universities and research institutions to develop LNG-related technologies and innovations.	Research on the development of new materials and technologies that support the efficient use of LNG as fuel.
<b>Partnerships &amp; Cooperation</b>	- Building public-private partnerships (PPP) for infrastructure investment and LNG supply at ports.	Private shipping companies can collaborate with the government for LNG infrastructure development.
	- International cooperation with developed countries in green shipping, such as South Korea, for technology transfer.	Learning from more advanced countries in LNG use and establishing collaborations in research and technology.

Aspect	Strategy	Description
<b>Economic Incentives</b>	- Providing tax incentives for companies that adopt LNG as fuel.	Incentives may include tax reductions for purchasing or modifying ships to use LNG.
	- Offering low-interest green financing schemes for LNG infrastructure development.	The government can collaborate with national banks or international institutions for LNG infrastructure financing.
<b>Pilot Projects</b>	- Launching pilot projects to test the application of LNG on commercial and passenger vessels on strategic routes.	Initial implementation on several ships to analyze the effectiveness of LNG before widespread adoption.
<b>Promotion &amp; Education</b>	- Educational campaigns about the benefits of LNG for the shipping industry and the environment.	Promotions that cover cost efficiency and reduced carbon emissions, while supporting Indonesia's commitment to environmental targets.

By implementing the above strategies, Indonesia can play a crucial role in accelerating the adoption of LNG-friendly green shipping. This initiative will not only help protect the marine environment from the negative impacts of carbon emissions but also enhance the competitiveness of Indonesia's shipping industry in the global market. With the right regulations, infrastructure investment, and collaboration with all parties, Indonesia can become a regional leader in sustainable shipping innovation, especially considering that South Korea has made significant progress in implementing LNG as a ship fuel.

## 4 Closing

### 4.1 Conclusion

Although South Korea currently leads in the adoption of gas fuels for green shipping, Indonesia possesses significant potential to accelerate this transition. With the right strategies and a strong commitment from all stakeholders, Indonesia can leverage its rich natural resources and take significant steps toward a more sustainable maritime industry. The comparison between Indonesia and South Korea in the implementation of green shipping indicates that the success of the transition to a sustainable maritime industry greatly depends on careful planning, strong policies, investment in environmentally friendly technologies, and synergy between the government and the industrial sector. South Korea serves as a model that Indonesia can emulate, particularly in technology development and incentive policies that promote the adoption of green shipping. While challenges still exist, with the implementation of appropriate strategies, Indonesia has the opportunity to hasten its transition to a more environmentally friendly shipping industry, enhance its competitiveness in the global market, and contribute to the reduction of carbon emissions.

## 4.2 Recommendations

The government needs to strengthen regulations regarding greenhouse gas emissions in the maritime sector, in line with the standards set by the IMO (International Maritime Organization). This includes implementing restrictions on sulfur emissions and other harmful gases for ships operating in Indonesian waters.

## References

1. IMO. (2020). IMO 2020 and the reduction of sulphur emissions. International Maritime Organization.
2. Ministry of Oceans and Fisheries, Korea. (2021). Green Ship Technology Roadmap. Seoul: Ministry of Oceans and Fisheries.
3. Kementerian Perhubungan Indonesia. (2022). Strategi Pengembangan Industri Maritim Nasional. Jakarta: Kementerian Perhubungan.
4. Lee, H. (2020). Green Shipping: Lessons from South Korea's Maritime Industry. *Journal of Maritime Studies*, 45(2), 134-156.
5. Purnomo, S. (2021). Implementasi Kebijakan Green Shipping di Indonesia: Tantangan dan Peluang. *Jurnal Maritim Nasional*, 52(1), 78-91.

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