Executive summary

The maritime shipping sector

facing the challenges of decarbonization and digitalization

Maritime shipping, the transport of freight and goods via waterways, has been growing for several years, and accounts for most of the world's freight transport. Although it is one of the least carbon-intensive modes of transport, the sheer volume of goods transported (80% of the international merchandise trade) and the fact that fossil fuels are still overwhelmingly used mean that the sector accounts for a significant share of global Greenhouse Gas (GHG) emissions (2.9%) and is projected to increase by 90-130% by 2050 under a business-as-usual scenario. To address the challenge of decarbonization, in 2023, the International Maritime Organization (IMO) adopted a revised GHG strategy including a common ambition to reach net-zero GHG emissions by or around 2050. Prior to that engagement, in November 2022, the Science-Based Target initiative (SBTi) released a specific guidance for the maritime transport sector with even more ambitious goals.

What's more, the sector is highly concentrated, with a few influential players controlling most of the volumes transported. Although these players' climate commitments are currently reduced and heterogeneous, it is possible to drastically reduce emissions by getting them to commit and to act concretely towards the decarbonization of their businesses. Their commitment should rely on the quantification of well-known shipping decarbonization levers.

This executive summary is an excerpt of the whitepaper on "the maritime shipping sector facing the challenges of decarbonization and digitalization" elaborated by Atos and WWF France.
In this report, we identify the challenges, trends, and exploring on how digitalization can help to accelerate the decarbonization of the maritime shipping sector.

For the complete white paper scan the QR code:

Maritime shipping and decarbonization trajectories

The freight sector has progressively become of the largest economic sectors of the 21st century. Indeed, between 1950 and 2020, the volume of global trade has grown by 4,100%. Freight and logistics reached a value of $8.6 trillion in 2020, and shipping as a transportation mode, dominates the world freight sector.

The energy required to transport goods is an essential element in understanding the impact that each of the different modes of transport has on climate change. Figure 1 compares the climate impact of the freight transport modes in terms of intensity, i.e in kilogram of CO2 equivalent emissions per t.km of good transported.

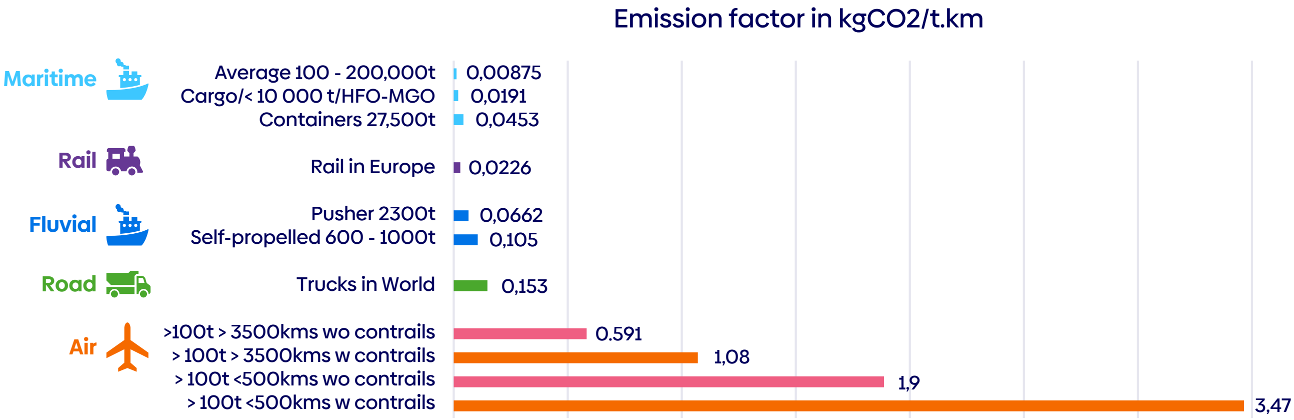


Figure 1: Comparison of the climate impact of different modes of transport for freight.
Source: I Care from the Base Empreinte ADEME.

In the shipping sector, big international actors have emerged concentrating the biggest part of the market. Three segments - bulk, tanker, and container - account for approximately 90% of global volumes and 65% of GHG emissions. Regarding the containers segment, there are more than 500 shipping companies in the world and the top 10 companies control 84% of the total transport capacity. However, almost 60% of the transport capacity in controlled by only four key players: MSC, Maersk, CMA-CGM and COSCO.

Although essential for understanding the shipping sector's climate impact, accurately tracking its emissions is difficult for several reasons, including differences in the scope of emissions considered, in the vessels' lifecycle, and the absence of data.

Institutions and public authorities have gradually introduced measures to monitor and mitigate the GHG emissions from the shipping sector. In Europe, the legislative package "Fit for 55" aims at reducing emissions in Europe by 55% in 2030 compared to 1990. It has adopted two specific decarbonization levers for shipping, namely targeting shore power supply and reducing of the GHG intensity of the energy used onboard.

Since a few players are responsible for a large share of the global fleet, their commitment to align their emissions with the Paris Agreement targets would have a massive impact on the total emissions of the sector. Indeed, as illustrated on Figure 2, even if only a third of the container shipping companies had set ambitious targets, this could result in 64% of the shipping container trade being powered by clean fuels.

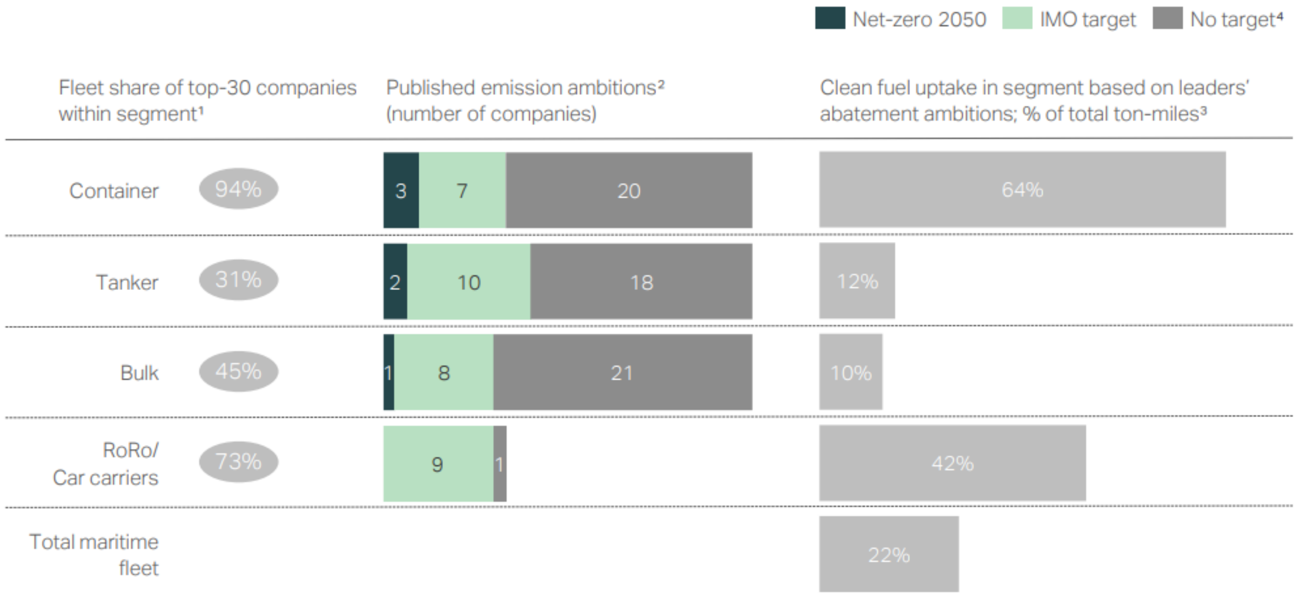


Figure 2: Shipping industry leader's published ambitions.
Source: Mærsk Mc-Kinney Møller Center for Zero Carbon Shipping.

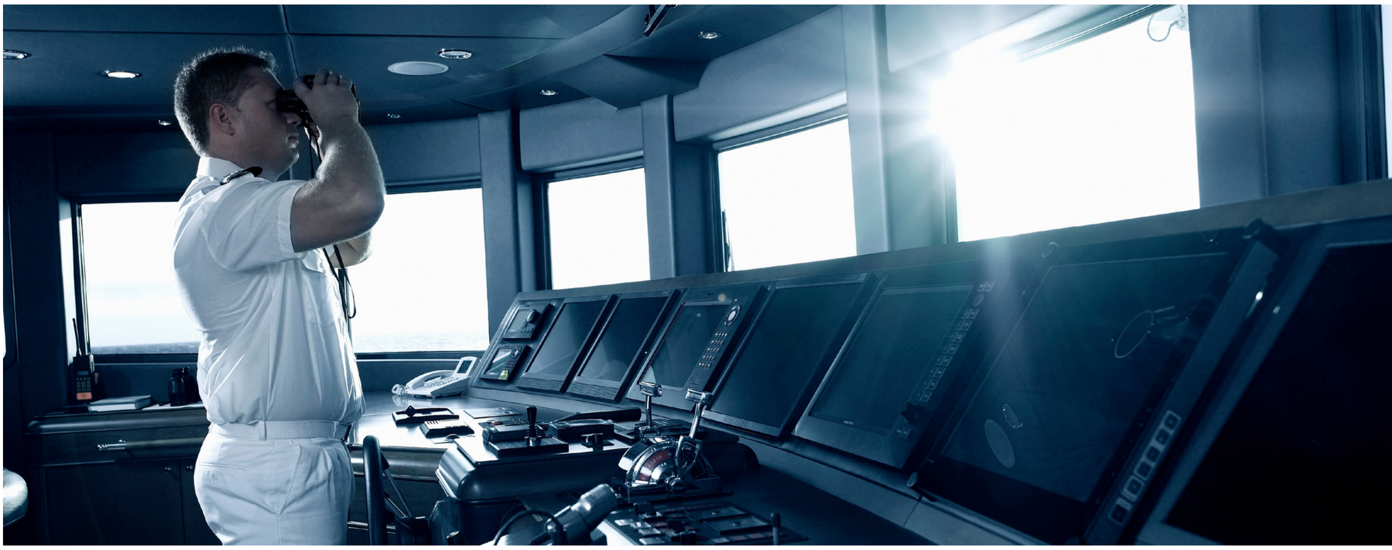
The shipping sector is in the early stages of collecting and using GHG emissions data and of reducing emissions. However, things have progressed recently as some of the biggest companies have already made strong commitments.

Key messages:

There is not enough commitment from the sector's stakeholders to ensure the achievement of global targets to contain climate change to 1.5°C. During 2023, SBTi, IMO and the EU updated their strategy and target setting on reducing of GHG emissions for the maritime shipping. To ensure the achievement of the global targets, market leaders must raise their level of commitment by defining ambitious targets, quantifiable reduction pathways and intermediate milestones.

Recommendations:

Based on the research findings, joint advocacy can help to align heterogeneity in target setting. In the maritime ecosystem, where a small number of companies control a large part of the market, first-mover leadership can lead to very significant reductions in the sector's GHG emissions, which can be followed by industry-wide disruption. Building a bottom-up trajectory of decarbonization levers can help set the right priorities for the decarbonization pathway.



In order to plan the decarbonization of the shipping sector and to help companies to set ambitious targets, several scenarios exist in the literature and present some differences. This study focuses on SBTi, IMO and IEA's decarbonization scenarios. Other sources have also been studied such as Ricardo, UMAS, DNV, CE Delft and IRENA. The graphic below (Figure 3) details the important gaps identified among them.

	ETP 2020: SDS	NZE 2021: NZE	Maritime sector	IMO[1] 2018	IMO 2023	Concawe & OGCI 2022	UMAS 2023	DNV 2022	CE Delft 2023	IRENA 2021
1 - Base year	2020	2020	2020	2008	2008	2020	2018	2022	2008	2020
2 - Perimeter of emissions	WTW	WTW	WTW	TTW	WTW	WTW	WTW	TTW	WTW	?
Covid effect	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
3 - Carbon budget dispatch[2]	12% ↑ 3%	↑	→	→	→	?	?	?	?	?
4 - Ambition[4] (in absolute)	NZ[3]	NZ	NZ	-50%	NZ	-70% to -103%	NZ	NZ and -50%	-28/47%	+10% to -80%
Target year	2070	2050	2050	2050	2050	2050	2050 With 2030 and 2040	2050	2030	2050

Outdated reports

[1] IMO 2018 has been replaced by IMO 2023

[2] Carbon budget dispatch: is the share of shipping emission in the global anthropogenic GHG emission supposed to increase (↑) or remain stable (→)

[3] NZ = Net Zero

[4] The ambition level is given for absolute emissions. When there are different scenarios for a source, the range of ambition between the most and least ambitious scenarios is given

Figure 3: Comparison of the different scenarios on selected criteria.
Source: I Care.

Most scenarios rely mainly on alternative low-carbon fuels to achieve long-term decarbonization. However, scenarios exploring short or medium-term targets tend to show that this lever will not contribute to shipping decarbonization fast and widely enough to reach targets aligned with the Paris Agreement and especially intermediate milestones. Indeed, the implementation of this lever requires production capacities and specific infrastructures that are part of a long-term vision.

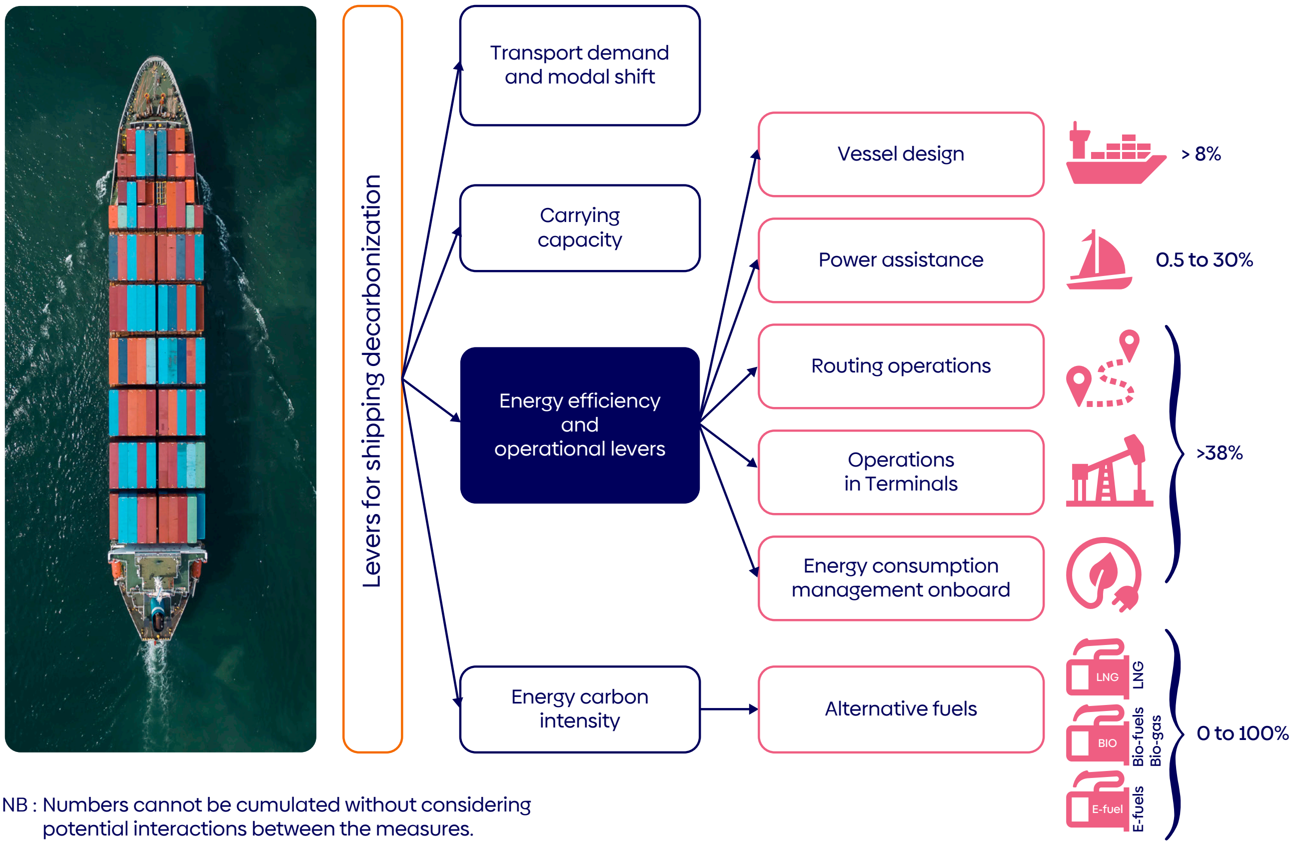
Operational optimization levers are not often assessed in-depth or do not always represent an important lever in decarbonization scenarios despite their great potential in the short and medium term.

Decarbonization levers and challenges to energy efficiency

This report details various decarbonization levers for reducing CO2 emissions available in the shipping sector, based on the Kaya equation.

Figure 4: The five levers for decarbonizing shipping, used in the Kaya equation emissions breakdown.
Source: I Care.

Specifically, this report concentrates on energy efficiency and operations optimization levers.



NB : Numbers cannot be cumulated without considering potential interactions between the measures.

Figure 5: The main levers and their potential to decarbonize the shipping sector.
Source: I Care based on reports from IMO, IEA, Ricardo and Glomeep.

Optimizing routing parameters such as speed management and adaptation of the route to external parameters (such as weather conditions) can deliver significant emissions reduction. Reducing the ship's speed, also included in the smart-steaming process, is a possible decarbonization lever.

Using data management to monitor energy consumption onboard, like electricity, lighting, air conditioning, heating, ventilation as well as other energy consuming equipment aboard can help save energy, reducing emissions.

Improving terminal operations also constitutes a lever for increased optimization in the shipping industry. More efficient port logistics can reduce the time that ships spend at the port, either than waiting outside the port or at berth to discharge and charge cargoes, thus reducing energy consumption.

Just-In-Time (JIT) arrival enables a ship to optimize its speed to arrive at the port when berth, fairway and nautical services are available, limiting inefficient fuel consumption.

Nonetheless, the adoption of energy efficiency levers and operational changes in the shipping sector can bring some challenges, such as technical issues, financial barriers and industry dynamics. Collaboration between stakeholders and contractual agreements are needed to overcome these challenges.

Key messages:

Energy efficiency and operational optimization could substantially contribute to shipping decarbonization in the short and medium term. These improvements can be implemented quickly (compared to using alternative fuels, which is more suitable for long term implementation), despite challenges such as interconnected cooperation between stakeholders, technical issues and financial barriers.

Recommendations:

The proven efficiency of operational optimization levers are a critical part of the Kaya equation and should be promoted and developed rapidly as their benefits could be realized in the short to medium term.

Contribution of digital technologies to shipping decarbonization

Decarbonization and digitalization represent two major shifts in the way the shipping business operates.

Digitalization empowers stakeholders to glean insights from intricate datasets, enabling process optimization, enhanced decision-making, and increased efficiency. Decarbonization requires robust emissions monitoring, vast operational and organizational changes, and renewed strategies from all stakeholders.

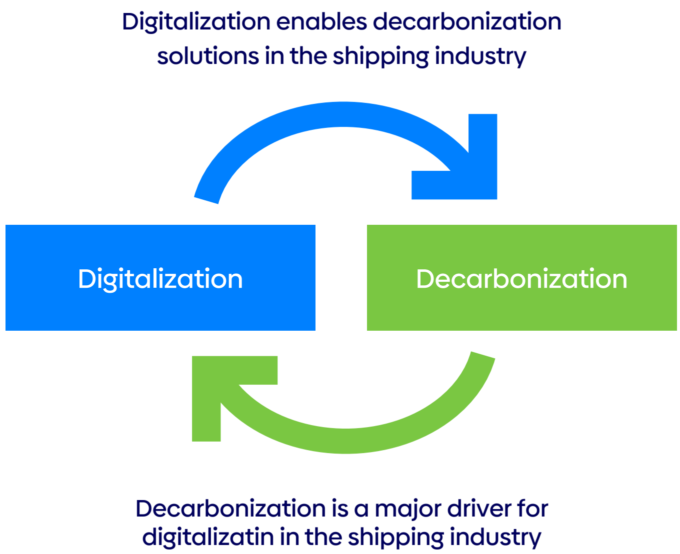


Figure 6: Digitalization and decarbonization are interdependent trends in the shipping industry.
Source: I Care.

Digitalization refers to the process of enabling, improving and/or transforming operations, functions, processes and activities, by using digitized data to obtain actionable knowledge with a specific benefit in mind. The digital value chain, as illustrated in figure 7, relies on a succession of steps, each one leveraging specific technologies to deliver the intented benefit in the end.

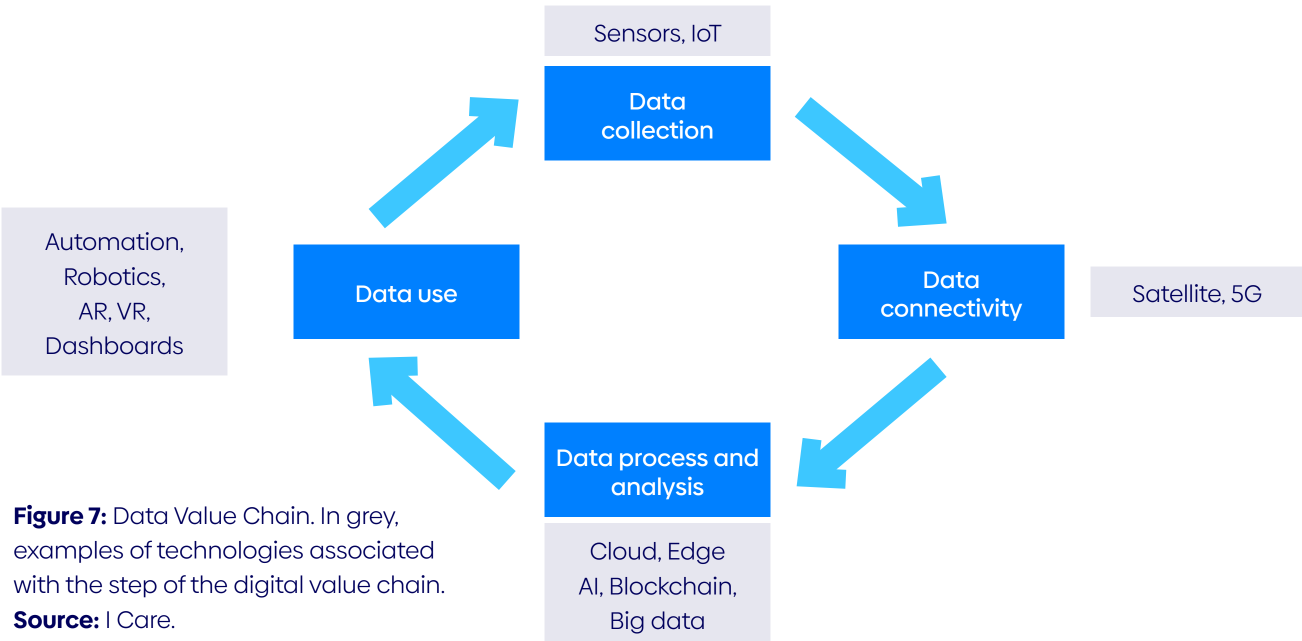


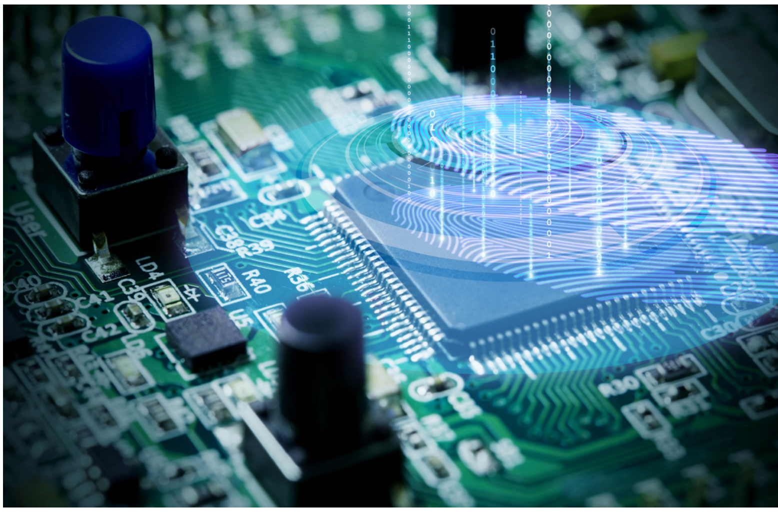
Figure 7: Data Value Chain. In grey, examples of technologies associated with the step of the digital value chain.
Source: I Care.

Digital technologies can optimize onboard energy consumption and operation. These include power generation via auxiliary engines, electricity consumption for lights and equipment, heat and/or cold production, ventilation or even predictive maintenance.

Digital technologies offer the potential for routing optimization and autonomous ships. Enhanced performance relies on sensors and IoT technologies that provide for the necessary data, coupled with high-performance AI tools that facilitate data processing and decision making. Edge computing can contribute to an autonomous ship's performance by resolving some of the connectivity issues ships can encounter while at sea and new satellite technologies can improve connectivity in remote areas.

Shipping companies can also leverage cloud technology for decarbonization with more efficient server utilization, better PuE (Power Usage Effectiveness), and efficient and consolidated low-carbon Data Centers locations. Migrating to cloud technology increases, by more than three times, the energy efficiency of the median of on-premise IT infrastructure, reduces carbon intensity of consumed electricity by 85% and has at least a 20% lower PuE than on-premise infrastructures[1].

Efficient terminal operations can improve sustainability across the entire freight value chain. With fast and secure operations, combined with essential data sharing and communication among participants, each stakeholder can better



synchronize to optimize their operations in a sustainable manner, avoiding unnecessary emissions related to delays and other inefficiencies.

It is important to emphasize that tracking and reporting ship's emissions is the first step in any decarbonization strategy. Knowing the starting point of emissions and having measurable performance indicators is essential for cargo owners, shipping companies and port operators. Digital tools could be used to collect, analyze, and manage accurate data related to GHG emissions.

The report illustrates the many ways that digital technology can contribute to decarbonization, highlighting the potential benefits of using sensors & IoT, satellite & 5G, cloud computing, edge computing, artificial intelligence and automation.

Key messages:

Digital technologies can facilitate the deployment of operational decarbonization levers, by helping reduce onboard energy consumption, optimize routing and terminal operations, and enable data sharing harmonization, standardization, and transparency between market leaders to foster integration across the maritime supply chain.

Recommendations:

Digital technologies offer promising ways to address decarbonization challenges, as they can improve transparency, data sharing and real-time monitoring, providing the necessary tools to implement energy-efficient practices.

The ecosystem should leverage the benefits of digitization, and support the establishment of data standards and data sharing, as a way to foster collaboration between stakeholders and accelerate the implementation of short- and medium-term levers.

Identifying use cases from similar industries and applying these to the freight sector could make a positive environmental impact.

[1] *Cloud and Net Zero. How businesses are taking decarbonization to the next level.pdf*

Key messages:

Attention must be paid to risks of negative externalities or rebound effects (biodiversity, wildlife corridors impact).

Recommendations:

The risk of negative environmental impacts can be limited by improving the efficiency of resources through the systematic application of circular economy principles and life-cycle analysis approaches to decarbonization-related technology solutions.

When deploying decarbonization levers, particular attention should be paid to marine protected areas, wildlife corridors or areas of particular importance for biodiversity. Just as green corridors are being considered to reduce carbon emissions, blue corridors should be protected when optimizing shipping routes to avoid noise disturbance and ship strikes on whales and dolphins, for example, preventing disruption to marine life.

To read the full report, scan the QR Code:

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