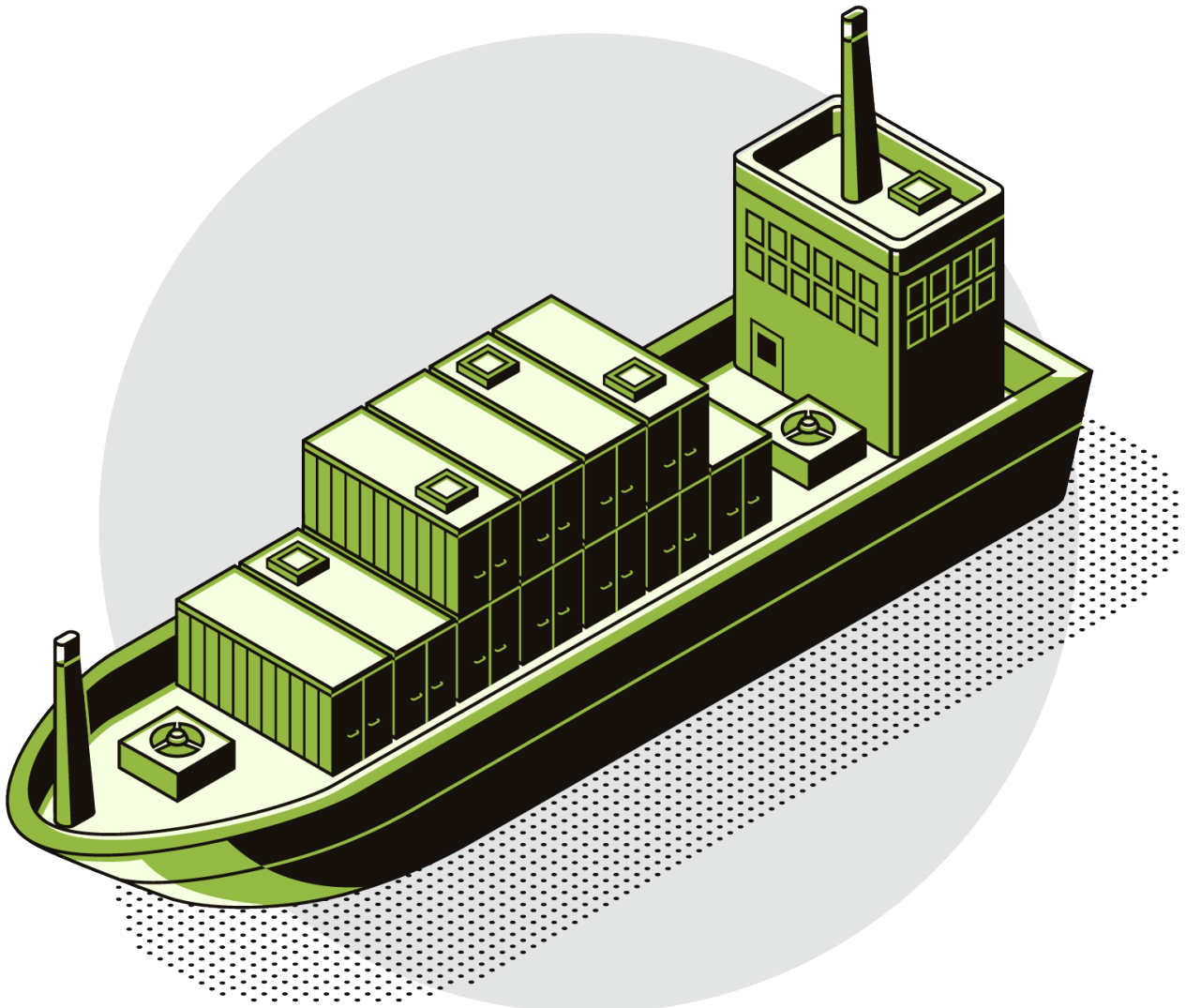
Deloitte.



Decarbonising Shipping: All Hands on Deck

18th Trans Middle East 2022 Exhibition and Conference

Deloitte and Shell Research Summary

18th Trans Middle East 2022 Exhibition and Conference

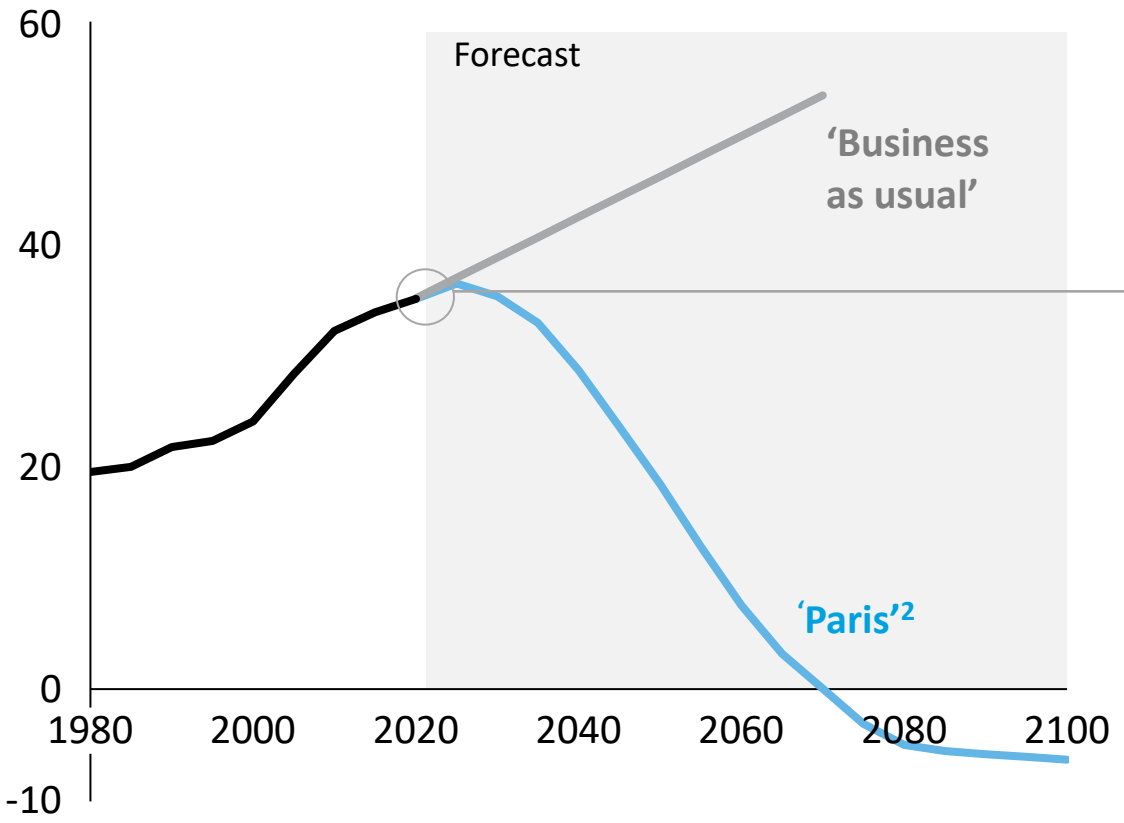
Contents

© Deloitte The Netherlands

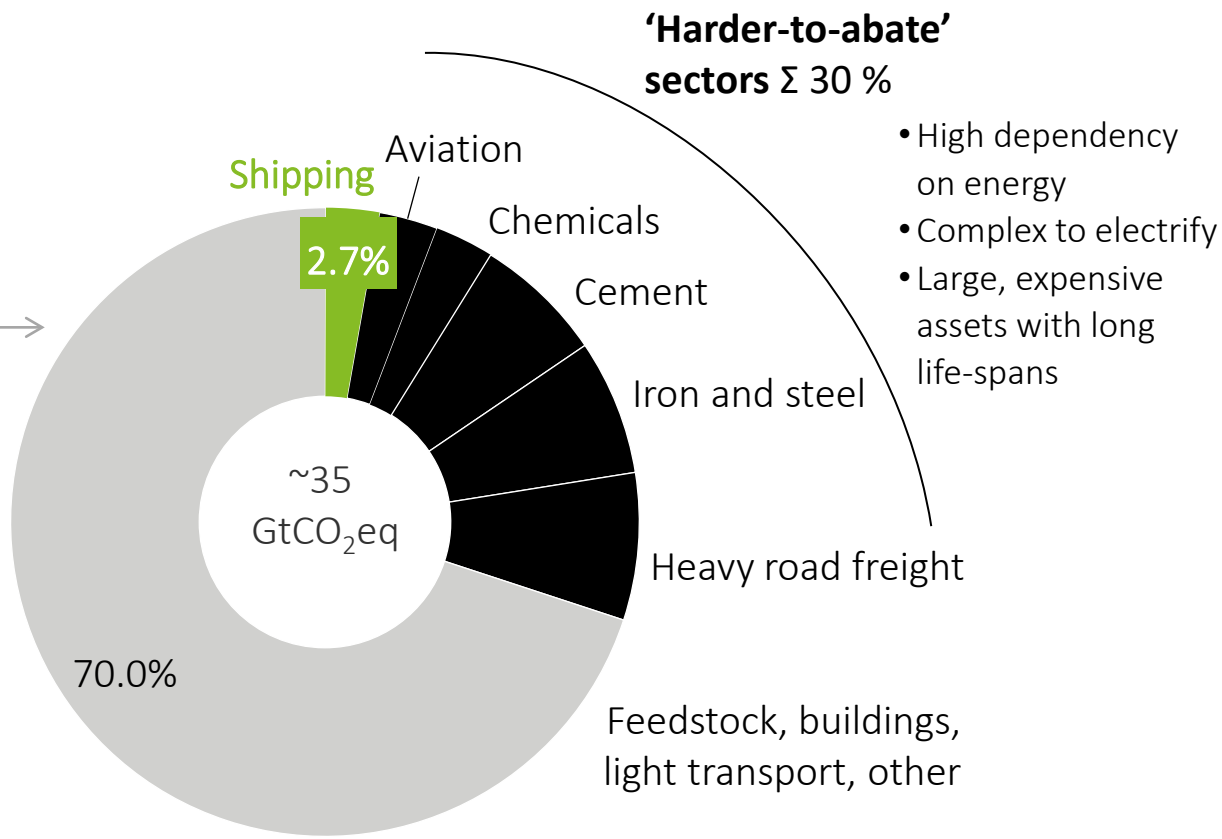
Climate change imperative

To reach the goals of the Paris Agreement, unprecedented level of emission reduction needs to be achieved; six sectors, including shipping, are 'harder-to-abate'

Global CO_2 emissions (Gt CO_2eq)[1]



2018 Global CO_2 emissions by sector

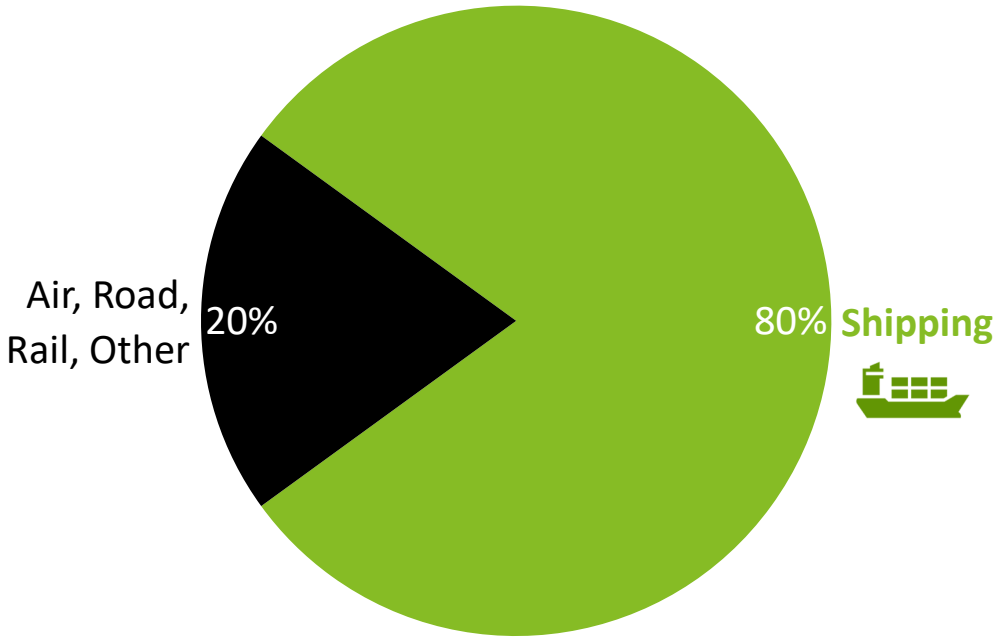


Source: Shell Sky scenario, 'Business as usual' based on IEA current policies scenario with linear extrapolation; Burn out – Dieter Helm; IEA Energy Technology Perspectives 2017; IEA 2014 baseline value assumptions; Deloitte analysis. Notes: 1) Energy-related emissions in Gigatons of CO_2 equivalent; 2) Net-zero emissions in 2070 to meet Paris Agreement ambition

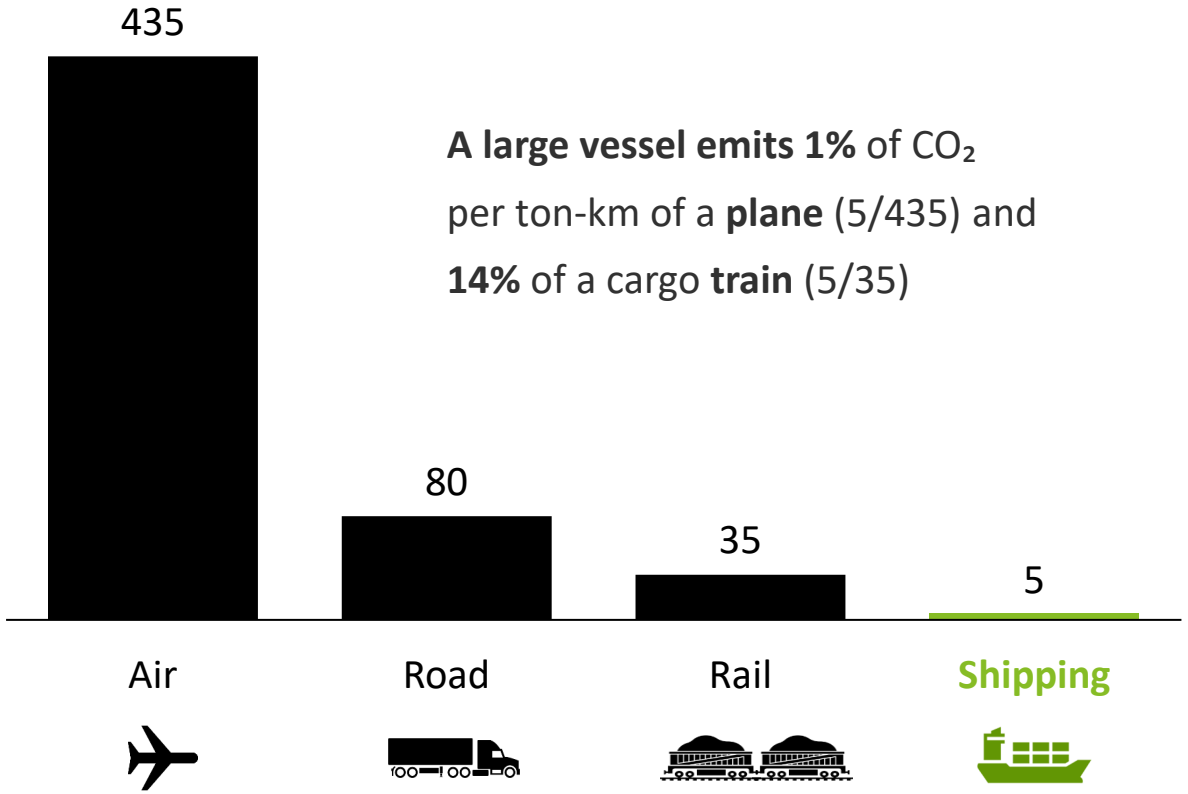
© Deloitte The Netherlands

Shipping is the backbone of the global economy and already the most emission efficient mode of transport

Global merchandise trade (2018)



Emissions by mode of transport (g CO_2/ton-km)[1,2]



A large vessel emits 1% of CO_2 per ton-km of a **plane** (5/435) and **14%** of a cargo **train** (5/35)

Source: UNCTAD (2018), Review of Maritime Transport; IMO GHG study 2009; Deloitte analysis

Notes: Energy-efficiency of transport is much dependent on the load factor, vehicle efficiency and cargo type; heavier cargo and larger vehicles will improve the cargo/vehicle weight ratio, resulting in better CO2/ton-km values; 2) Air = Boeing 747, Road = Truck > 40 ton, Rail = 3-4 hp / short-ton, Shipping = Average of very large container vessel (3 gCO2/ton-km), oil tanker (6), bulk carrier (8)

© Deloitte The Netherlands

Bulk carriers, oil tankers and container ships account for 85% of shipping emissions

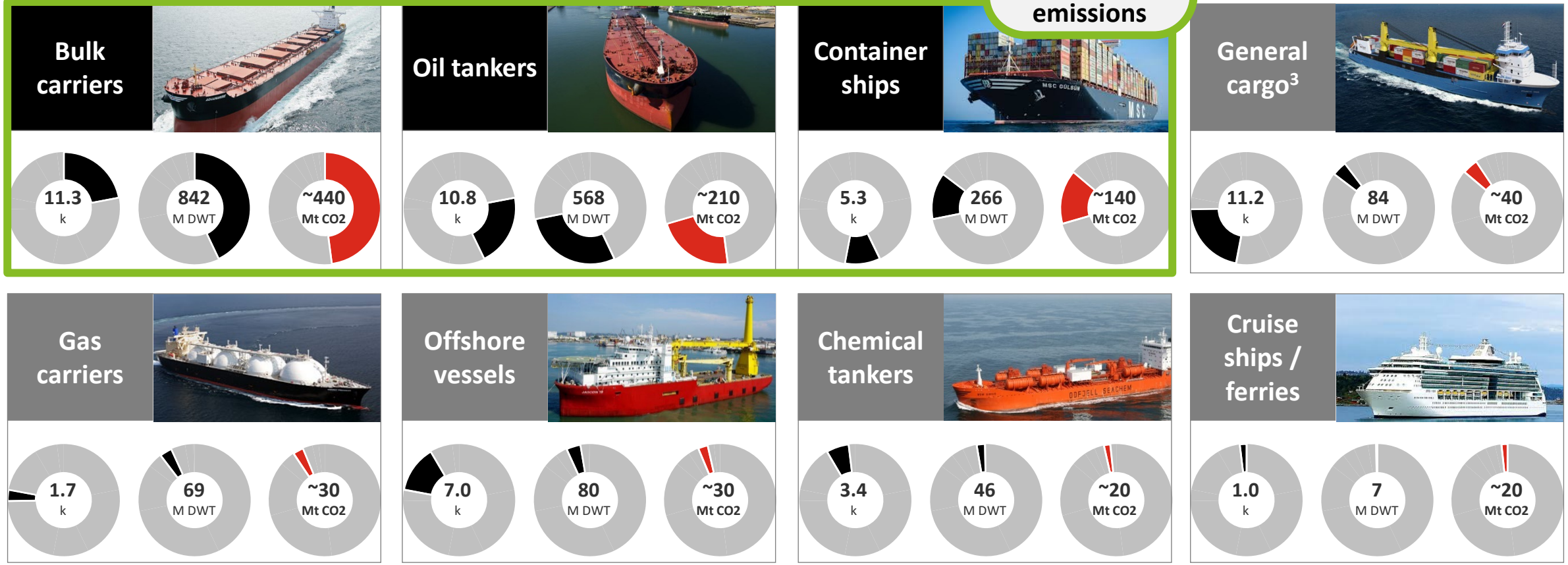
Global shipping fleet1

Σ~51.7k vessels

Σ~1,962 DWT[2]

Σ~930Mt CO2

~85% of total emissions



Source: UNCTAD; IMO; IEA; Deloitte analysis

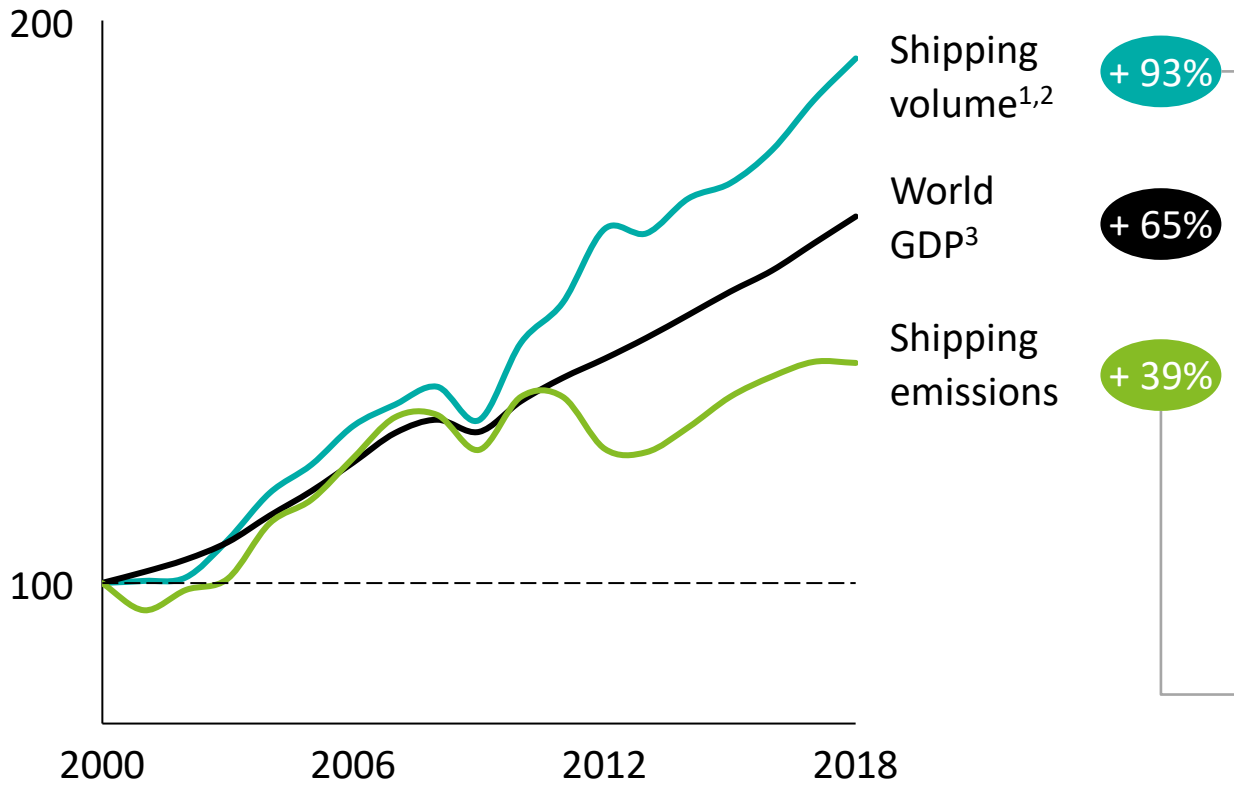
Notes: 1) Ships of >1,000 gross tons, representing 99% of global tonnage; 2) DWT = Dead Weight Tonnage, an indicator of capacity; 3) General cargo includes multipurpose and other unclassified vessels

© Deloitte The Netherlands

Pressure to decarbonise shipping

On the current course, shipping volume and emissions are set to grow

Shipping volume, emissions and GDP growth (2000 – 2018)



Shipping volume and emissions trends

Long-term trend (selection)	**Impact on shipping**
Economic growth (particularly developing regions)	↗
More agile supply chains, nearshoring, 3D printing	→
Trade protectionism and trade barriers	→
Shifting consumer behaviour, circular economy	→
Short-term impact: COVID-19	→
Net long-term impact on shipping volume	↗
Bigger, more efficient ships	→
Net long-term impact on shipping emissions	↗

Colour indicates estimated magnitude of impact — Low — High

Source: UNCTAD; World Bank; IEA; IMO; Deloitte analysis

Notes: 1) International shipping, accounting for over 80% of global shipping 2) Shipping volume are ton-miles (weight of cargo shipped over a distance); 3) World GDP in constant 2010 $, to eliminate effect of inflation

© Deloitte The Netherlands

Pressure to decarbonise shipping

However, shipping – as the only industry – has set ambitious global decarbonisation targets

Shipping decarbonisation ambition

*"At least **halve** international shipping greenhouse gas **(GHG) emissions by 2050**,*

*while reducing **CO_2 emissions intensity** by at least **40% by 2030**,*

*and pursuing efforts towards **70% by 2050**, relative to a 2008 baseline"*

In 2023 revised IMO Strategy is expected, incl. mid term measures for 2023-2030

Source: IMO (2018), IMO Action to Reduce Greenhouse Gas Emissions from International Shipping; Deloitte analysis

© Deloitte The Netherlands

Recognising the scale of the ambition, we have partnered with Shell and brought together over 80 CEOs and senior shipping leaders to chart the path to decarbonisation

Research objectives and participants

Comprehensive
including not only fuels but economic, regulatory and organisational factors

Voice of the sector
as those within shipping will play the most instrumental role

Path forward
looking beyond the challenges, clarifying a set of actions and a roadmap

To clarify how shipping can respond to its dual challenge of meeting the demand of the world's growing population, while radically reducing its emissions, we have brought together:

- **82 senior shipping leaders**, including 33 CEOs
- From **22 countries**, across **the globe**
- **74 interviews** and **10 hours of workshops**
- Representing the **most prominent organizations across the ecosystem**[1]: ship owners, operators, charterers, customers, ports, ship builders, regulators, financiers

Notes: 1) Participant organisations included 4 of top 10 global bulk and tanker operators, 4 of top 10 container, 3 of top 5 cruise, 3 of top 5 ship financiers, 2 of top 5 ship builders and 8 ports

© Deloitte The Netherlands

Shipping is facing major barriers across all factors, with particular challenges in customer demand, regulation and clarity on technology

Barriers to shipping decarbonisation

Readiness questions		Readiness factors		Personal Vehicles (Illustrative only)	Shipping (Participants' view on criticality of barriers)	Main barriers[1]
Why should the sector decarbonise? i.e. what might trigger industry stakeholders to act	1	Market and Customer Demand	Minor barrier		85% Major barrier	• Customers not willing to pay • No incentives form investors • Risk-averse financiers • Lack of emission transparency
	2	Regulatory Incentives	Minor barrier		70% Major barrier	• Lack of binding regulation • Global regulation slow, complex • Uneven playing field
Can the sector decarbonise? i.e. is decarbonisation feasible in a foreseeable future	3	Technology Alignment	Minor barrier		80% Major barrier	• No mature zero-emission fuels • Too many fuels considered • HFO 'bottom of the barrel'
	4	Clarity on Roles and Decision-Making	Minor barrier		50% Major barrier	• Many small, private owners • Inflexible contracting models
How fast can the sector decarbonise? i.e. what effort is required to implement change at scale	5	Ease of Asset Replacement	Minor barrier		60% Major barrier	• Risk of lock-in to wrong fuel • Long time to replace fleet
	6	Ease of Infrastructure Replacement	Minor barrier		65% Major barrier	• Investment, time to scale-up and dependence on other sectors • Ship-bunkering, chicken-and-egg

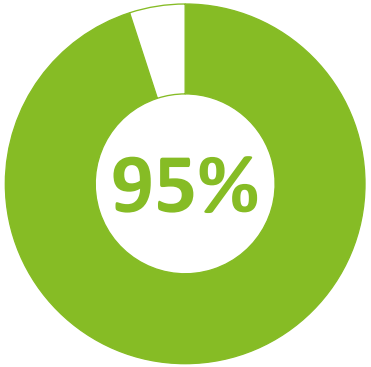
Source: Interviews, workshops; Deloitte analysis. Notes: 1) See appendix for a more detailed description of barriers

© Deloitte The Netherlands

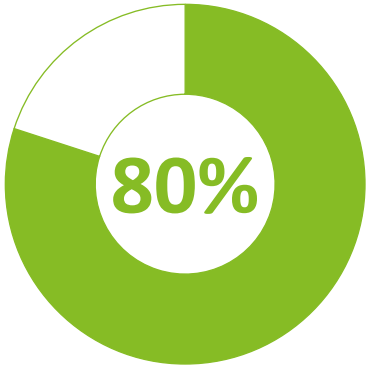
Decarbonisation readiness and barriers

Despite the recognition of structural barriers and the impact of COVID-19 crisis, shipping leaders indicate that decarbonisation is already among top priorities in the industry

Shipping leaders' view on importance of decarbonisation



of study participants perceive **decarbonisation as important or a top 3 priority** on the industry agenda



of participants indicated the **importance** has somewhat or significantly **increased in the last 18 months**

*"**Consumer pressure** is increasing"*

Technology Provider

*"Decarbonisation is **one of the biggest challenges** we face. However, we have never been more **united around a problem**, and there is **optimism** that **we can make it happen**"*

Ship Operator

*"Everyone who orders a vessel already has to think about **what engine, what fuel will make sense**"*

Ship Owner

*"[Decarbonisation] will come right back up to the **top of the shipping agenda when COVID-19 crisis is over**"*

Ship Operator

Source: Interviews, workshops; Deloitte analysis

© Deloitte The Netherlands

Decarbonisation readiness and barriers

To determine the key barriers to shipping decarbonisation, we have applied a comprehensive framework, looking at six factors

How to determine barriers to decarbonisation – readiness frameworks

Readiness questions		Readiness factors	
Why should the sector decarbonise? i.e. what might trigger industry stakeholders to act	1	Market and Customer Demand	**Pressure** and **incentives** from society, customers, financiers and investors which create motivation for ship owners and operators to change
	2	Regulatory Incentives	**Instruments** applied by global, regional and local authorities. These can include incentives such as tax cuts and disincentives like fines and carbon levies
Can the sector decarbonise? i.e. is decarbonisation feasible in a foreseeable future	3	Technology Alignment	Technical and commercial **feasibility of alternative fuels** and other lower emission technology alongside clarity on how to further develop these
	4	Clarity on Roles and Decision-Making	The ease in **making decisions**, clarity on the **roles** and **responsibilities** of key groups in the industry, and whether their priorities are aligned
How fast can the sector decarbonise? i.e. what effort is required to implement change at scale	5	Ease of Asset Replacement	What it takes to **replace** / **upgrade** the **ships**. This depends on ship cost, complexity, lifespan, and the rate at which alternative technologies are developed
	6	Ease of Infrastructure Replacement	What it takes to **produce new fuels at scale**, **deliver** and prepare for **bunkering**. The more fuel and the more dispersed the infrastructure, the greater the challenge

Source: Interviews, workshops; Deloitte analysis

© Deloitte The Netherlands

Decarbonisation readiness and barriers

All readiness factors show major, moderate or minor barriers

Main barriers

Why should the sector decarbonise?	1. Market and Customer Demand	Customers and charterers are **not willing to pay or co-fund** lower emission solutions	**Investors** have no incentives to **invest in companies with** lower emission solutions	**Financiers** do not have the **risk appetite** to fund unproven technologies	**Lack of transparency** regarding **emissions** hinders decision-making
	2. Regulatory Incentives	Lack of **binding regulation** regarding carbon emissions limits progress	Enacting global regulation is a **slow and complex process** with many interests to align	The industry is worried that misalign-ment of global and local regulation may lead to an **uneven playing field**	
Can the sector decarbonise?	3. Technology Alignment	Alternative fuels that support 2050 ambition have **technical limitations, are unproven and / or perceived as unsafe**	**Too many future fuels** are being considered, and there is **lack of clarity on how the preferred fuel(s) will be chosen** to allow for scale	HFO is hard to match in terms of **commercial attractiveness** and **existing scale**	
	4. Clarity on Roles and Decision-making	The global fleet is **owned by many small companies,** and **multiple stakeholders** are involved in ship operations, **complicating decision-making** regarding new technologies	**Contracting models are inflexible** hindering investments that support lower carbon emissions		
How fast can the sector decarbonise?	5. Ease of Asset Replacement	Ship owners are **reluctant to invest in net-zero vessels** due to risks resulting from **lack of clarity regarding future fuels and regulation**	**Ship lifespans are long**, requiring **significant time to replace** existing fleets		
	6. Ease of Infrastructure Replacement	Infrastructure to **produce zero-emission fuels** will require **significant investment, time to scale up** and will depend on **decisions in other sectors**	**Bunkering** providers and ship operators are **waiting on each other to make the initial investments** in net-zero ships and infrastructure		

Severity Major | Moderate | Minor

© Deloitte The Netherlands

Shipping leaders recognise that to address the barriers to decarbonisation the industry will need a novel approach, based on three principles

Shipping leaders' view on how to decarbonise – SOLUTION PRINCIPLES

Adopt an **ecosystem** perspective	The challenge is too large for any one organisation alone. Shipping leaders call for **a holistic** and **integrated perspective**, with **each industry stakeholder** having a role to play
Think big, **start small**, scale fast	**Uncertainty** needs to be tackled through small actions that **generate momentum**. As these initiatives prove beneficial, early adopters will attract early followers and initial investment. **Scaling up** needs to follow in **specific segments** with the biggest impact
Focus on **behaviours** and triggers	Incentives should be based on an **understanding** of what will **motivate stakeholders** across the value chain to take a long-term perspective

*"Real **commitment from customers** would go a long way to unlock investment"*

Ship Owner and Operator

*"We don't have time to go through iterative technology development. **2030 is tomorrow, 2050 is one ship lifetime away**"*

Shipping Technology Provider

*"The solution will come from the **operators with their name on the ships**"*

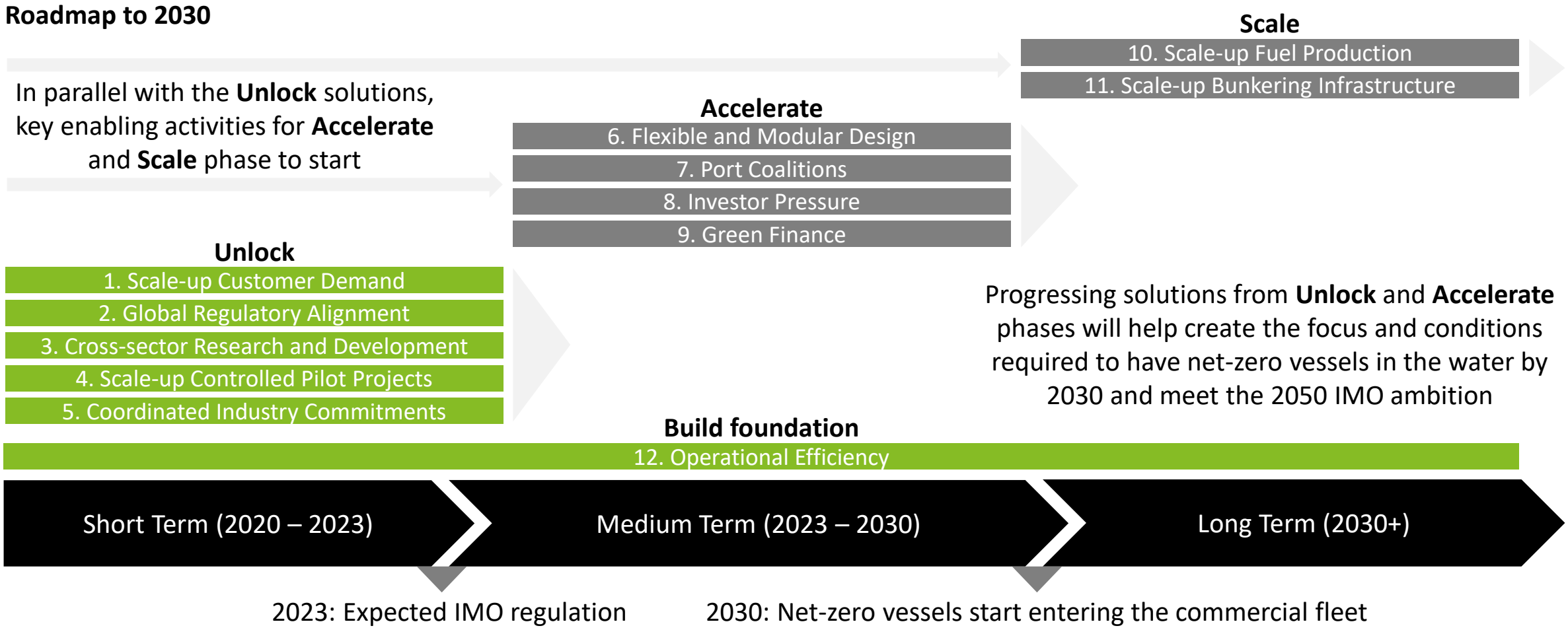
Ship Operator

Source: Interviews, workshops; Deloitte analysis

© Deloitte The Netherlands

Solutions

Through these principles, shipping leaders outlined twelve solutions, of which six need to be started immediately



Source: Interviews, workshops; Deloitte analysis

© Deloitte The Netherlands

All hands on deck

There is a realization that the industry needs to build on the ongoing initiatives and scale-up the change quickly

- To achieve the objective of having the first net-zero ships entering the global fleet around 2030, **the industry needs to realize progress on all of the solutions in the next 10 years**
- **Tangible results** across the solutions from the Unlock phase will be needed in the **next two to three years** to set the industry on the right path
- **Shipping leaders believe that this is doable**, but it requires **immediate engagement and mobilization**. The existing coalitions need to be the starting place. It is now critical to **build on the momentum and work together today to drive real, practical change for the future**

> *"We can build rockets that come back from the moon but not make the ships green? No way.* ***We can do it!****"*
>
> Ship operator

© Deloitte The Netherlands

Deloitte.

Deloitte refers to one or more of Deloitte Touche Tohmatsu Limited ("DTTL"), its global network of member firms and their related entities. DTTL (also referred to as "Deloitte Global") and each of its member firms are legally separate and independent entities. DTTL does not provide services to clients. Please see www.deloitte.nl/about to learn more.

Deloitte is a leading global provider of audit and assurance, consulting, financial advisory, risk advisory, tax and related services. Our network of member firms in more than 150 countries and territories serves four out of five Fortune Global 500® companies. Learn how Deloitte's approximately 286,000 people make an impact that matters at www.deloitte.nl.

This communication contains general information only, and none of Deloitte Touche Tohmatsu Limited, its member firms or their related entities (collectively, the "Deloitte network") is, by means of this communication, rendering professional advice or services. Before making any decision or taking any action that may affect your finances or your business, you should consult a qualified professional adviser. No entity in the Deloitte network shall be responsible for any loss whatsoever sustained by any person who relies on this communication.

© 2020 Deloitte The Netherlands