



Mærsk Mc-Kinney Møller Center
for Zero Carbon Shipping

Maritime Decarbonization Strategy 2022

Launch Webinar | we will begin shortly...

On today's panel



Bo Cerup-Simonsen

CEO

Mærsk Mc-Kinney Møller Center for
Zero Carbon Shipping



Claus Graugaard

Head of Onboard Vessel Solutions
Mærsk Mc-Kinney Møller Center for
Zero Carbon Shipping



Torben Nørgaard

Head of Energy & Fuels
Mærsk Mc-Kinney Møller Center for
Zero Carbon Shipping



Sara Åhlen Björk

Chief Economist
Mærsk Mc-Kinney Center for
Zero Carbon Shipping

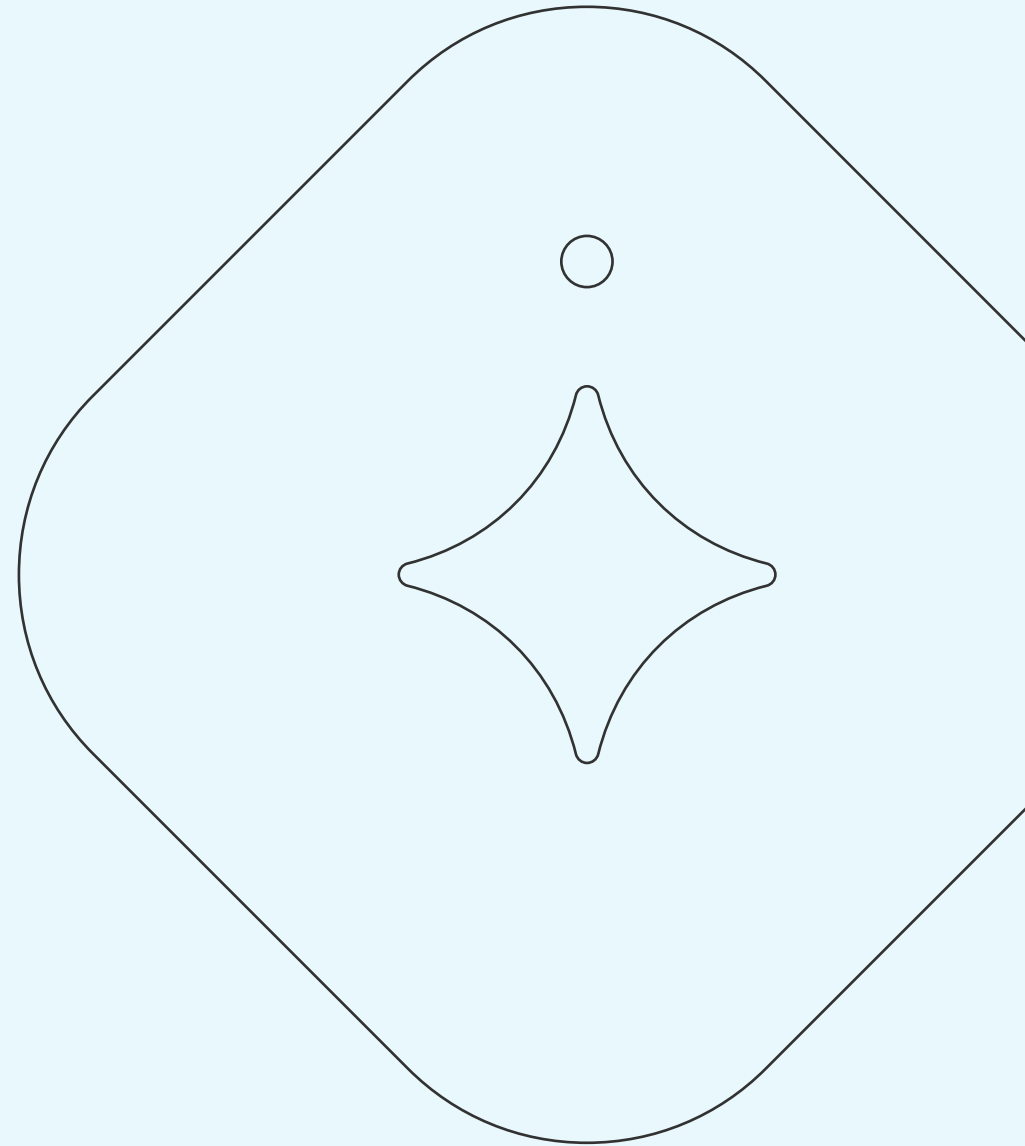


On today's agenda:

- 09.00 Introduction
- 09.05 Setting the scene
- 09.20 MDS highlights
- 10.00 Q&A session
- 10.30 Closing



All time indications are CET

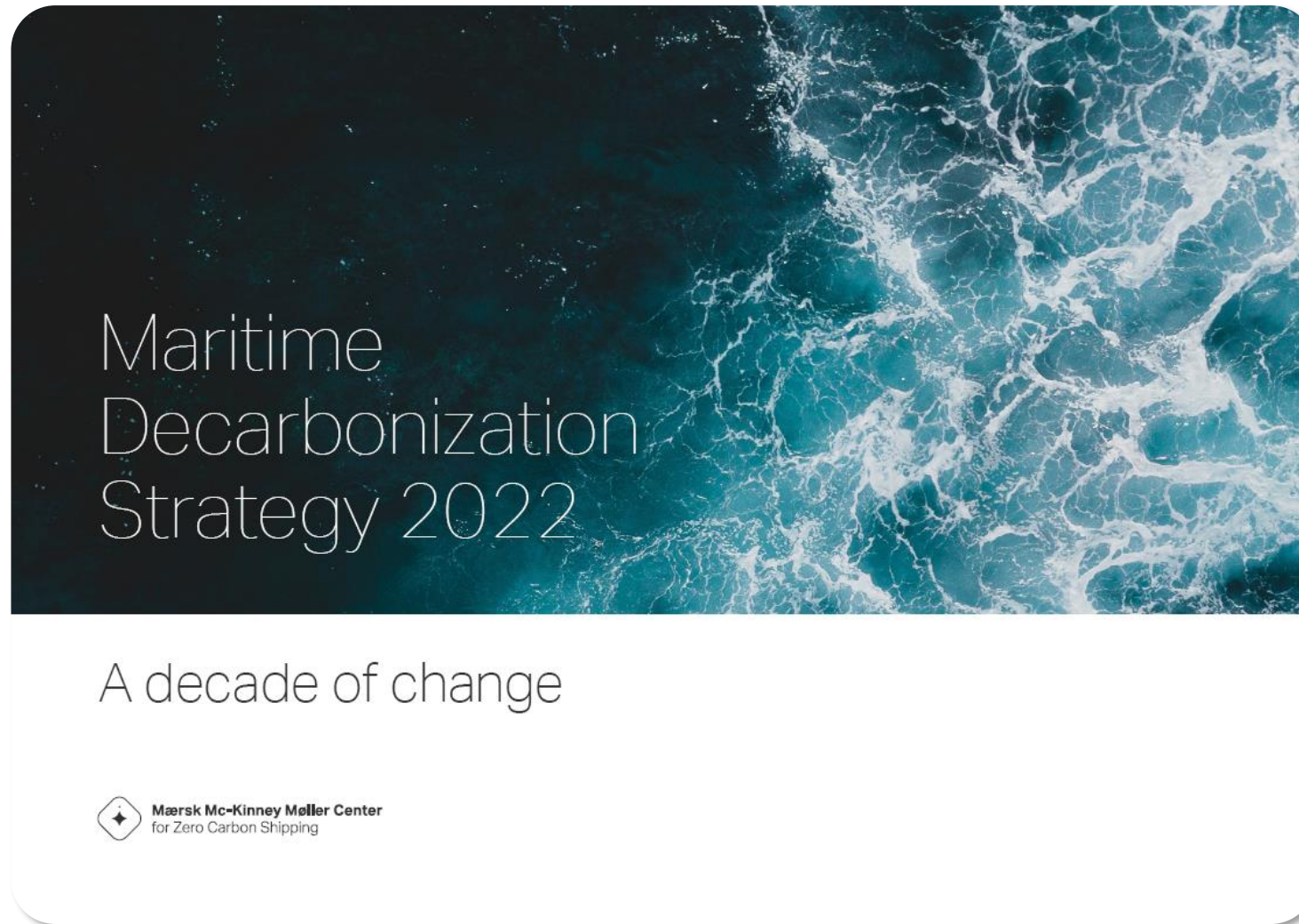


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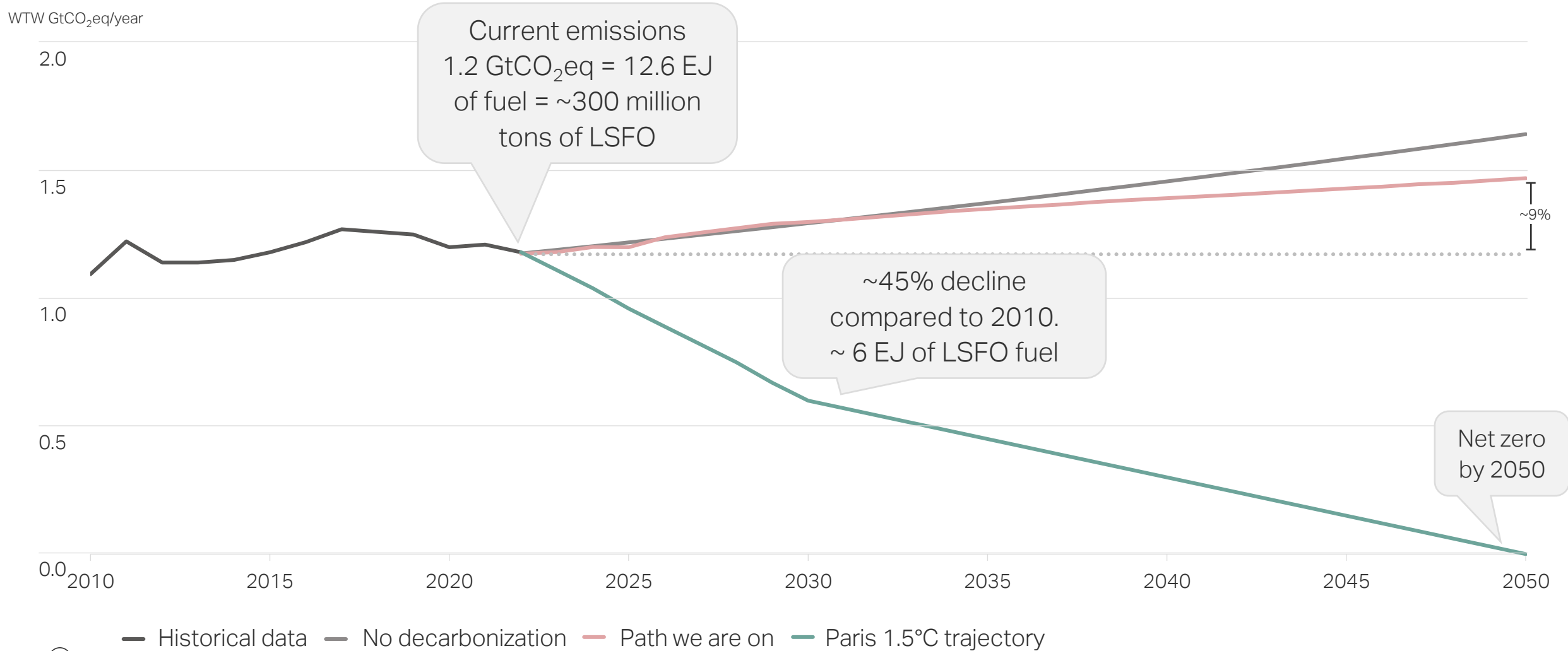
Launching Maritime Decarbonization Strategy 2022



Download the report and many other publications on www.zerocarbonshipping.com



The challenge remains – we are not on the right path



Decarbonizing shipping requires replacing and reducing the 12.6 EJ of energy required to propel the fleet. But how much is 1 exajoule of energy actually?

Global fleet

1 EJ (10^{18} joules) is about



8%

of the energy consumed
by the global fleet each
year

Fuel oil

1 EJ is equivalent to approx.



24

million tonnes of fuel oil

Electricity

1 EJ corresponds to nearly



280,000 GWh

of electricity. That's the
annual electricity
consumption of Mexico

Petroleum

1 EJ is approx. equivalent
to roughly



173

million barrels of petroleum.
That's roughly 25%
Germany's annual
petroleum consumption

Solar and wind

1 EJ of energy per year
corresponds to around



80 GW

of installed solar and wind
capacity assuming a 40%
capacity factor



Action is required within this decade and acceleration needs to happen in four areas in parallel



The industry must
elevate onboard
energy efficiency



We must enable
alternative fuel
pathways



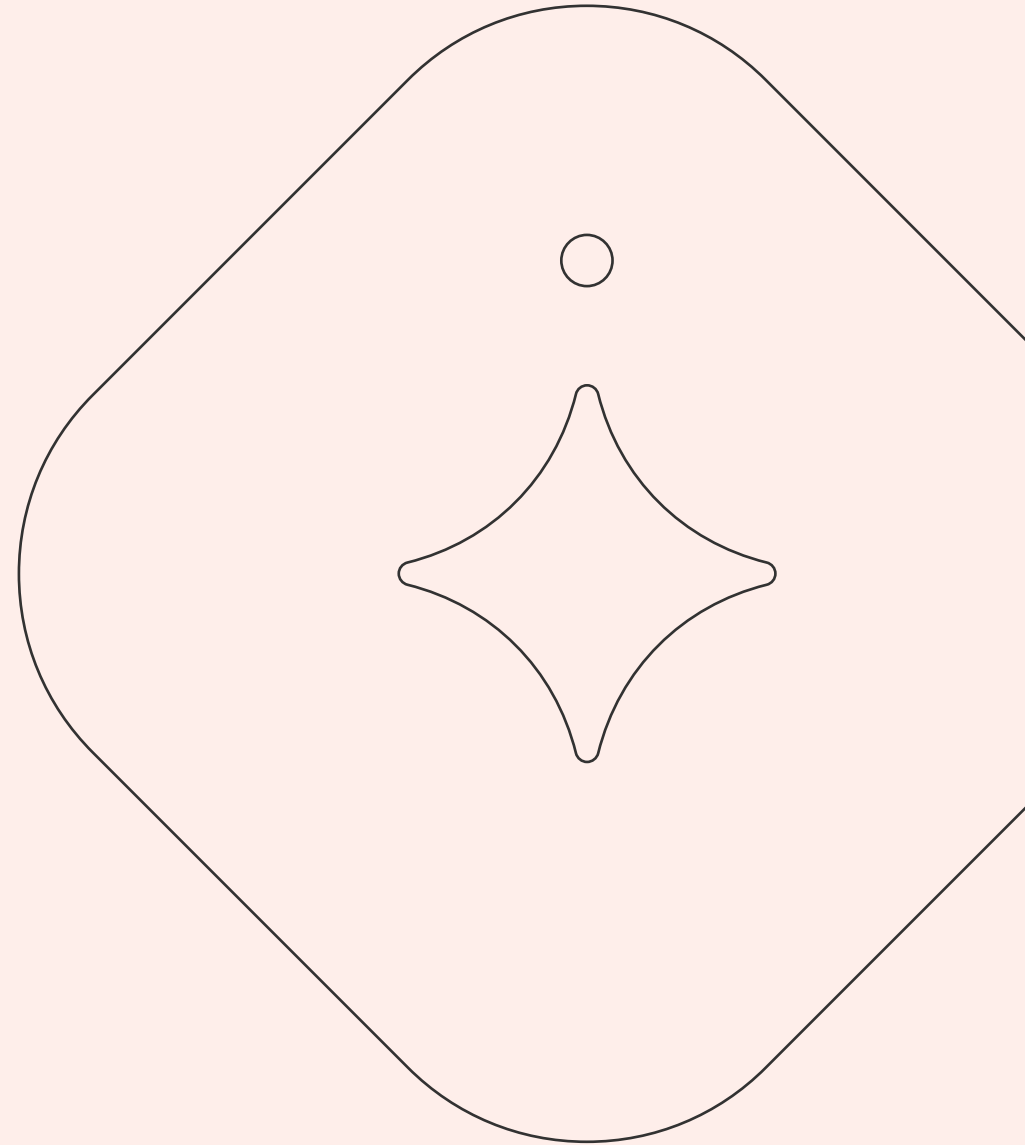
Regulation, policy
and commitments
must promote
abatement action



We must support
bold first movers
and fast followers
to unlock the
transition



Elevating onboard energy
efficiency



Large fuel savings and emission reductions can be unlocked with voyage optimization and fleet strategies

Area	Category	Examples	Potential energy efficiency gains per ship	Current fleet uptake*			
				Bulk	Tanker	Container	Passenger
Operational measures	Voyage Optimization	Voyage planning, and weather routing, trim and draft optimization, energy management, hull, and propeller fouling management	1-10%				
	Fleet strategies	Fleet portfolio optimization, vessel deployment and utilization, scheduling, and speed optimization	1-15%				
Technological solutions	Hull & propeller efficiency	Hull form optimization, propeller design, anti-fouling systems, propulsion-improving devices, air lubrication	1-8%				
	Engines and systems	Engine technology, electrification and hybridization, waste heat recovery systems, shaft generator	1-5%				
	Alternative power systems	Wind assisted propulsion	1-8%	P	P		P

Not applied

P Pilot installations

Limited adaption

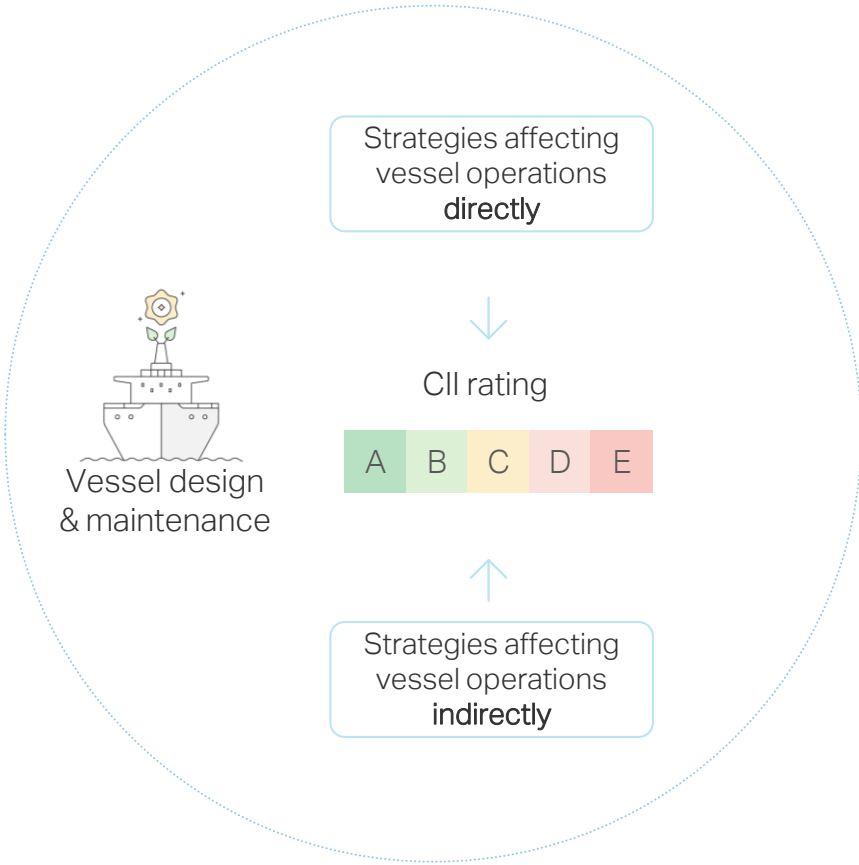
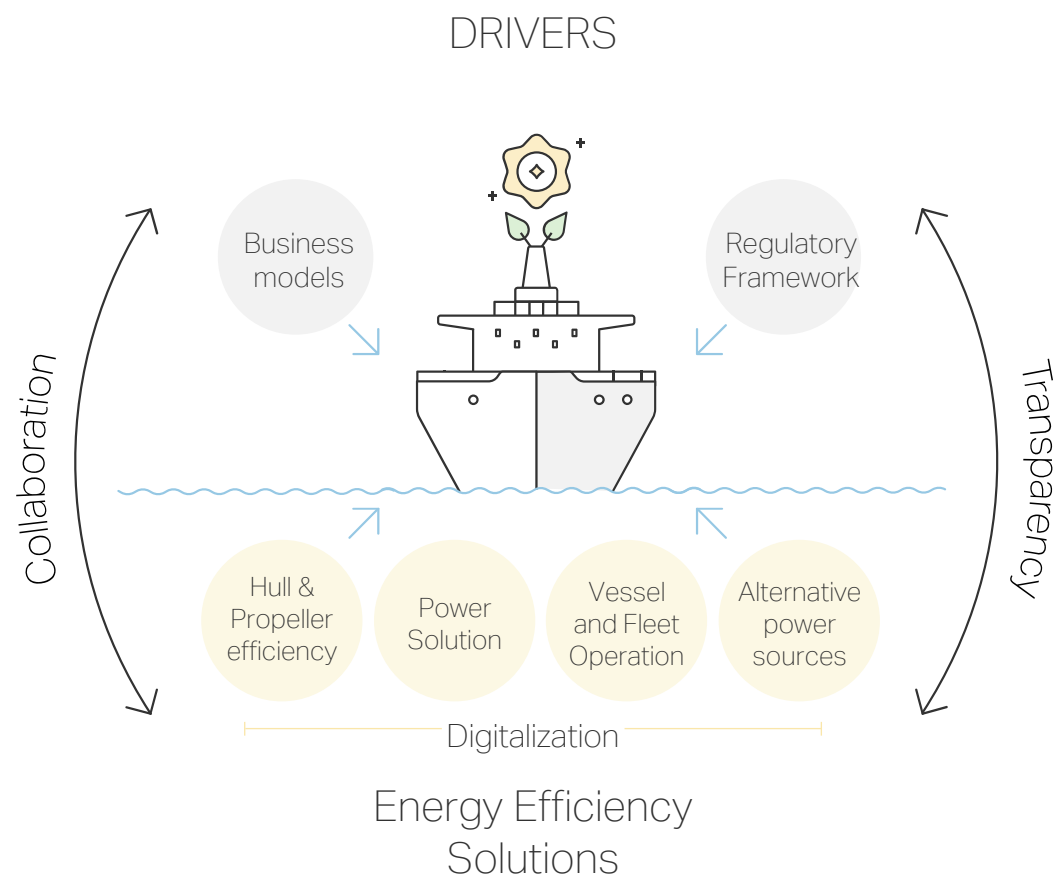
Growing adaption

Best practice



*Based on an analysis of publicly available information, knowledge from our partners and industry experts at the Center.

Improved regulations and new collaborative business models based on transparency can help drive uptake of energy efficiency solutions



CII is a holistic regulation that, with clearer guidance, could drive transparency and cooperation in the industry.

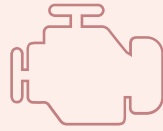


Action now: What will it take to save 1 EJ of energy by 2030 using efficiency measures?



1/3 of all vessels must have optimized hull forms and propulsion-improving devices fitted on their hull, rudder, and propeller*

... that would mean a **3x increase in adoption** of propulsion-improving devices in the bulk, tanker, and container fleets **compared with today**



AND 1/4 of all vessels must include new, capex intense technologies such as air lubrication and wind assisted propulsion

...that would mean a **400x increase in adoption of new technologies** like air lubrication and wind assistance in the bulk, tanker, and container segments **compared with today**



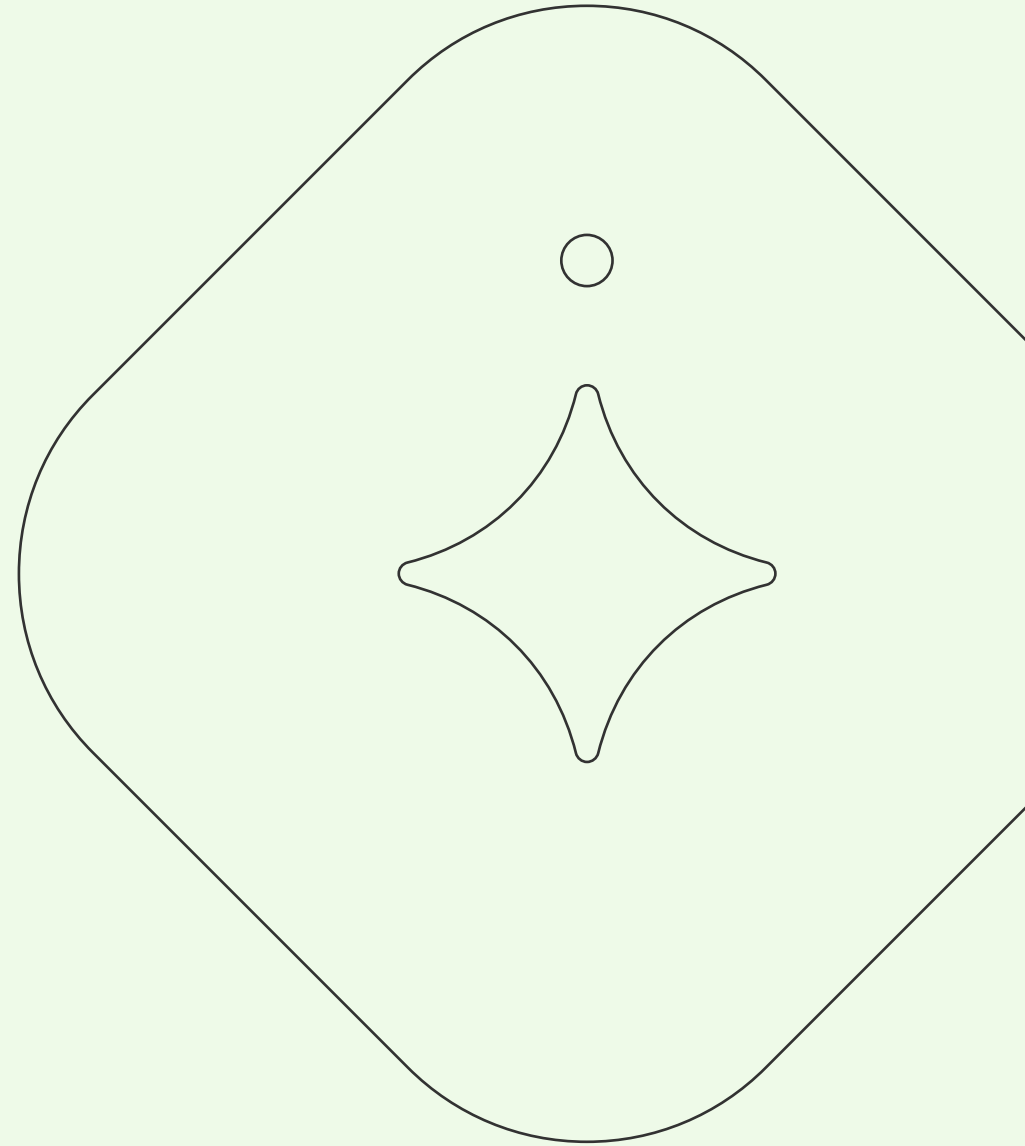
AND all vessels must utilize all operational efficiency measures





'All vessels' includes the bulk, tanker, container, gas carrier, passenger and RORO car carrier fleets. Applies to both newbuilds and retrofit programs.

*Adoption will be driven by compliance with EEDI Phase 2 and 3

Enabling alternative fuel pathways



Alternative fuels have varying maturity levels and challenges in the early years of transition

	Feedstock availability	Fuel production	Fuel storage, logistics and bunkering	Onboard energy storage & fuel conversion	Onboard safety and fuel management	Vessel emissions	Regulation & certification
e-ammonia							
Blue ammonia							
e-methanol							
Bio-methanol							
e-methane							
Bio-methane							
e-diesel							
Bio-oils							

- 

MATURE
 Solutions are available, none or marginal barriers identified.
- 

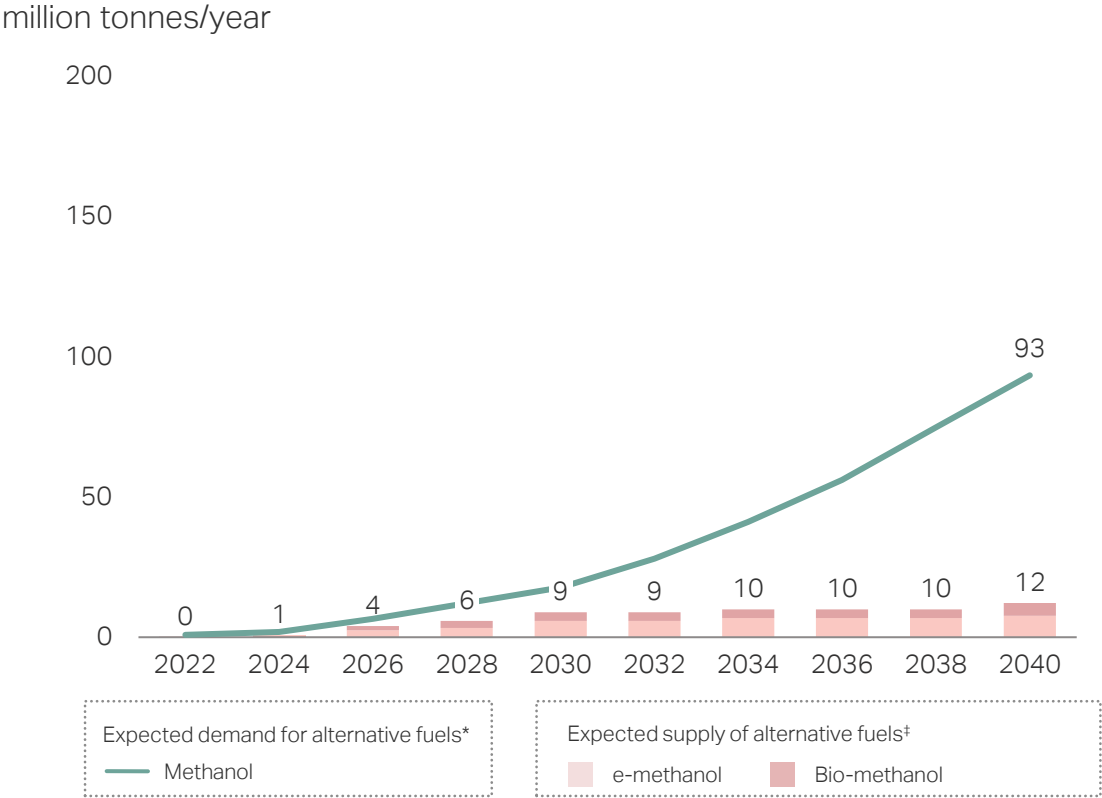
SOLUTIONS IDENTIFIED
 Solutions exist, but there are some challenges on e.g., maturity and availability.
- 

MAJOR CHALLENGES
 Solutions are not developed or lack specification.

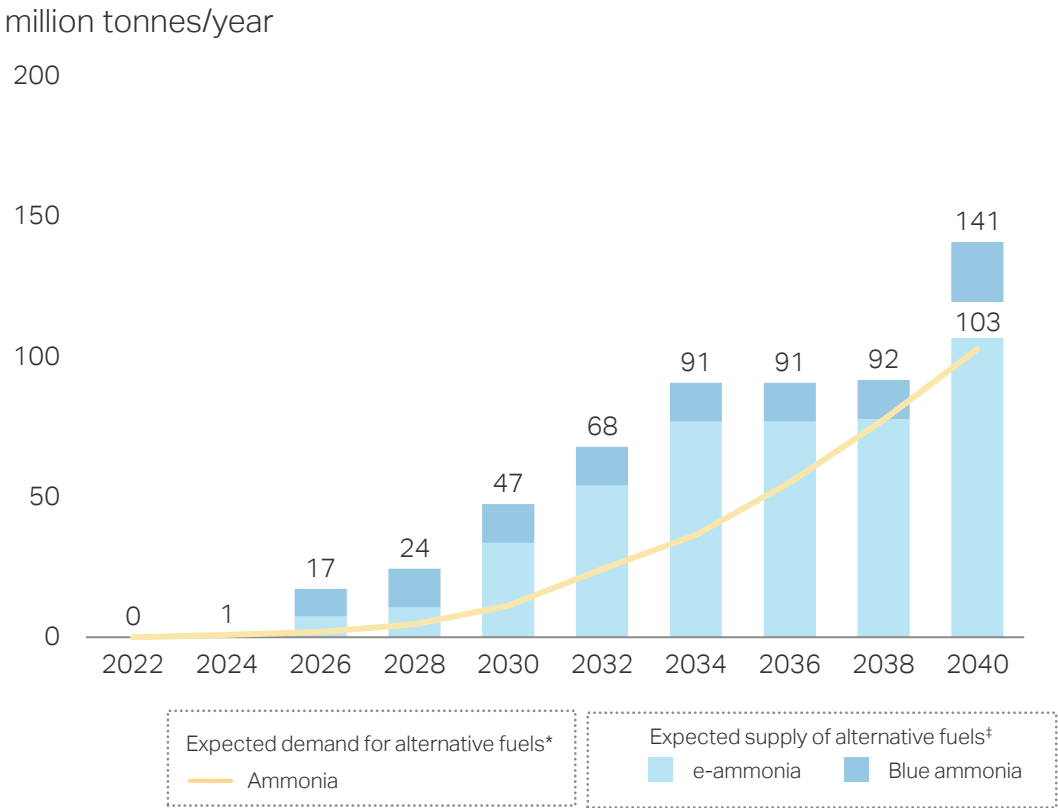


The disconnect between demand and supply of alternative fuels should be addressed during this decade

Methanol



Ammonia



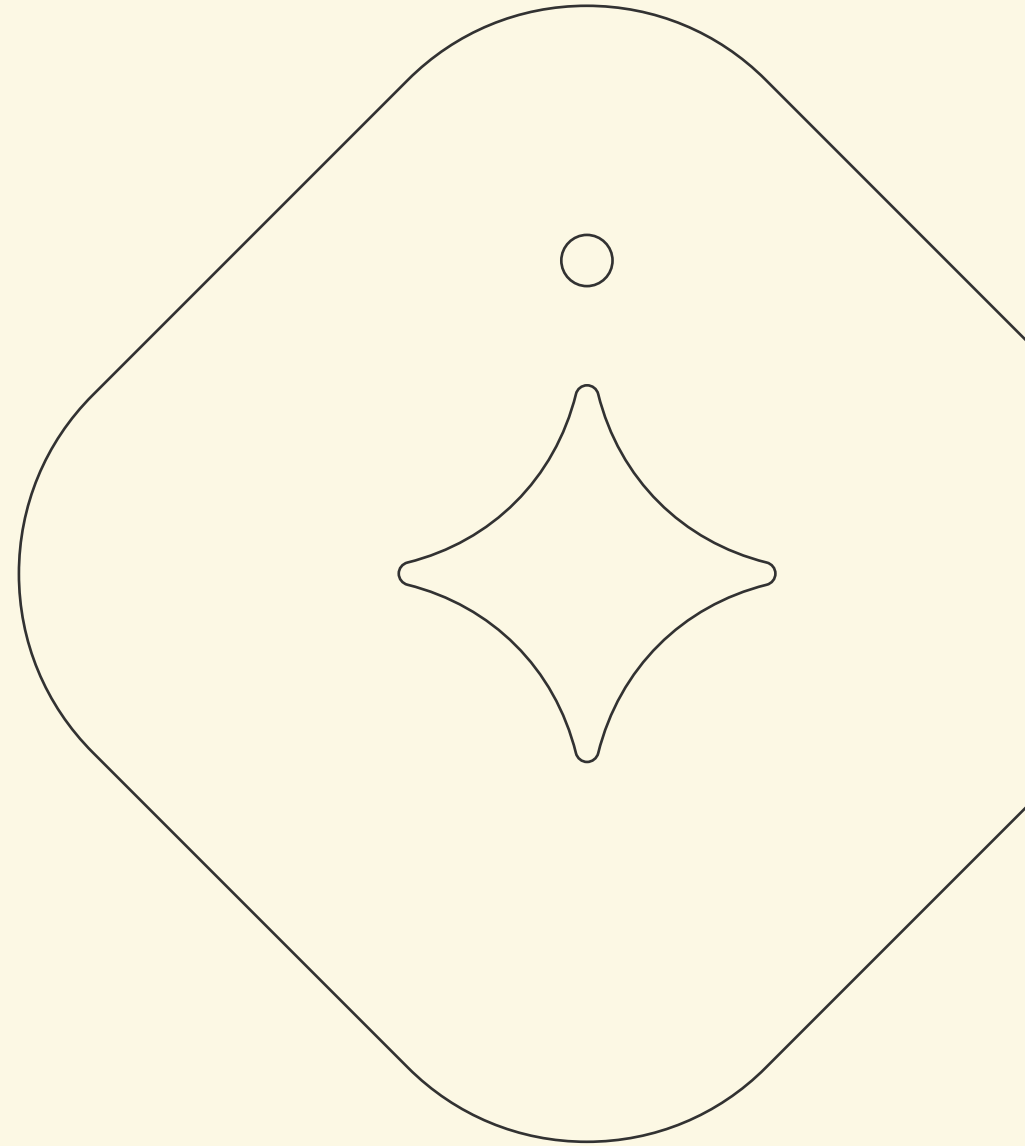
Source: MAN Energy Solutions, Shipping en route to Paris Agreement Overshoot, 2022
Source: Cumulative production capacity based on announcements aggregated by MMMCZCS.

Action now: What will it take to produce 1 EJ of each alternative fuel by 2030?

Alternative fuel type	Capacity in millions of tonnes per year required for 1 EJ of each fuel	Production required to produce 1 EJ of fuel	How can we put this into perspective?
Bio-methane	20	1,120 plants	Equivalent to 2/3 of all current production of biogas produced in the world today (including all sectors)
e-methane	20	320 plants	2 times more methane than used by shipping today as LNG
Bio-methanol	50	480 plants	Equivalent to 50% of all current production of grey methanol produced in the world today (including all sectors)
e-methanol	50	426 plants	Requires 70 million tonnes of biogenic CO ₂ feedstock-- more than 5x the CO ₂ produced by the Drax biomass power plant. ³⁷
Blue ammonia	50	48 plants	Equivalent to 20% of all current production of grey ammonia produced in the world today (including all sectors)
e-ammonia	50	63 plants	More than 5x the potential annual e-ammonia production of the Asian Renewable Energy Hub ³⁸



Promoting abatement
action through regulation,
policy and commitments



Utilize the power of commitments, targets, and regulations to further stimulate decarbonization



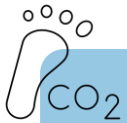
Regulatory certainty
through global targets



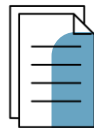
Build on early regional
initiatives and cross-
border co-operation



Create a transparent and
de-risking environment



Factor in societal values
and climate impact



Adopt technical
documents and
certification schemes



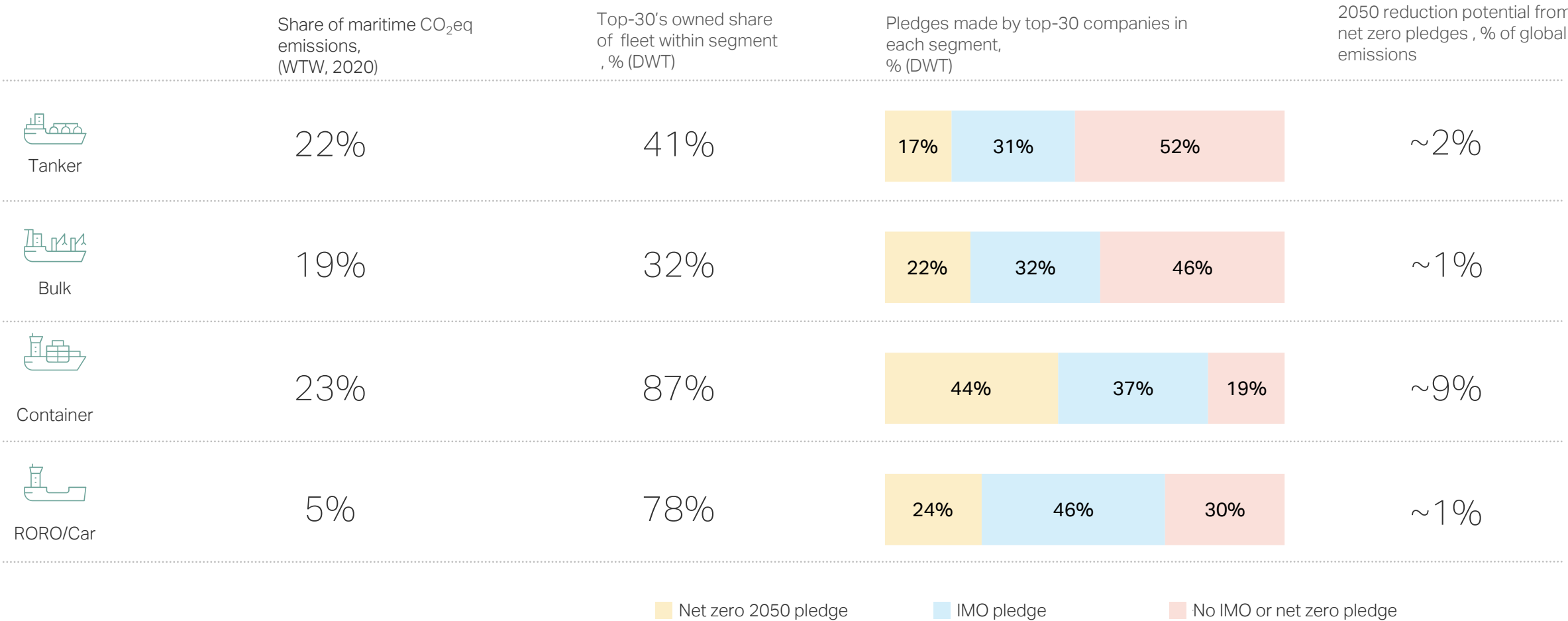
Support robust global
carbon pricing



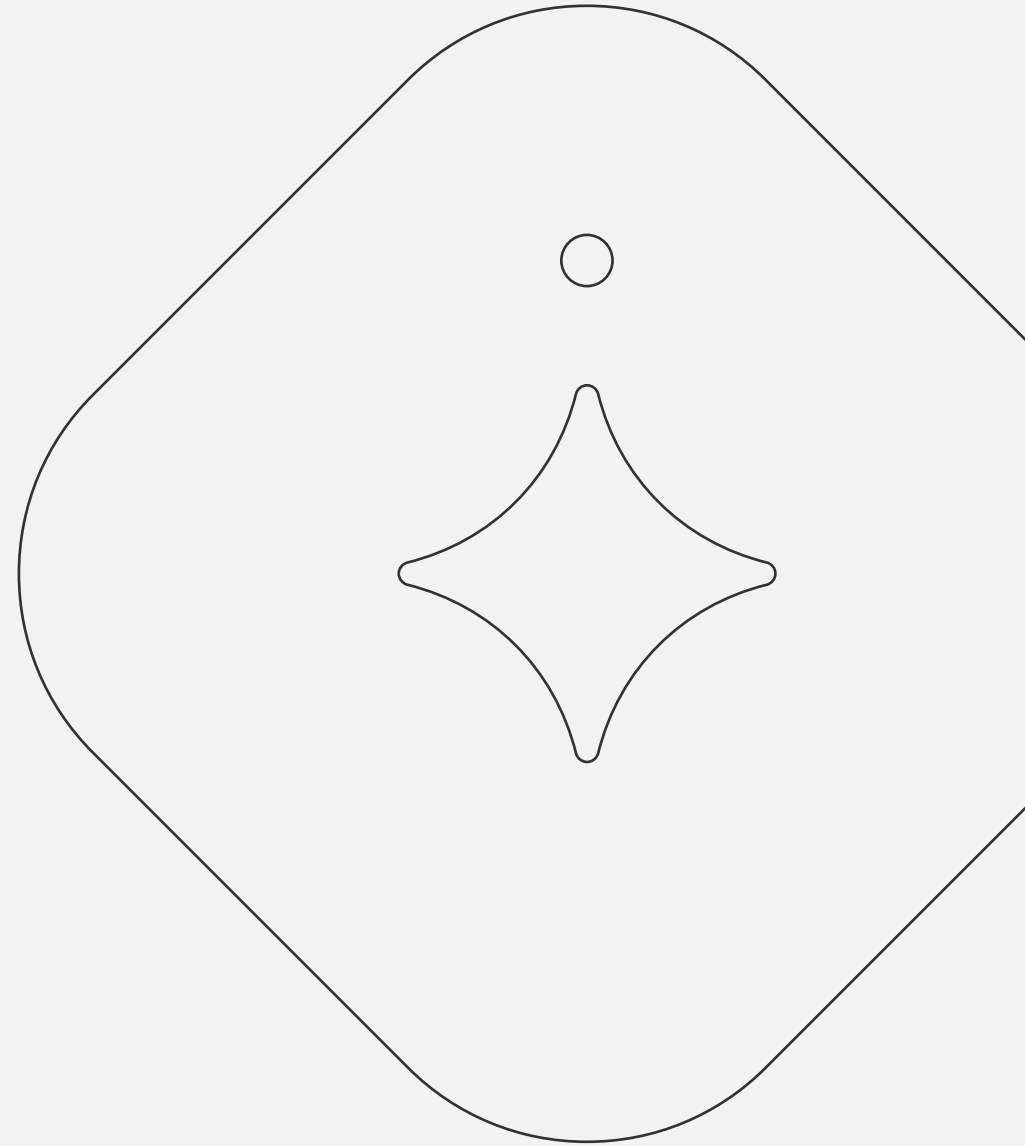
We need a level playing field with same rules and standards for all

Maritime rules and standards	Fuels						Power/Propulsion technologies		
	Bio-fuels	Methane	Methanol	LPG	Ammonia	Hydrogen	Batteries	Fuel Cells	Wind
IMO Safety of Life at Sea (SOLAS), safety revision		Low flashpoint fuels are referenced in SOLAS and pointed to the IGF Code. However, the IGF doesn't cover all these fuels explicitly, refer to alternative design approach.							
IMO MARPOL, emissions and environmental impact revision									
IMO IGF Code									
IMO IGC Code									
IMO Guidelines / Unified Interpretation / Circulars									
International Association of Classification Societies (IACS) Unified Requirements/Unified Interpretation									
Class Rules / Guidelines									
Bunkering Standards – generic (Society of International Gas, Tanker, and Terminal Operators (SIGTTO), International Bunker Industry Association (IBIA, etc.)									
ISO standards Bunkering, fuel safety, fuel quality, sea trials									
LCA / WTW methodology standard									

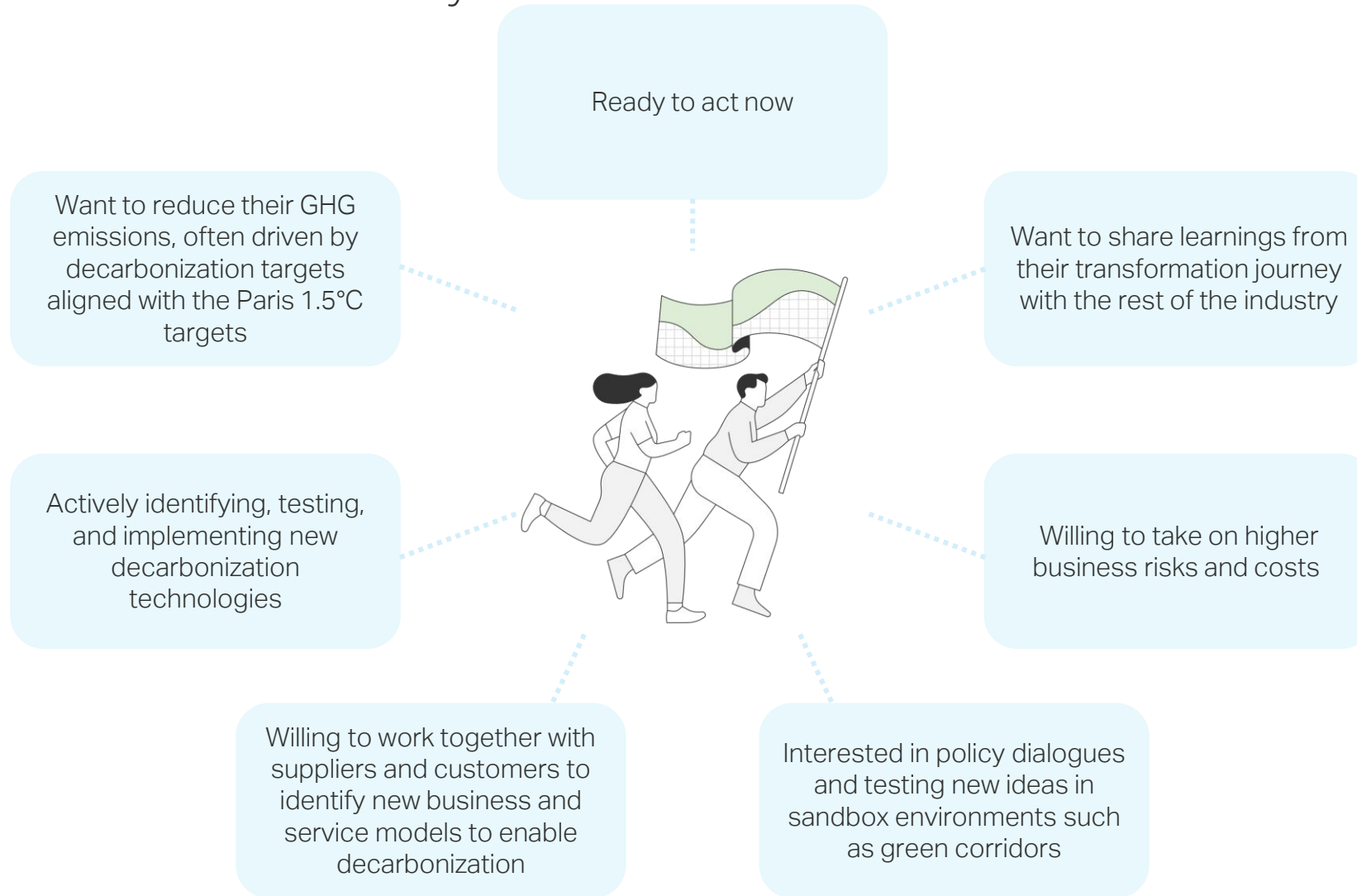
Action now: Industry climate leaders are showing the way by setting decarbonization targets and reporting on their progress



Supporting bold first
movers and fast followers



The future will be shaped by those who create the visions, concepts and solutions of tomorrow ... today



Action now: There is a job for everyone across the maritime ecosystem and no time to waste

Transition drivers

Alternative fuel producers



Unlock barriers to enable all alternative fuel pathways

Promote and scale the already commercially available alternative fuels

Ports & terminals



Re-purpose existing infrastructure to support scaled uptake of alternative fuels

Share learnings and develop blue-prints on safe handling of all alternative fuels

Vessel owners & operators



Order dual-fuel ships

Maximize energy efficiency

Send demand signals to fuel producers

Deepen dialogue and green service offering with customers

Market enablers

Regulation and policy making



Focus on removing barriers and close cost-gaps

Present long-term regulatory roadmaps and experiment with regulatory sandboxes to find solutions fast

Introduce carbon pricing

Financing



Mobilize capital to decarbonization tech

Engage in private-public partnerships

De-risk investments by providing e.g., cheaper cost of capital, governmental guarantees, subsidies

Cargo owners & customers



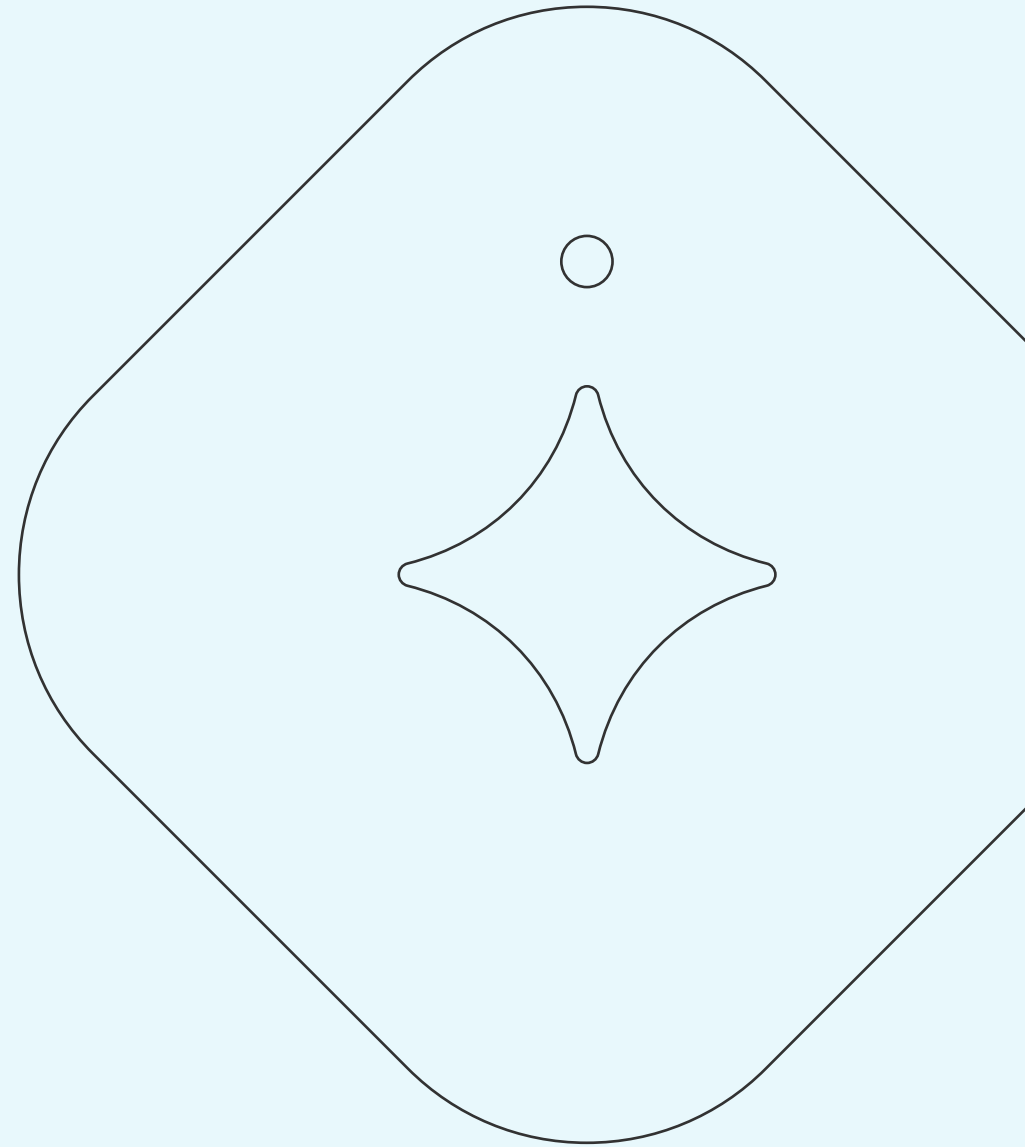
Be transparent about green shipping demand

Increase willingness to share some of the cost to alternative fuels

Work to find solutions on how to aggregate fragmented supply and demand



Ready for questions?



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