Welcome to
Maritime Sustainable Solutions Match 2025!

Hartmann, Lothar
EEN Advisor

Insights and implications for industrial life cycle design: towards a holistic decarbonization of shipping

- Welcome / **EEN**
- Decarbonizing the maritime value chain / **ReFlow**
- Save fuel and eliminate microplastics with e-coating / **Clean Ocean Coatings**
- Accelerating maritime decarbonization with AI / **Toqua.ai**
- Making biofuel feasible / **Frontier Fuels**
- Towards zero emission operations on inland and short sea routes / **Zulu Associates**
- Automated and sustainable ship recycling / **Leviathan**
- Regulatory implications: efficient and environmentally sound disposal of ships waste / **Euroshore**

About: Enterprise Europe Network

- International platform to support SMEs
- Today active in 55 countries
- EU-Funding advisory
- Sustainability advisory
- Internationalization services, matchmaking
- EEN is co-funded by the European Commission and managed by the European Innovation Council and SMEs Executive Agency (EISMEA)

Maritime emissions

The maritime sector accounts for **14.2% of the EU's CO2 emissions from transport**, behind the road sector, and almost equivalent to the aviation sector.

CO2 emissions from maritime transport have increased annually in the EU since 2015 (except for 2020), amounting to **137.5 million tonnes in 2022**, 8.5% more than the previous year.

Source: https://emsa.europa.eu/emter-2025/emter-in-24-languages.html

SustainableSolutionsMatch

Today: Harmful shiprecycling practices

In 2022, while 13.2% of the global fleet was flagged under an EU Member State, **only 7% of recycled end-of-life vessels carried those flags** at the time of disposal.

In Bangladesh, India and Pakistan ships are broken apart directly on the beach instead of in an industrial site: a practice known as "**beaching**".

Since 2009, **8.221 ships have been "beached"**, leading to **470 deaths** and **512 injuries**.

Sources: https://emsa.europa.eu/emter-2025/emter-in-24-languages.html
https://shipbreakingplatform.org/

Tomorrow: Climate neutrality needs circularity and cooperation

Emissions arise at all levels

SYSTEM	Hull		Machinery	
SUBSYSTEM	Hull Material	Hull Protection	Aux. Engine(s)	Main Engine(s)
SHIPBUILDING	Steel production, logistics, cutting, welding	Coating, Anodes, logistics	Construction, logistics, fitting, tests & trials	
OPERATION	N/A	N/A	Fuels consumption, fuels logistics	
MAINTENANCE	Steel production, logistics, cutting, welding	Coating, Anodes, cleaning, material logistics	Main spares, logistics	
END OF LIFE / RECYCLING	Steel recycling, logistics	N/A	Steel and materials recycling, reuse, logistics	

Inspired by: https://www.researchgate.net/publication/280313109_Assessing_Environmental_Impacts_of_Ships_from_a_Life_Cycle_Perspective

Related EU-goals

- Achieve **climate neutrality** until 2050.

- Join the co-implementation of the **mobility transition pathway** and set your own business' goal.

- The Waterborne Technology Platform (WTP) pledged to provide and demonstrate **zero-emission solutions for all main ship types and services before 2030**.

- A **Circular Economy Act proposal** will serve to catalyse investment in recycling capacity and encourage EU industry to effectively **substitute virgin materials** and to reduce the landfilling and incineration of used raw materials.

SustainableSolutionsMatch

Sources:
https://climate.ec.europa.eu/eu-action/transport/reducing-emissions-shipping-sector_en
https://single-market-economy.ec.europa.eu/sectors/automotive-industry/mobility-transition-pathway_en
https://www.waterborne.eu/
https://commission.europa.eu/document/download/10017eb1-4722-4333-add2-e0ed18105a34_en

#EENCanHelp

Thank you!

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Decarbonizing the Maritime Value Chain

ReFlow®

Mogens Thyssen

Chief Commercial Officer

ReFlow is dedicated to driving the green transition
by helping companies become data-driven in their sustainable practices.

ReFlow was founded in 2018 based in Copenhagen.

As part of the Grieg Group, ReFlow benefits from a strong maritime network.

Our team consists of 12 employees located across four countries and over 2000 employees across the group.

We specialize in the maritime sector, providing environmental engineering solutions to major clients like Maersk, Viking Life saving and Wärtsilä.

Supported by:

DEN DANSKE MARITIME FOND

Microsoft for Startups Founders Hub

Innovation Fund Denmark

SCALE-UP CHAMPIONS

ClimateHub™

One-stop climate management

Company-level GHG reporting

- Compliant with GHG protocol
- Calculate scope 1,2 and 3 emissions
- Integrate LCA data & track changes

Product-level emissions

- Lifecycle assessments that are ISO 14040/44 compliant
- Datasets from ecoinvent, supplier data and custom materials
- Automated transparency and quality check
- Ready for future EU regulations

Scope of emissions 1-3 for products & companies

Evaluate circular reduction scenarios

Document product & company emissions

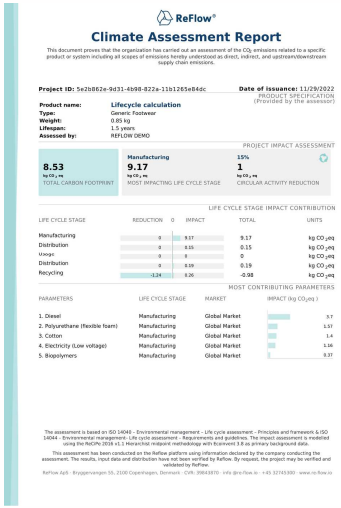
Share & Request LCA climate data across the value chain

Compare environmental performance between products (benchmark)

Value-chain emissions using ClimateHub

Tier 2

Cast-iron foundry

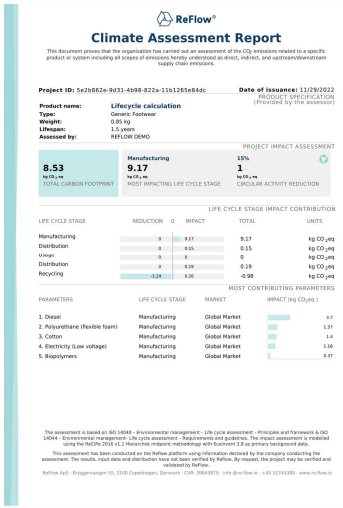

ReFlow®
Climate Assessment Report
This document proves that the organization has carried out an assessment of the CO_2 emissions related to a specific product or system including all scopes of emissions hereby understood as direct, indirect, and upstream/downstream supply chain emissions.
Project ID: 5e2b862e-9d31-4b98-822a-11b1265e84dc
Date of issuance: 11/29/2022
PRODUCT SPECIFICATION (Provided by the assessor)
Product name: Lifecycle calculation
Type: Generic Footwear
Weight: 0.85 kg
Lifespan: 1.5 years
Assessed by: REFLOW DEMO
PROJECT IMPACT ASSESSMENT
8.53 kg CO_2 eq TOTAL CARBON FOOTPRINT
Manufacturing 9.17 kg CO_2 eq MOST IMPACTING LIFE CYCLE STAGE
15% 1 kg CO_2 eq CIRCULAR ACTIVITY REDUCTION
LIFE CYCLE STAGE IMPACT CONTRIBUTION
LIFE CYCLE STAGE | REDUCTION | 0 | IMPACT | TOTAL | UNITS
Manufacturing | 0 | 9.17 | 9.17 | kg CO_2 eq
Distribution | 0 | 0.15 | 0.15 | kg CO_2 eq
Usage | 0 | 0 | 0 | kg CO_2 eq
Distribution | 0 | 0.19 | 0.19 | kg CO_2 eq
Recycling | -1.24 | 0.26 | -0.98 | kg CO_2 eq
MOST CONTRIBUTING PARAMETERS
PARAMETERS | LIFE CYCLE STAGE | MARKET | IMPACT (kg CO_2eq.)
1. Diesel | Manufacturing | Global Market | 3.7
2. Polyurethane (flexible foam) | Manufacturing | Global Market | 1.57
3. Cotton | Manufacturing | Global Market | 1.4
4. Electricity (Low voltage) | Manufacturing | Global Market | 1.16
5. Biopolymers | Manufacturing | Global Market | 0.37
The assessment is based on ISO 14040 - Environmental management - Life cycle assessment - Principles and framework & ISO 14044 - Environmental management - Life cycle assessment - Requirements and guidelines. The impact assessment is modelled using the ReCiPe 2016 v1.1 Hierarchist midpoint methodology with Ecoinvent 3.8 as primary background data.
This assessment has been conducted on the Reflow platform using information declared by the company conducting the assessment. The results, input data and distribution have not been verified by Reflow. By request, the project may be verified and validated by Reflow.
Reflow ApS - Bryggervangen 55, 2100 Copenhagen, Denmark - CVR: 39843870 - info @re-flow.io - +45 32745300 - www.re-flow.io

Shared from ClimateHub™

- Scope 1, 2, 3
- Validated data
- Circularity rating
- Supply-chain emissions
- Comparable data
- Integrated into PLM
- Transparency and QA

Tier 1

Valves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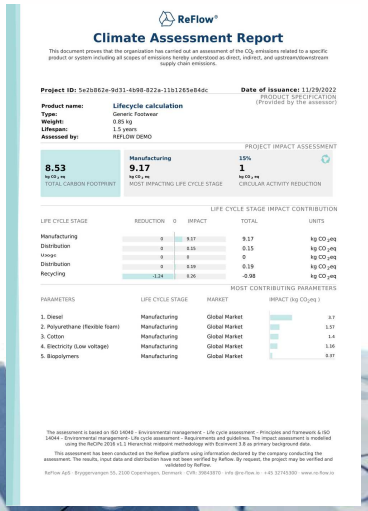
Shared from ClimateHub™

- Scope 1, 2, 3
- Validated data
- Circularity rating
- Supply-chain emissions
- Comparable data
- Including supplier data
- Transparency and QA
- Intergrated proc. systems

Tier 0

Shipowner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SustainableSolutionsMatch

Data-driven Decarbonization

- Sustainable Solution:
  - Making the right decisions using Lifecycle Assessments (LCA) based approach.
  - Validated Climate Calculations
  - Access to the worlds leading data base.

- How It Works:
  - Combines digital tools with expert environmental engineering advice.
  - User-friendly interface for easy environmental performance calculations.
  - Facilitates data sharing with stakeholders for transparency.

- Adaptability:
  - Started in the maritime industry, now serves various industry sectors.
  - Supports compliance with environmental standards like ISO 14040/44.
  - Customizable to meet unique industry requirements.

Environmental performance made easy.

- We make Engineering level science available with easy access and quality/validated data.
- We make it easier to make scientific calculations without losing transparency for companies without inhouse competencies.
- We are focused on the maritime sector from components level across engines and fuels to full ISO vessels LCA modelling.

Core segments for ReFlow

Ship owners

Product Emission estimates.

Manufactures / Ship services

Other partnerships of interest

- Environmental NGOs and Advocacy Groups
- Academic and Research Institutions
- Technology Providers
- Certification Bodies
- Industry Associations
- Government Agencies
- Sustainability Consultants
- Shipyards
- Naval Architects

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Book a meeting with: ReFlow

Mogens Thyssen
Chief Commercial Officer
ReFlow Aps.
https://re-flow.io/

een.ec.europa.eu

ReFlow®

Up2Circ

enterprise europe network

Ecoating

Clean Ocean Coatings GmbH

Linke, Christina
CEO

Ecoating – a biocide-free hard coating

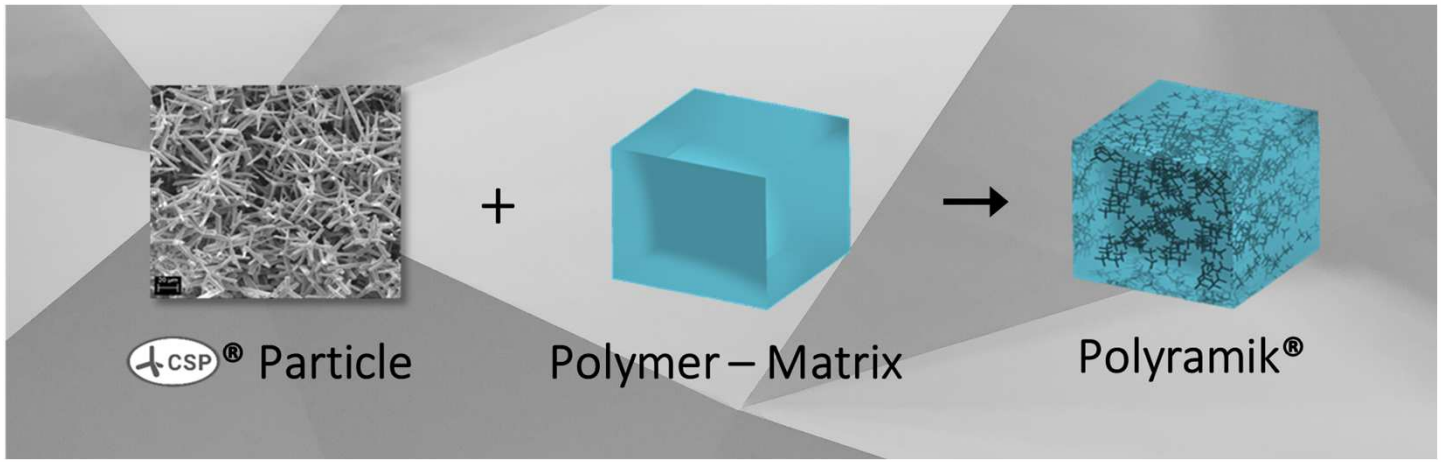
SMOOTH SURFACE

EASY TO CLEAN

LASTS TWICE AS LONG

SustainableSolutionsMatch

A patented nanostructured particle in combination with a polymer matrix.



SustainableSolutionsMatch

ECOATING - WIN-WIN FOR THE CUSTOMER AND THE OCEAN

ECOATING	STANDARD
✓ Solvent free	✗ Solvents
✓ Biocide free	✗ Biocides
✓ No microplastic	✗ 50 % Microplastic
✓ Entry to all ports	✗ Local restrictions
✓ - 6 % Fuel	

SustainableSolutionsMatch

Market/Target audience – Who can apply your solution?

SustainableSolutionsMatch

Cooperation partners we would like to connect:

- Interested Customers, especially Ferries
- Smart Cleaning Solutions Provider
- Well-Connected Distributors

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Book a meeting with: Clean Ocean Coatings

Christina Linke
CEO
Clean Ocean Coatings GmbH
https://www.cleanoceancoatings.com/en/clean-ocean-coatings

een.ec.europa.eu

CLEAN OCEAN COATINGS

Up2Circ

enterprise europe network

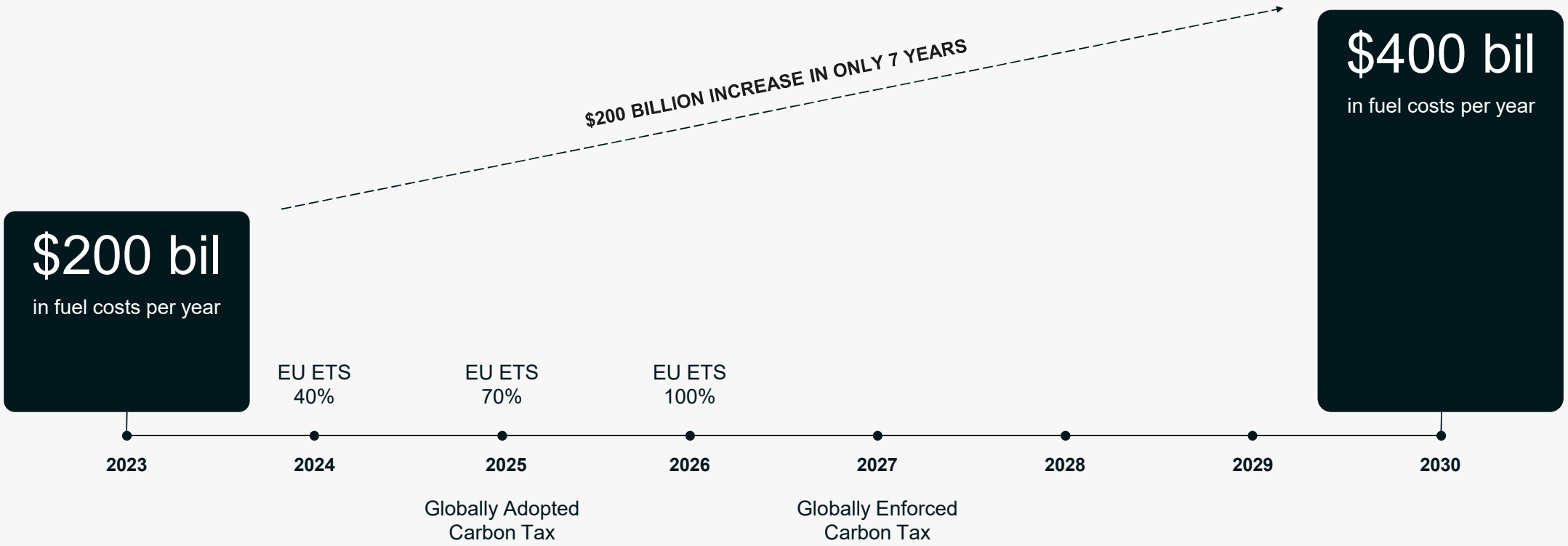
Decarbonizing Shipping.
Today. Profitably.

GLOBAL AMBITIONS REQUIRE GLOBAL COLLABORATION

Customers & Pilot Customers

Compatible solutions

CARBON TAXES WILL DOUBLE SHIPPING'S LARGEST COST: FUEL



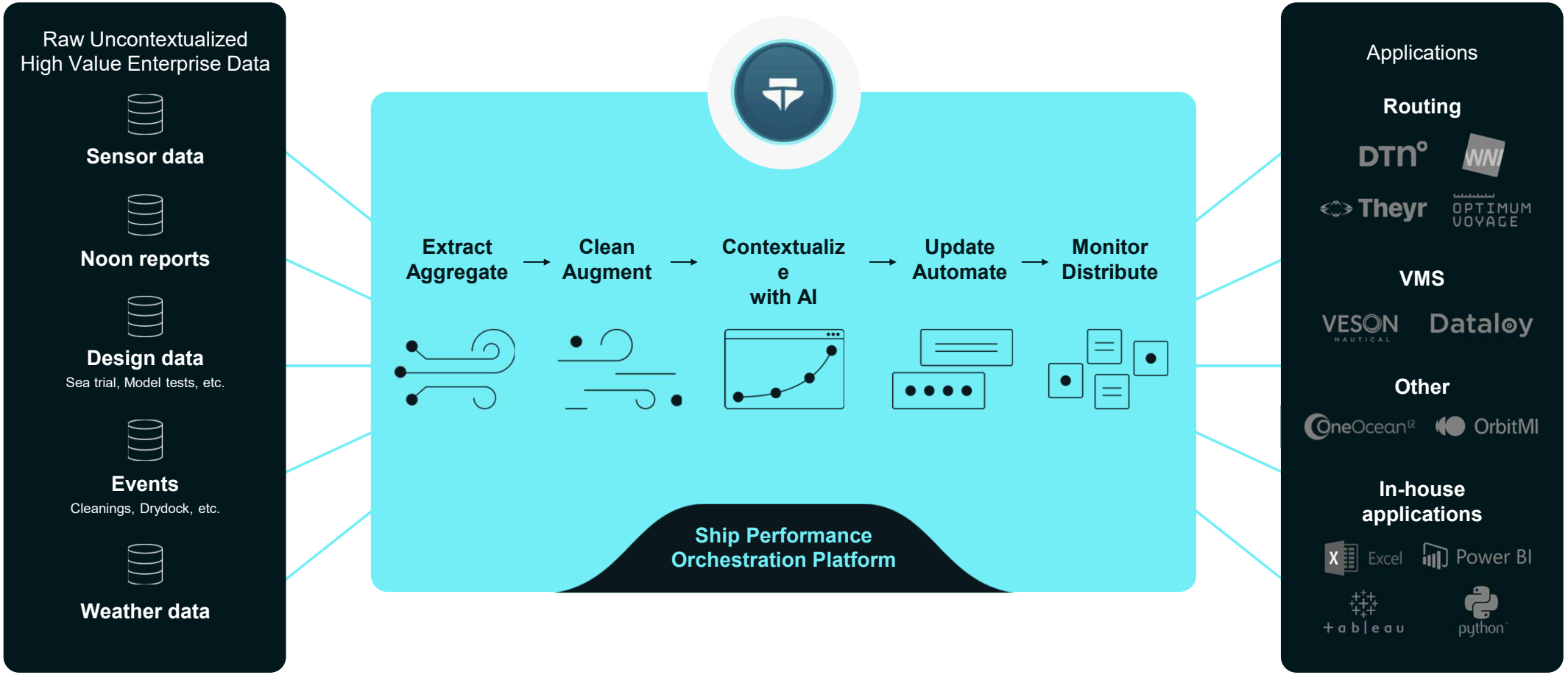
BIG DATA & CONNECTIVITY IS ABRUPTLY ARRIVING IN SHIPPING

1.000.000

data points per day

TOQUA BRIDGES THE GAP

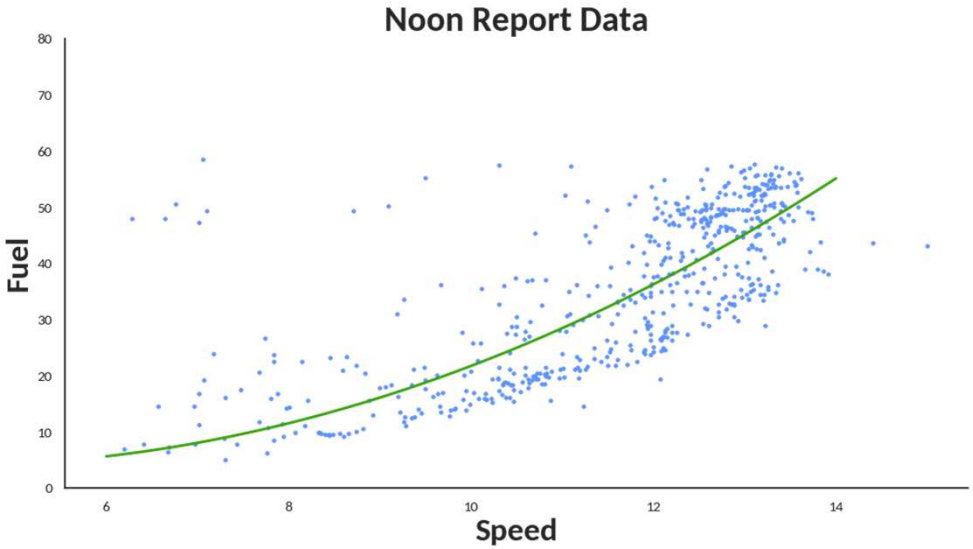
Data Orchestration layer to harness big data & AI in shipping

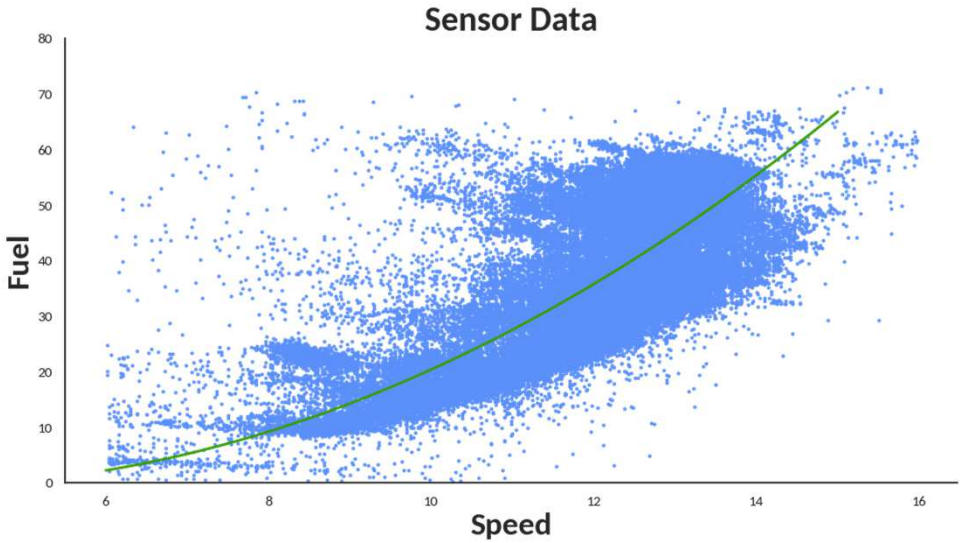


Listed solutions serve as examples only. Toqua's models are designed to work with any 3rd party solution.

MORE DATA BY ITSELF IS NOT THE ANSWER

More data leads to more noise





TOQUA’S SHIP KERNELS OVERCOME THESE CHALLENGES

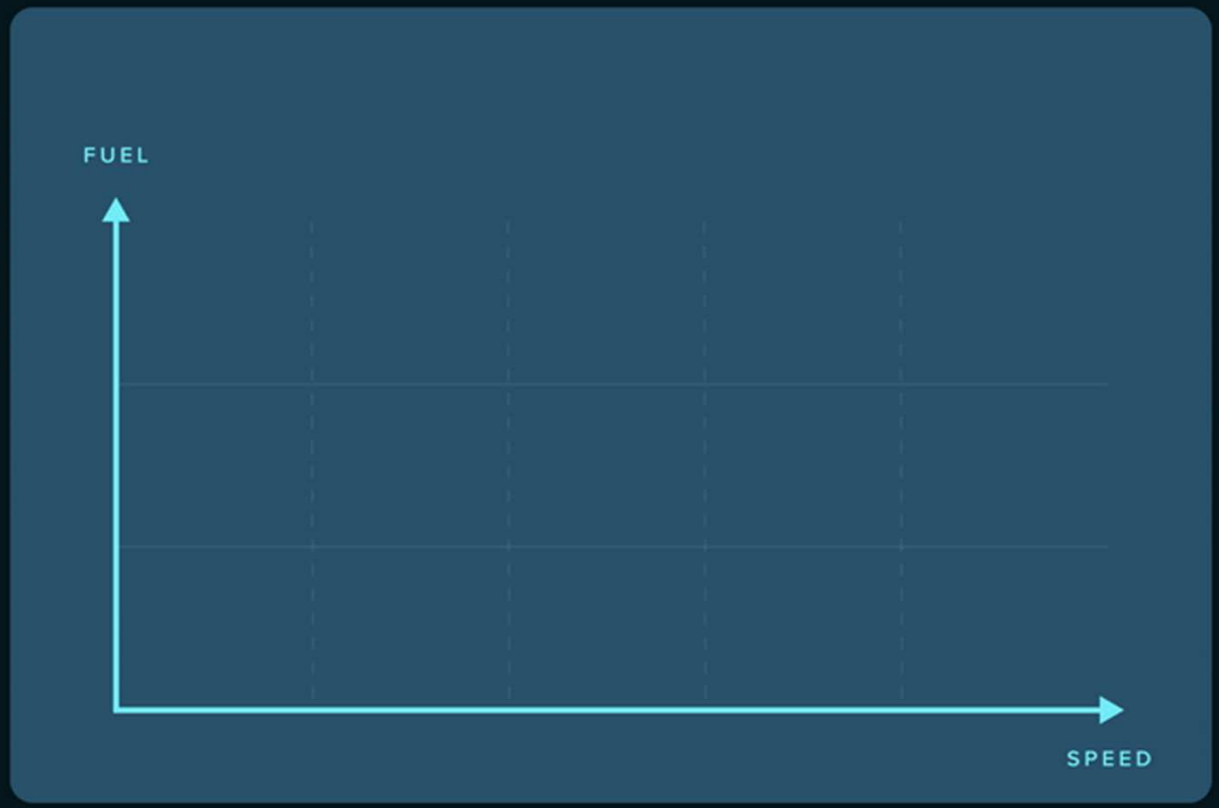
using physics-informed AI

TOQUA

REMOVE NOISE

MODEL ALL CONDITIONS

EVOLVES OVER TIME



INDICATIVE VALUE FOR A FLEET OF 25 SUEZMAX VESSELS

1. Technical

Hull Performance Monitoring: ~$2.25mil/year

Less noise → Timely cleanings → Fuel savings

2. Chartering

Maximize Commercial Upside: ~$2.65mil/year

Sharper speed-fuel numbers → Sharper decisions → More profit

3. Operations

Double savings of routing: ~$3.75mil/year

Better models → Better Optimization → More fuel savings

4. Decarbonization

Validate return on ~$37mil 5-year-budget for ESDs

Validate actual savings of ESDs to guarantee effective budget allocation

5. Management

Shared truth to offload ~$11.1mil of decarb-costs

Set-up upside-sharing agreements to share ESD-investment burden

Assumptions: 10.000 mt fuel/ship/year at $600/mt. $6mil/ship/year in fuel. Hire rate of $25.000/day, 283 days/year. Vessel age: 10 years. Yearly ESD budget: $300k. Savings typically of 1.5% and 2.5% for 1. and 3. respectively. Earnings increase of 1.5% for 2. Potential to offload 30% of ESD investments via upside-sharing agreements.

IT’S NOT JUST ABOUT **SAVING MONEY.**
IT’S ALSO ABOUT **BECOMING GREENER.**
AND **MAKING MORE MONEY BY BEING GREEN.**

Save fuel costs

Reducing your single largest cost by up to 10% is a no-brainer.

Reduce emissions

Comply with emission reduction regulations. Customers demand greener transport.

Make more money

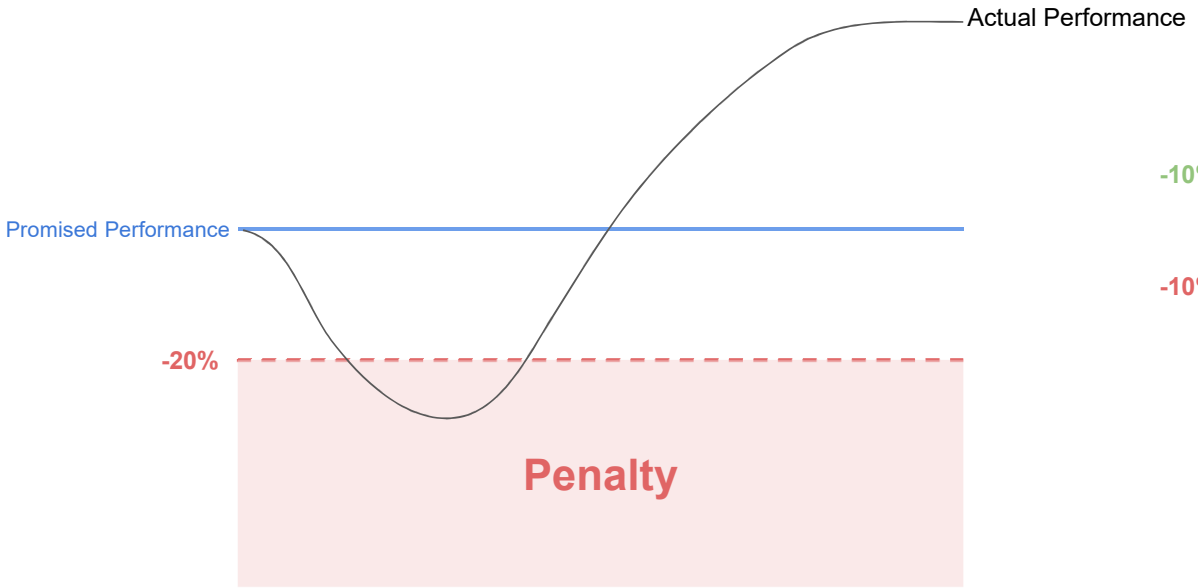
Align interests between owners and charterers to reward efficiency.

LET'S CHANGE THE INDUSTRY TO **REWARD EFFICIENCY**

Align incentives of owners and charterers to save fuel, reduce emissions, avoid conflicts, and increase revenue.

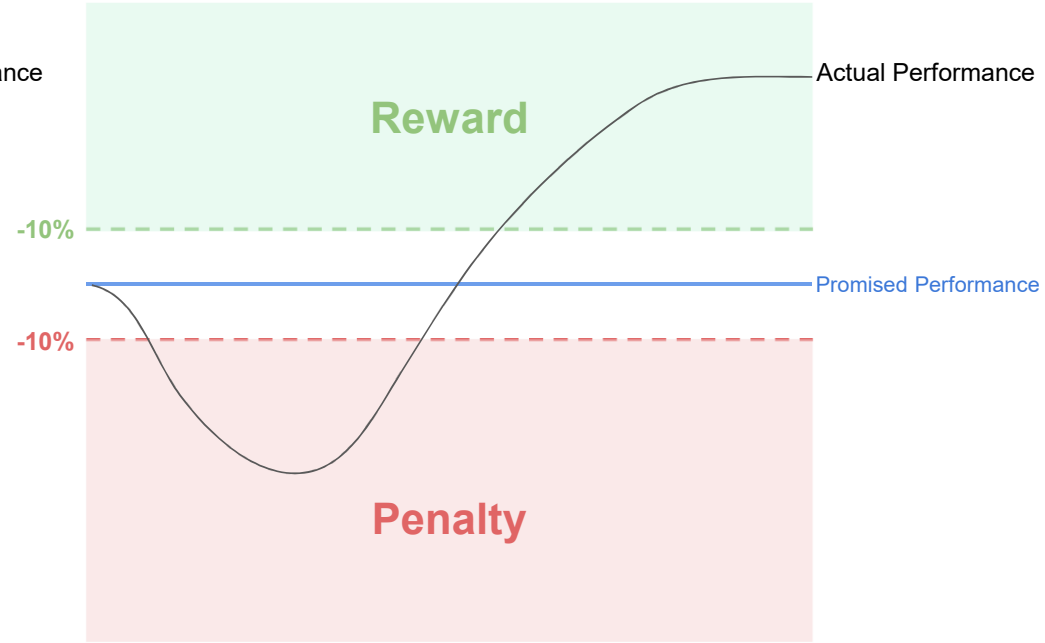
Today

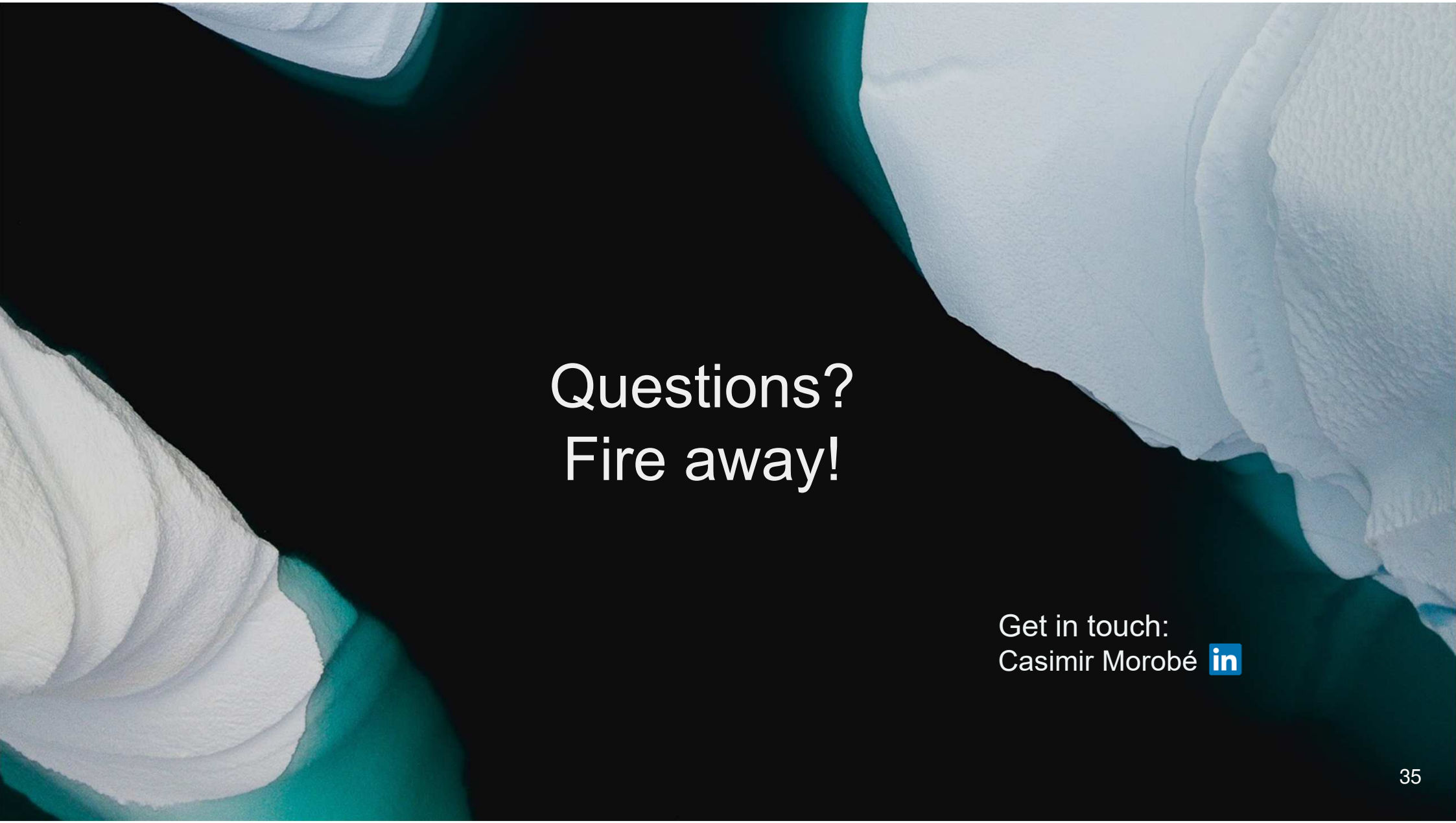
Exclusively Penalizing



Tomorrow

Performance-rewarding




Questions?
Fire away!
Get in touch:
Casimir Morobé

Making Biofuel Feasible

Frontier Fuels

Maack, Johann
Co-Founder & Head of Technology

Cost-effective Marine Biofuels

PRODUCTS

1-to-1 replacement for fossil fuels for all large marine engines to immediately reduce CO_2 emissions

MOTIVATION

- ✓ Marine engines can handle a wide range of fuels
- ✓ >3,000 by-products and residues produced by EU Industry today
- ✓ Lifecycle CO_2 emissions of bio-based residues close to 0

INNOVATION

Machine Learning networks to identify bio-based residues that can be used directly as marine fuel

SustainableSolutionsMatch

Introducing Machine Learning to fuel development

- **Machine Learning** networks to estimate suitability of a residue as marine fuel
- **Data-driven screening** allows us to consider the >3000 residues as fuel candidates
- Our development process is therefore **faster and more effective**

Key Advantages and Sustainability Impact

Cost-Effective

More affordable than existing biofuels

Sustainable

Almost zero emissions with CO_2 savings of 97%

Easy-to-Use

No modifications to engine system needed

» **Accelerate Decarbonization** of the shipping industry by offering an affordable and sustainable alternative

Target Audience – Who can benefit from our solution?

Shipping Companies

- Container Liners
- Cruise Vessels
- Chemical Tankers
- …

Cargo Owners

- Reducing supply chain emissions
- Car manufacturers, freight forwarders, wind turbine manufacturers, …

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Looking to form partnerships with …

- **Producers of bio-based chemicals**
- **Logistics and Tank Storage providers**
- **Factories with industrial boilers or power generation**
- …

#EENCanHelp

Book a meeting with: Frontier Fuels

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Head of Technology
FF Frontier Fuels GmbH
https://www.frontierfuels.eu/

een.ec.europa.eu

Frontier Fuels

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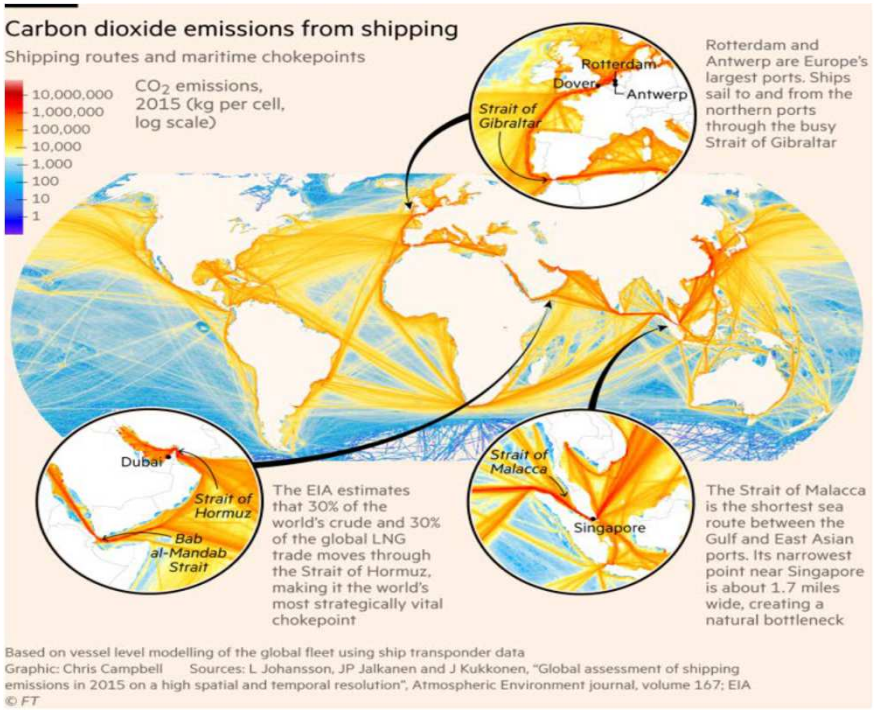
enterprise europe network

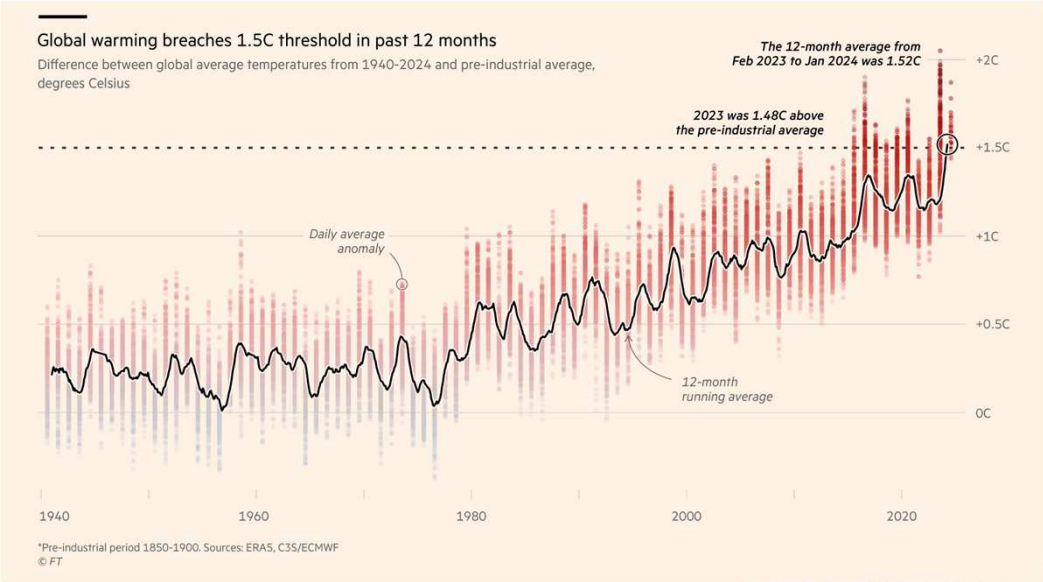
ZERO EMISSION shipping for inland and short sea vessels

ZULU Associates

Antoon Van Coillie
CEO

Shipping = 3% of Global GHG





SustainableSolutionsMatch

Non-Fossil Fuel energy more expensive per KWH than fossil fuel

Yet ECONOMICS drive choices by Shippers

Through

Using energy efficient hulls
Modular energy carriers
Unmanned operation

=

Change of ECONOMIC EQUATION

Resulting in non fossil fuel vessels being PRICE competitive and ENERGY AGNOSTIC

Solving CREW SHORTAGES

Market/Target audience – Who can apply your solution?

All STAKEHOLDERS involved in logistic flows that are executed on or can be shifted to waterways and short sea routes:

SHIPPERS (Amazon, Nike, Ikea, ...)
LOGISTICS PROVIDERS
SHIPPING LINES
PORTS
...

Sustainable and circular innovation needs good networks along the whole value chain. What kind of cooperation partners would you like to connect to beyond finding new customers?

VC INVESTORS that are interested in tackling the GHG issues in Maritime context

DEVELOPERS of systems that improve non fossil propulsion and develop algorithms for unmanned operation

SustainableSolutionsMatch

#EENCanHelp

Book a meeting with: ZULU Associates

Antoon Van Coillie
CEO
ZULU Associates
https://www.zulu-associates.com/

een.ec.europa.eu

ZULU ASSOCIATES

Up2Circ

enterprise europe network

NEED OF HARMONISED END OF WASTE CRITERIA

Euroshore International aisbl

Sophie Delair
Secretary General

The activity of port reception facilities (PRF)

Companies collecting and treating waste from ships.

Regulated by IMO MARPOL Convention
Annex I Oily waste
Annex II Noxious liquid substances in bulk
Annex III Harmfull substances carried by sea in packaged form
Annex IV Sewage
Annex V Garbage from ships
Annex VI Air pollution
Ballast water

International, European and national layers

Onboard : maritime legislation
Onshore: land legislation

https://www.youtube.com/watch?v=6d7kbDgY0NA

38 members
20 countries
70% Oily waste
2,5 million tonnes in 2019

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Decarbonisation: a collective effort

DESIGN OF SHIPS

USE OF ALTERNATIVE FUELS

ZERO DISCHARGE PRINCIPLE

PRF (WASTE RECOVERY & RECYCLING)

DISMANTLING OF SHIPS

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How to better recycle waste?

RECOVERING MARITIME FUEL

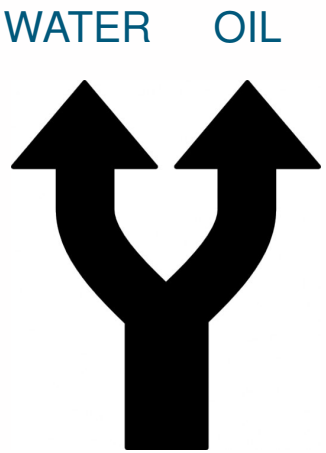
Alternative fuels not fully available at large scale.
Infrastructures not there and require huge investments.
Lifetime of a vessel & number of vessels.

Transitional period for several decades.

- Immediately available solution
- Better than extracting new fuel
- Geopolitical context vs energy dependency

Heavy fuel oil demand estimated: 260m tpa
Oily waste: 2% of the originally loaded fuel quantity
Oily waste received is 60-70% water, balance is oil
15-40 % carbon reduction compared to production of new virgin fuel

How does it work in brief?



- ✓ **Dewatering => recovered fuel**
- ✓ **Thermal valorization in licensed waste treatment plants**

Legal issue:

Addressing waste as a resource has led to the Circular Economy model.

Member State inconsistencies in interpretation of related waste law are hampering the objective of using marine fuel efficiently

It requires an EU led collective solution in order to meet the demands of a global market.

NEED HARMONISED EUROPEAN END OF WASTE CRITERIA

#EENCanHelp

Book a meeting with: Euroshore International

Sophie Delair
Secretary General
Euroshore International
https://euroshore.com/

een.ec.europa.eu

EUROSHORE
SUSTAINABLE SHIP WASTE SOLUTIONS

Up2Circ

enterprise europe network

Discussion

- What is missing to boost international cooperation for circularity in maritime industries?
- Which regulations are needed to accelerate the transition towards circularity?
- Does it make sense to integrate ship-recycling as a discipline into shipdesigners- and shipbuilders curricula?

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Thank you!

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