

The potential role of carbon capture onboard ships



Our markets and landscape

Fleet and market mix



- Strategy currently driven by our products, vegetable oils, and chemicals trades
- This is where we envision greatest growth and potential for differentiation
- Heavily parcelled and high-level of worldwide triangulation, using a mix of strategically placed COAs and spot exposure

Ownership mix

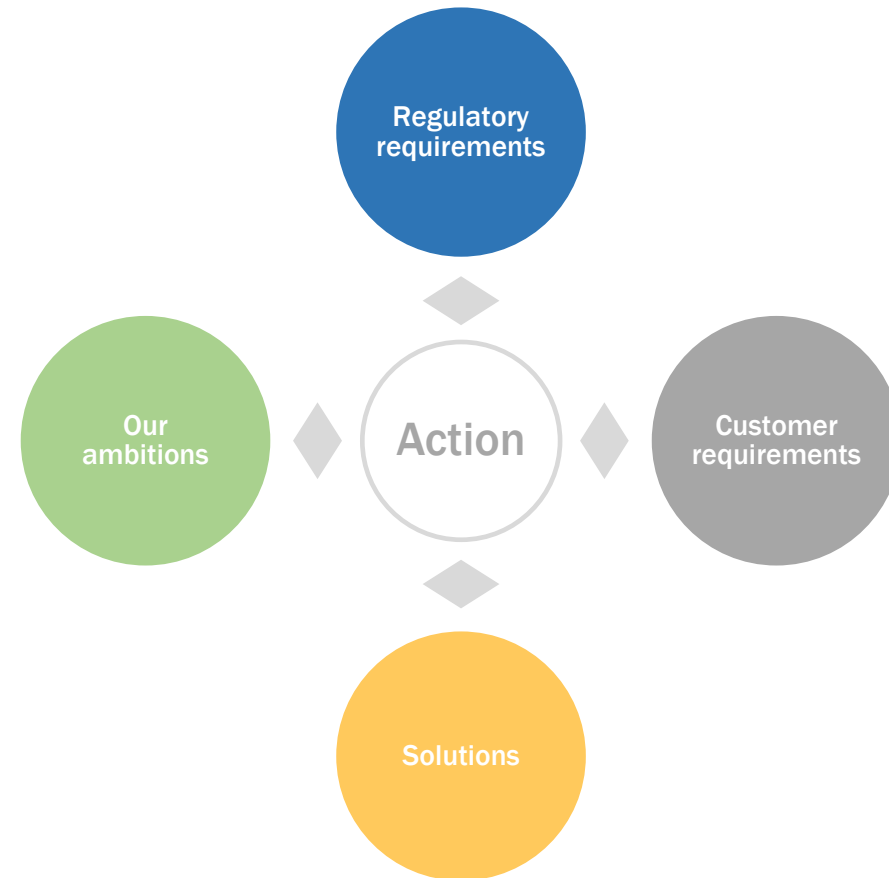


- Our ability to modify the technical efficiency of the fleet is limited, given ownership structure
- New business models and tools required, including greater collaboration with our charterers and customers both upstream and downstream
- Driving down operational efficiencies key to remaining agile in a volatile and uncertain policy/market

How do we approach decarbonisation?

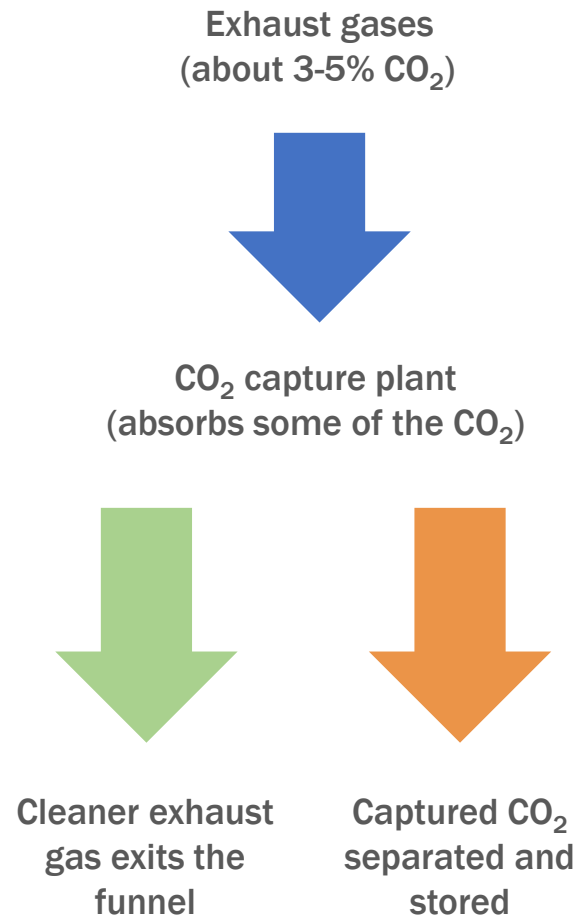
Solving an incomplete puzzle:

- Impending regulation and how markets react to and work through requirements remains mostly unknown
- Our customers' ambitions for their scope 3 emissions are largely disengaged and of low priority, compared to our own to have carbon neutral operations by 2040
- Willingness-to-pay has not yet established or been tested in tanker markets, but capacity to do so exists already
- Technical solutions have not matured or, more importantly, scaled, especially for alternative, low carbon fuels
- Soft (operational) solutions may not take you far enough towards 2030 or 2050, but can deliver reductions today



What is carbon capture and why might it be necessary?

4



Availability and search costs

Scale up of alternative fuels will likely be very slow and insufficient to meet demand, but we need action sooner rather than later

Deep-sea and tramp shipping are unlikely to be able to make use of and compete for such fuels at scale

If large parts of shipping cannot compete for alternative low or zero carbon fuels, it may need to rely on conventional fuels for longer whilst reducing emissions through other means like carbon capture

This may also allow other sectors more willing and able to take advantage of new fuels to decarbonise first, alleviating unnecessary pressure on total decarbonisation

Broader potential

Carbon capture creates the opportunity for negative emissions, if, for instance, we capture CO₂ from bio or green fuels (like green methanol)

A growing CO₂ economy and use of CCS in hard to abate sectors (like steel production) will broaden infrastructure and opportunities for re-using or sequestering CO₂.

Importantly, this might happen faster than the scale up of alternative low/zero-carbon fuels for shipping

Our carbon capture journey so far

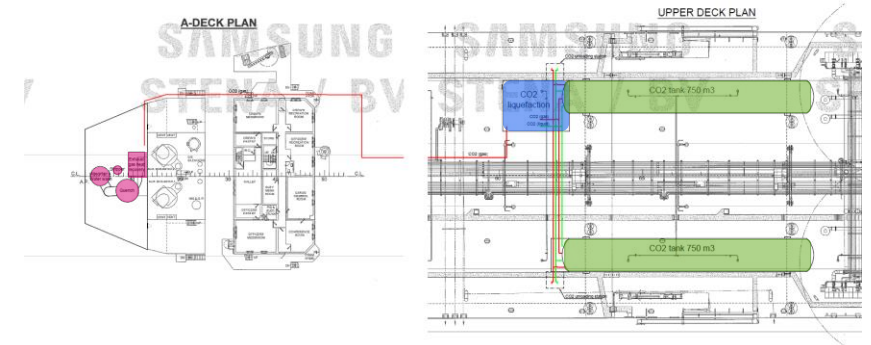
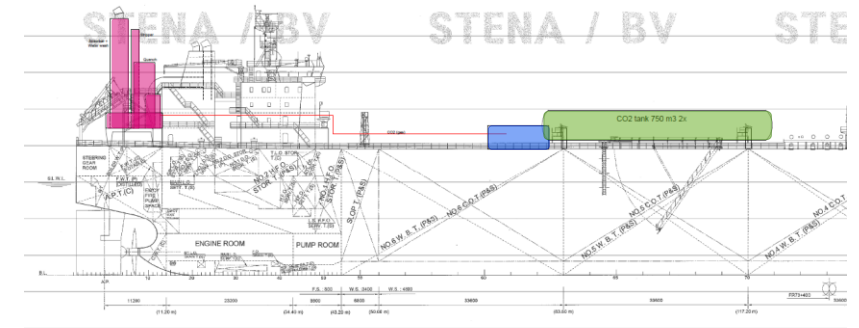
2021

Feasibility study with the Oil and Gas Climate Initiative:

- We addressed the challenges for deep-sea shipping, where we believe carbon capture could be most useful or relevant
- This meant targeting good capture rates (10-50% or more) and doing that over deep-sea voyages (21 days or more)
- We looked at the case of a Suezmax crude tanker, as potentially one of the most challenging options but with potentially great impact for the industry
- We targeted removing CO₂ with minimal to no extra energy requirements to run the system, essentially working off of any available waste heat

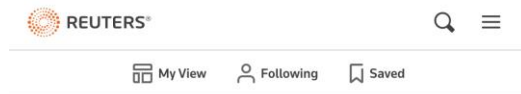
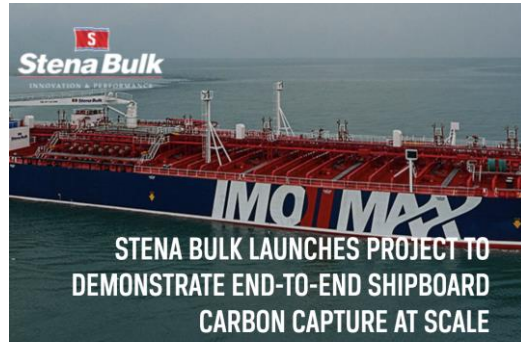
Key outcomes:

- High operational costs due to excess fuel required to reach 10%+ capture
- High capital costs from the liquefaction system, storage tanks, and materials
- But costs for carbon capture, especially when assessed against other long-term high CO₂ reduction technologies such as NH₃ and H₂ showed greater promise



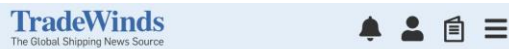
Where we are going next

2022



2 minute read · October 5, 2022 6:45 AM GMT+2 · Last Updated a month ago

Consortium kicks off project to capture carbon emissions onboard oil tanker



GCMD chief executive Professor Lynn Loo said the carbon capture project is a mid-term solution that can help the maritime sector decarbonise. Photo: GCMD

Stena Bulk to test onboard carbon capture system on tanker

Project with Singapore-based Global Centre for Maritime Decarbonisation targets at least a 30% capture rate on MR

Design, build, and demonstrate a carbon capture system:

- Design, build, and deploy a mobile carbon capture plant on an MR (IMO2) tanker doing deep-sea voyages across the world
- Capture CO₂ from HFO or MGO as a start, but evaluate a future phase using synthetic or bio-based fuel to show the potential for net-negative emissions
- Capture at least 30% of CO₂ in exhaust, consistent with IMO's 2030 ambitions for the MR fleet
- Show and evaluate the storage of CO₂ onboard on at least 7-14 days long passages
- Target an initial cost/tCO₂ consistent with a prototype build of ~€200/tCO₂, but show a viable pathway towards an ultimate "nth of a kind" target of ~€125-€150/tCO₂
- Show the successful capture and off-loading of CO₂ (no release to atmosphere) as part of normal operations

