

Overview of “CC-Ocean” project

July 2021

Mitsubishi Shipbuilding Co., Ltd.

PRESS INFORMATION

Mitsubishi Shipbuilding to Test World's First Marine-based CO₂ Capture System

-- "CC-Ocean" Project in Partnership with "K" Line and ClassNK Part of Japan Government Initiative to Support Development of Marine Resource Technologies --

2020-08-31



- World's first marine-based demonstration test of CO₂ capture to take place on "K" Line's coal carrier for Tohoku Electric
- Project will identify potential risks, and conduct operability and safety evaluations to determine ongoing specifications



Logomark of CC-Ocean project



- Based on MHI’s carbon capture technology for onshore power plant, modified to marine use.
- Using amine chemical absorption method, small scale demonstration plant will capture 0.1 ton/day of CO₂.
- Will be operated & tested for 7 months, after installation on board the 88,000DWT coal carrier owned by “K”-Line.
- With verification from ClassNK, HAZID study on equipment operation and chemical handling on board.



Conceptual drawing of the CO₂ recovery demo plant

| | |
|--------------------------------|---|
| Exhaust Flow Rate | abt. 65Nm ³ wet/h |
| CO ₂ Capture Amount | abt. 0.1 ton/day (Captured CO ₂ will be compressed and bottled for laboratory examination.) |
| CO ₂ Capture Rate | abt. 65% (Due to mobile spec. 90% is technically possible) |
| Weight | abt. 5ton |

Carbon Capture Device (Schematic Diagram)

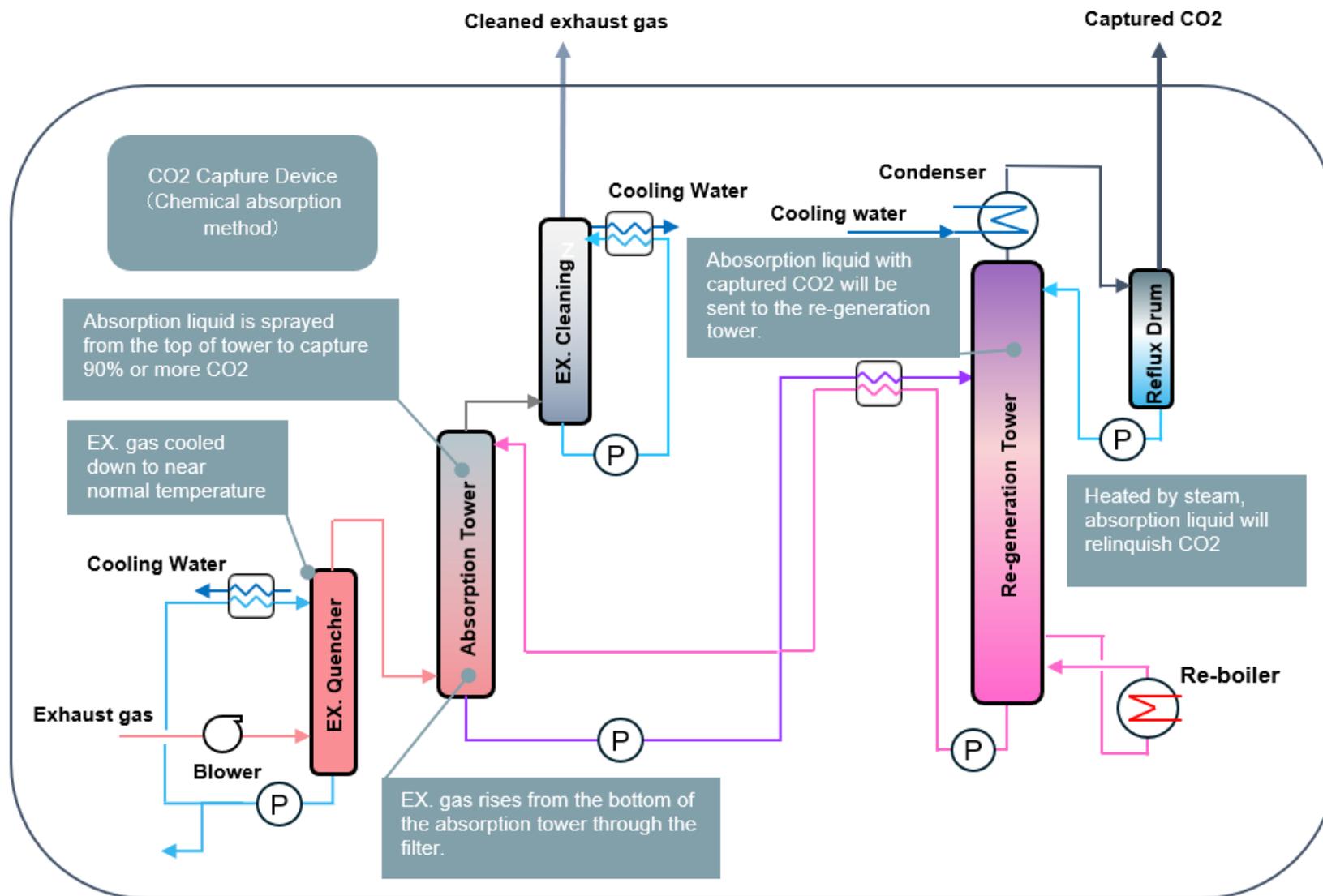


Image of test installation

Ship name: CORONA UTILITY
Vessel type:
88,000 ton type bulk carrier (coal carrier)
Ship Registry:
Japan (Sakata City, Yamagata Prefecture)
Ship classification: Class NK
Completion: January 2016
Owned by: "K" Line

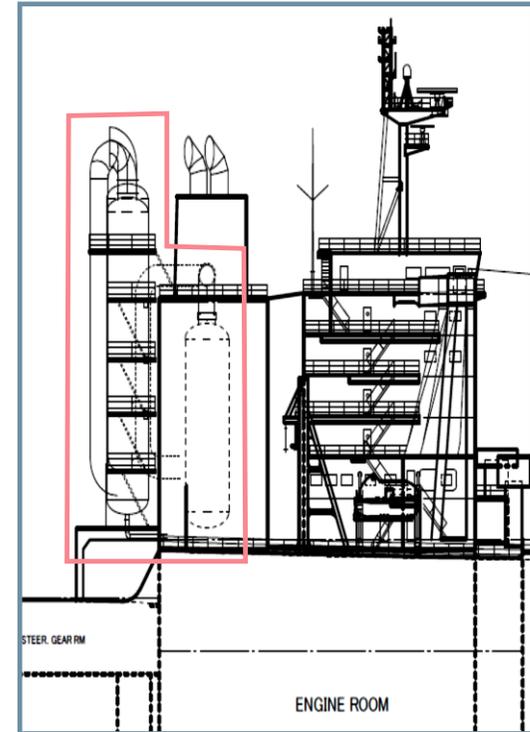
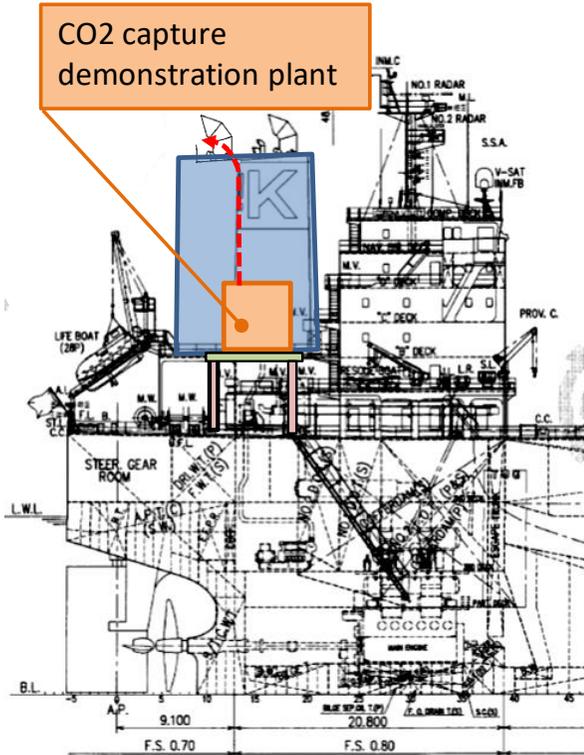
Image of downsizing

CO2 capture plant
Capacity: 200 CO2-ton/day

On-shore example



Downsizing image for FSRU



| | 2020 (Fiscal) | | | | 2021 (Fiscal) | | | |
|--|---------------|----|----|----|---------------|----|----|----|
| | 1Q | 2Q | 3Q | 4Q | 1Q | 2Q | 3Q | 4Q |
| Marinization + HAZID | | → | | | | | | |
| Design & manufacture of CO2 capture system | | | → | | | | | |
| Retrofit construction | | | | | | → | | |
| Demonstration test (1m) | | | | | | → | | |
| Demonstration test (6m) | | | | | | | → | |
| Removal construction | | | | | | | | → |

※2nd demonstration test for 6 months will be carried out only by ship crews

Expected outputs

- Marinization requirements (System & Operation)
- Evaluation of the effect of ship motions to CO2 capture efficiency
- Evaluation of the sulfur content in exhaust gas to amine absorption liquid
- Establishing on-board operation manual for both system and chemicals
- Identifying deterioration speed of amine absorption liquid
- Downsizing study for future marine application

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