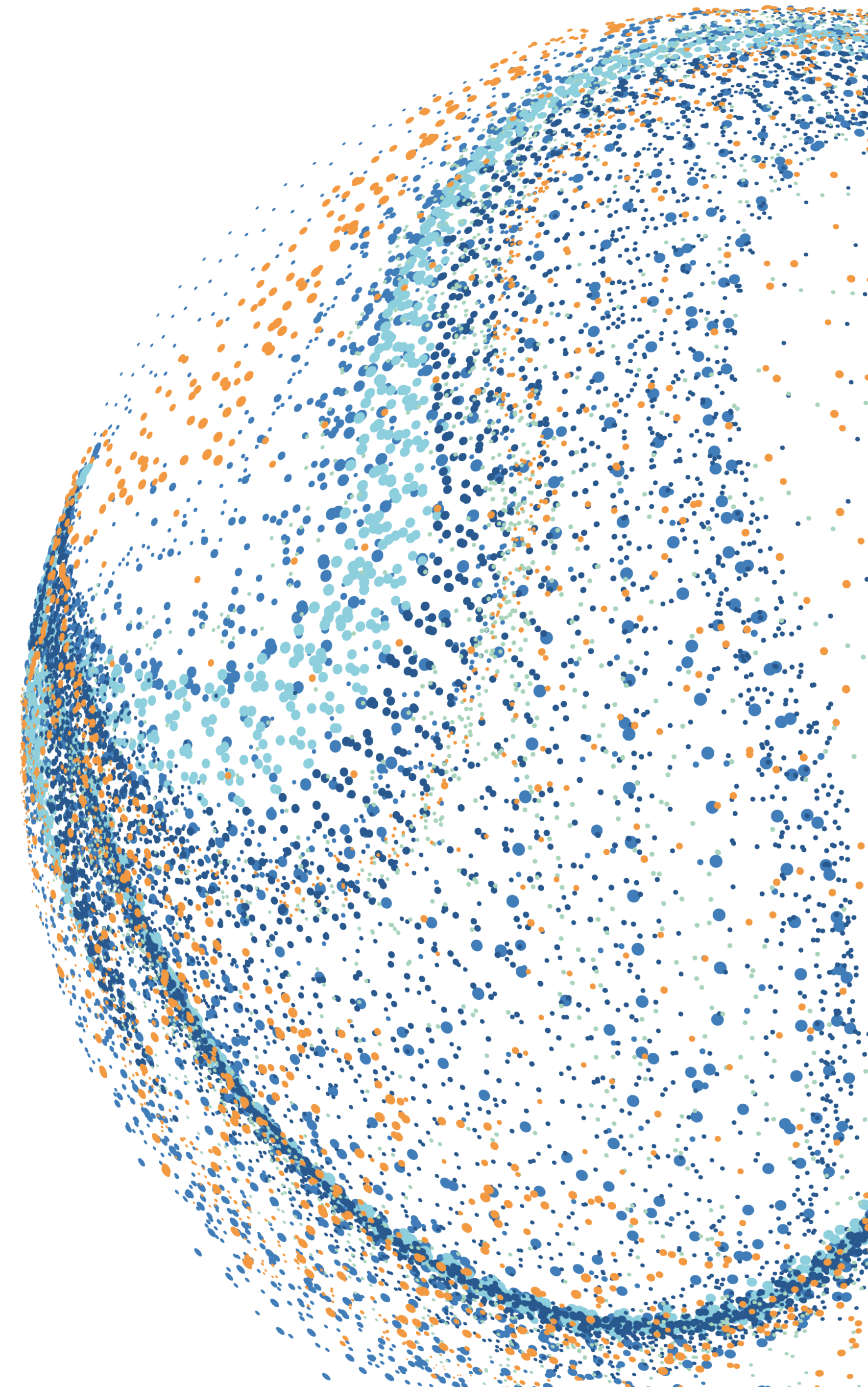


Maximize your investment on scrubber installation

Jon Helge Ulstein
Wilhelmsen Ship Management

Disclaimer : While care has been taken to ensure the information in this publication is accurate, this is a general guide and not intended to be relied on for any specific purpose. Wilhelmsen Ship Management Holding Limited and its subsidiaries cannot be held responsible for any errors or consequences arising therefrom. If you would like to reproduce any part of this publication, please seek our prior approval.



Background & Introduction



Jon Helge Ulstein has a combined 30 years of maritime experience ranging from his sailing days as Chief Electrician, newbuilding supervisor and Vessel Manager.

- Support 5 scrubber installation on the Wallenius Wilhelmsen vessels
- Board member in Massterly, a joint venture between Wilhelmsen & Kongsberg for autonomous logistic solutions.
- Experience with scrubber, big data projects and condition based maintenance.

I will share my experience and lessons learnt during scrubber installation and hopefully you will benefit from it.

983

Vessels with scrubbers installed or on order



See colour key to right



Number of ships with scrubbers installed or on order

63%
Retrofitted Ships



Number of scrubber towers installed or on order

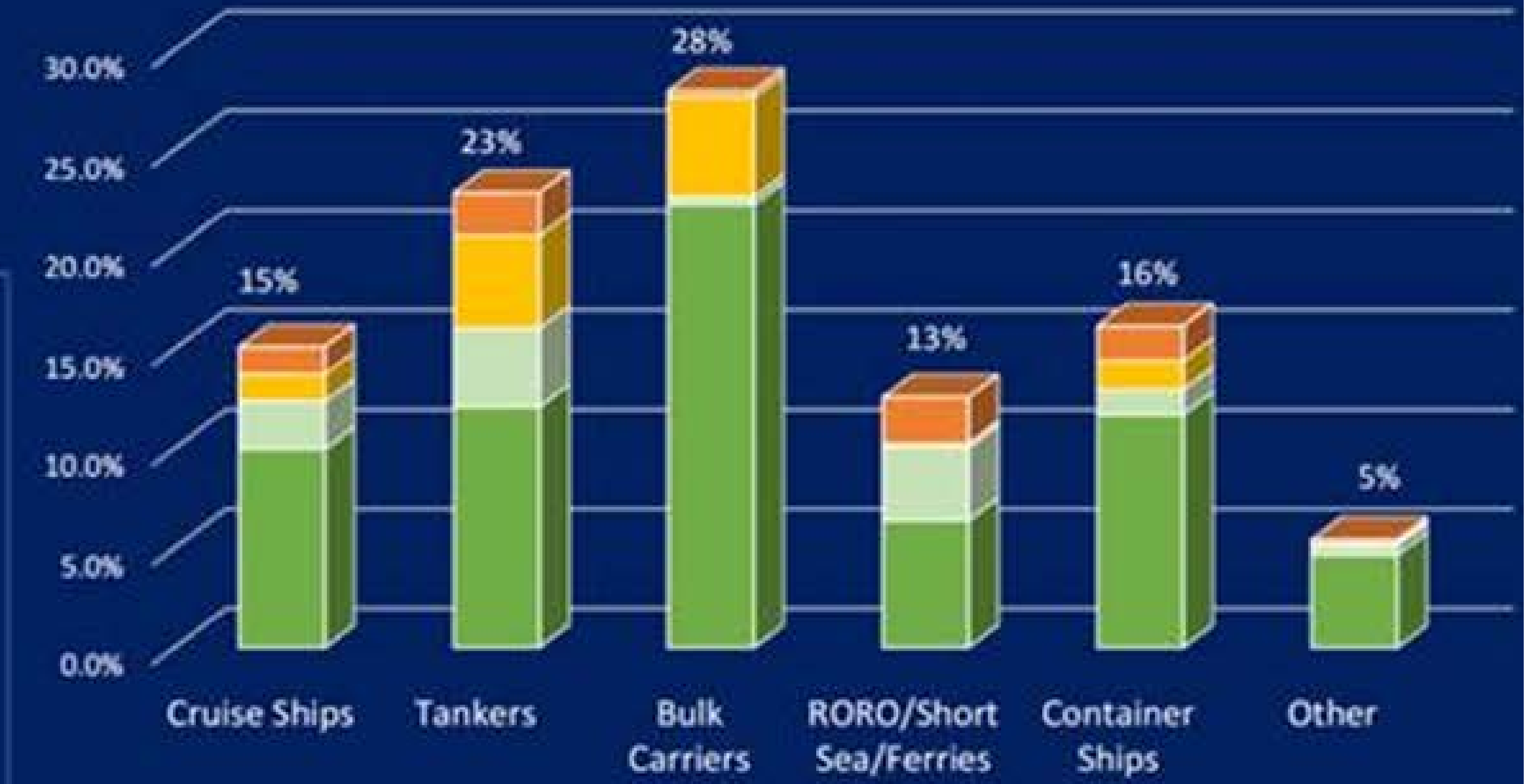
63%
Open Loop Scrubbers



Largest power engines by scrubber type installed or on order (MW)

72MW
Largest Engine Power

Vessel types with scrubbers installed or on order



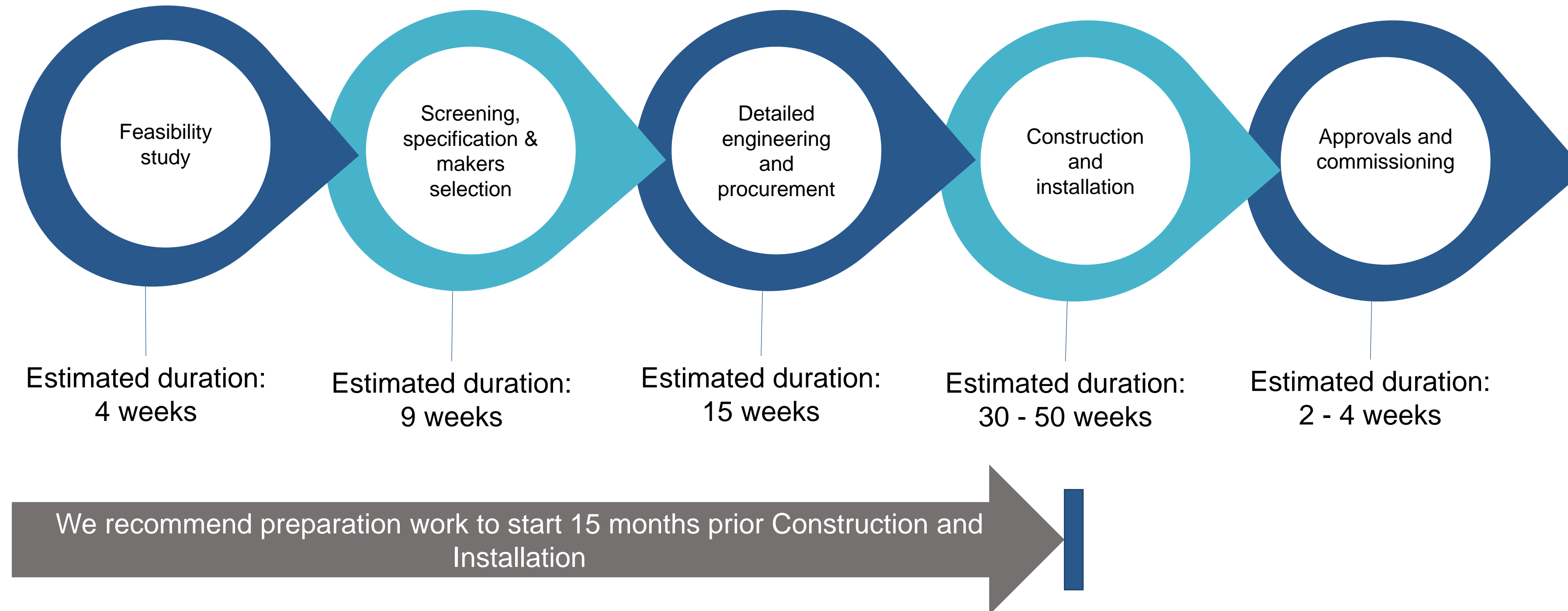
Key to bar and pie charts

- Retrofit Open Loop
- Retrofit Hybrid
- New Build Open Loop
- New Build Hybrid

Data as of 31 May 2018

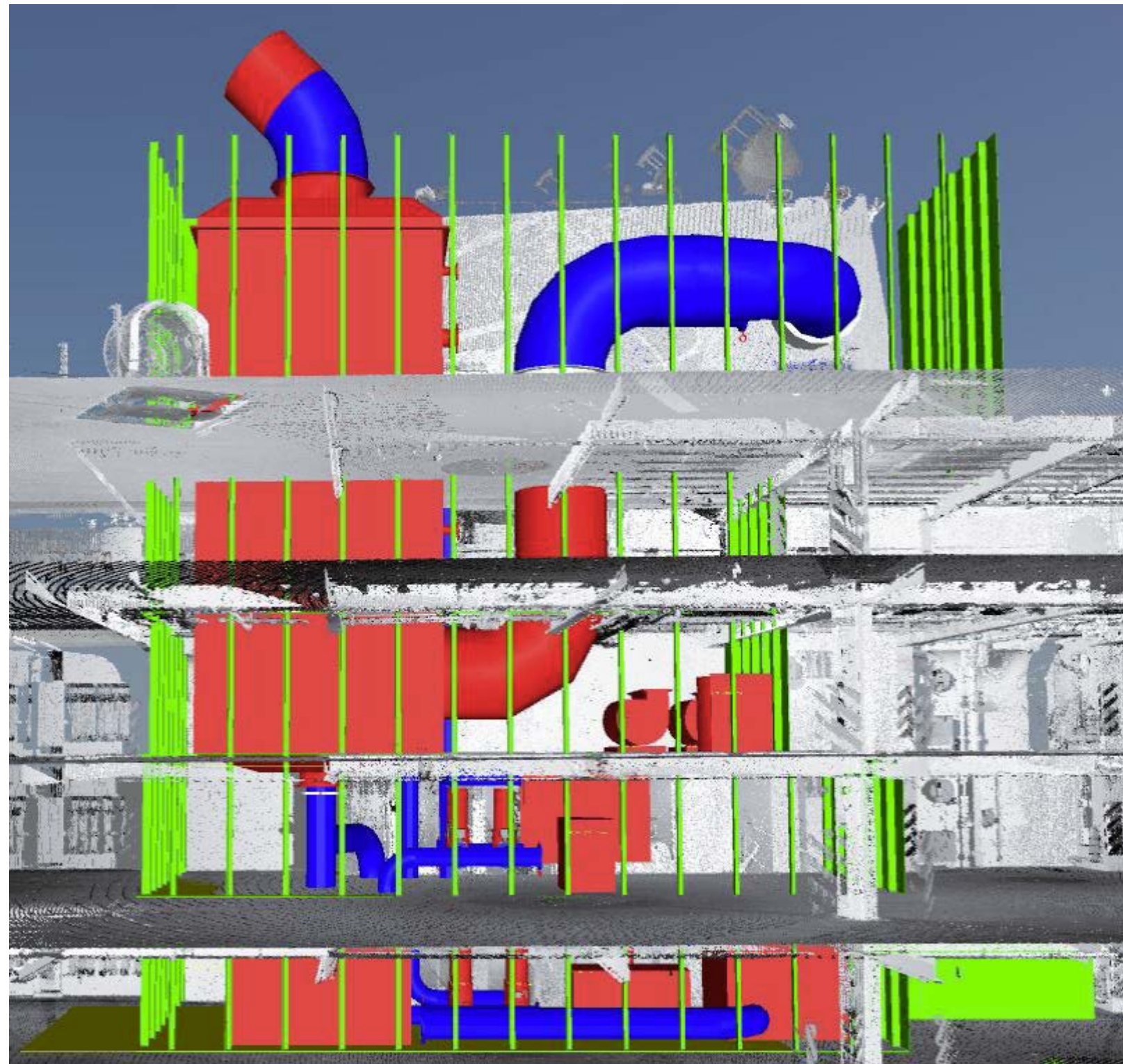
* Retrofits and new building installations. Not including riding gangs. 5% main installation yard unknown/undecided

Scrubber installation – key process & estimated duration



* Above will differ a lot depending on supplier and demand and should only be looked at as guidance.

Feasibility study



The feasibility study is prepared by either owner or consultants and should cover the following information :

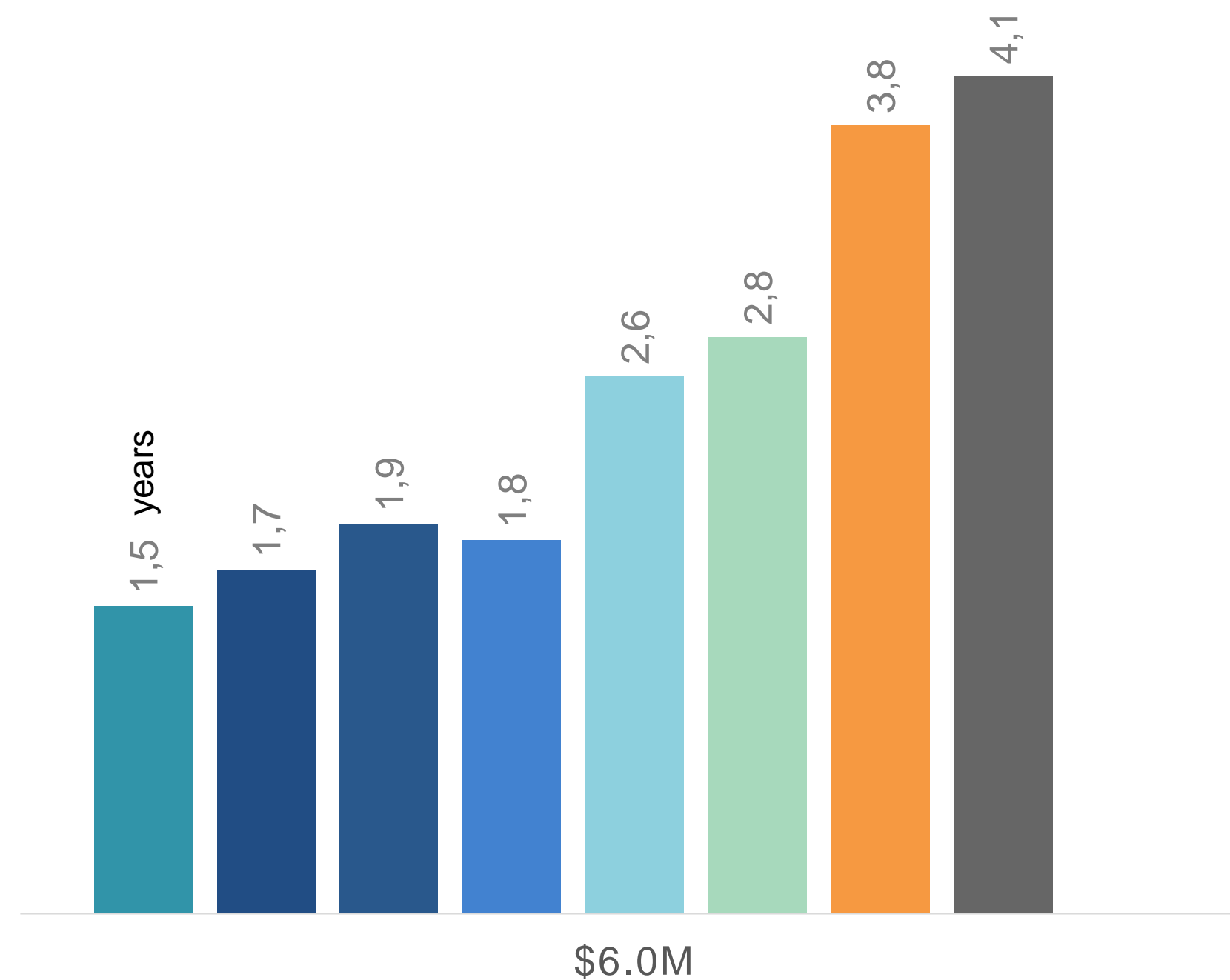
- Regulatory background for scrubber
- Review of scrubber technology
- Review of technical feasibility
- Review of commercial feasibility

The purpose of this study is to provide a specific guidance in technical and commercial aspects for installing scrubber

Breaking even on your scrubber investment

SCRUBBER YEARS TO BREAK-EVEN
\$6.0M INVESTMENT,
BY VARIABLE FUEL SPREAD

■ 300 ■ 275 ■ 250 ■ 225 ■ 200 ■ 175 ■ 150 ■ 125

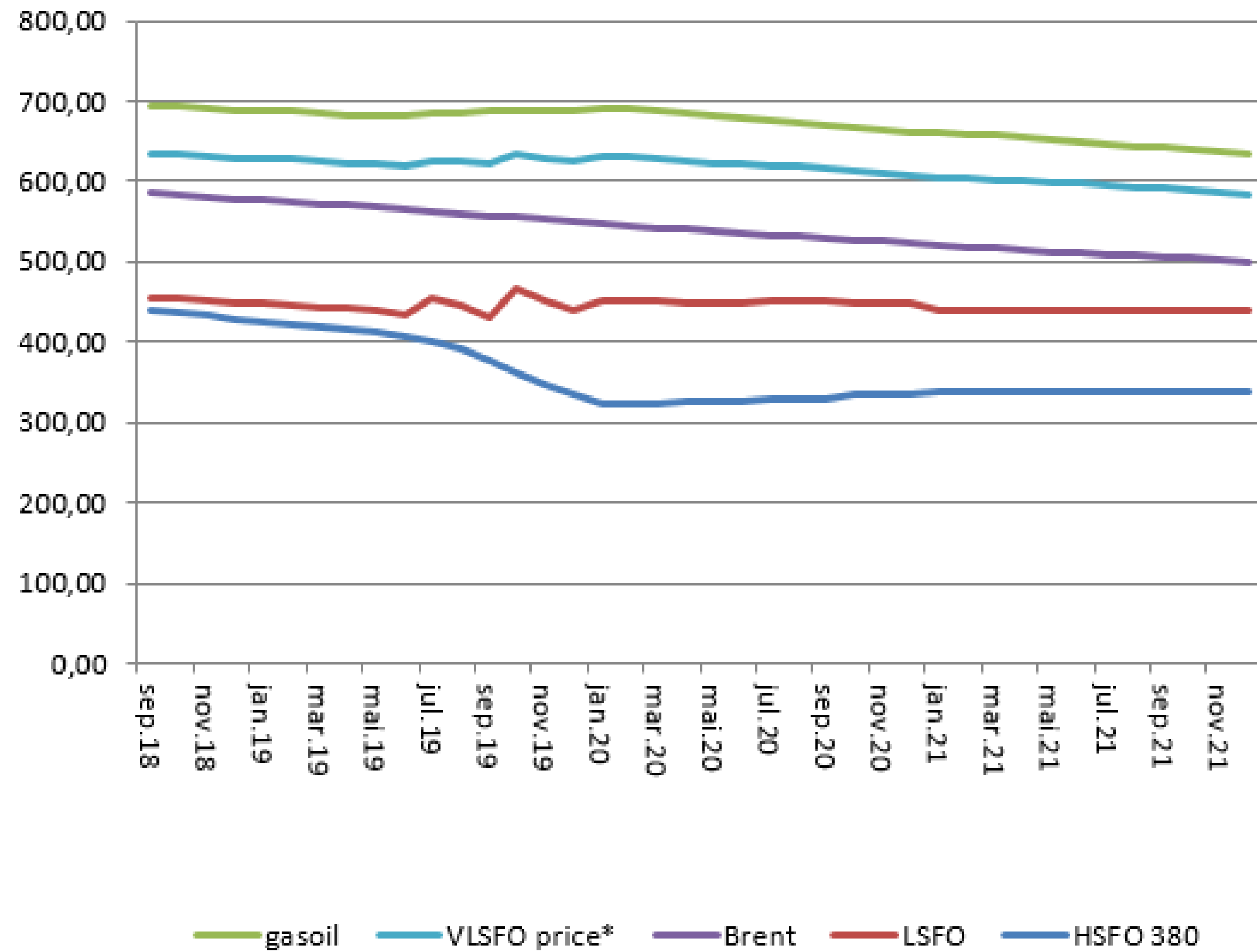


Investment value on scrubber (equipment + installation)

Scrubber could be a good investment :

- Low payback time
- Engine operate on same fuel – less maintenance required
- Safety – no switching fuel
- No issues on mixing hybrid fuels

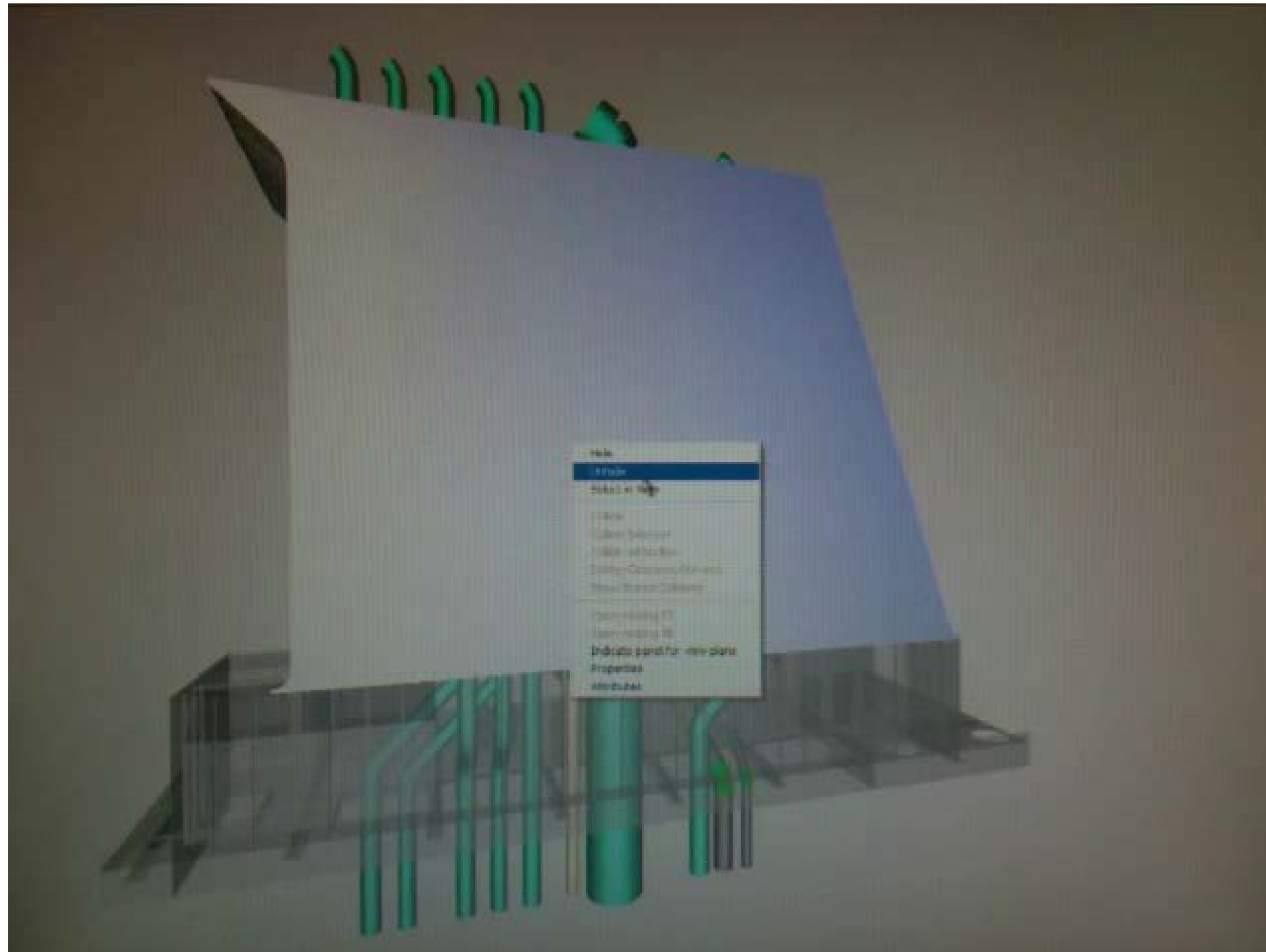
Forward curves, Sept 2018



	Premium LS MGO-HSFO (sept 18)	Premium LS MGO-HSFO (aug 18)	WFS estimate
sep.18	254,50	236,98	246,46
okt.18	256,08	240,93	250,57
nov.18	258,25	240,93	252,98
des.18	260,03	242,71	254,85
jan.19	262,33	247,40	262,24
feb.19	263,77	248,80	261,24
mar.19	264,86	249,89	269,88
apr.19	266,85	251,70	264,29
mai.19	270,16	254,63	267,36
jun.19	275,63	258,75	284,63
jul.19	283,66	266,28	292,91
aug.19	295,09	278,30	306,13
sep.19	309,18	293,61	322,97
okt.19	324,80	310,95	342,05
nov.19	338,86	326,91	359,60
des.19	353,11	341,48	375,63
jan.20	368,16	356,51	392,16
feb.20	367,00	356,30	391,93
mar.20	364,84	355,22	390,74
apr.20	358,91	348,70	383,57
mai.20	355,92	347,17	381,89
jun.20	353,40	345,90	380,49
jul.20	346,81	338,65	372,52
aug.20	344,04	336,37	370,01
sep.20	341,46	334,35	367,79

3D animation of scrubber installation

Done by maker to estimate if the scrubber fits your vessel



Screening, specification & makers selection



Make your own outline specification and budget



Screening of makers

Compare between scrubber makers – criteria such as: current lead time, technology, benefits and installed units

Good source to view all scrubber makers : <http://www.egcsa.com>



Create shortlist & select scrubber maker



Contract negotiation

Matching your specification/requirements and makers specification and offer



Scrubber installation depending on your vessel operating area and time

Detailed engineering and procurement



Detailed engineering



Drawings approvals from class



Procurement



Installation preparations

Construction and installation



Equipment delivery



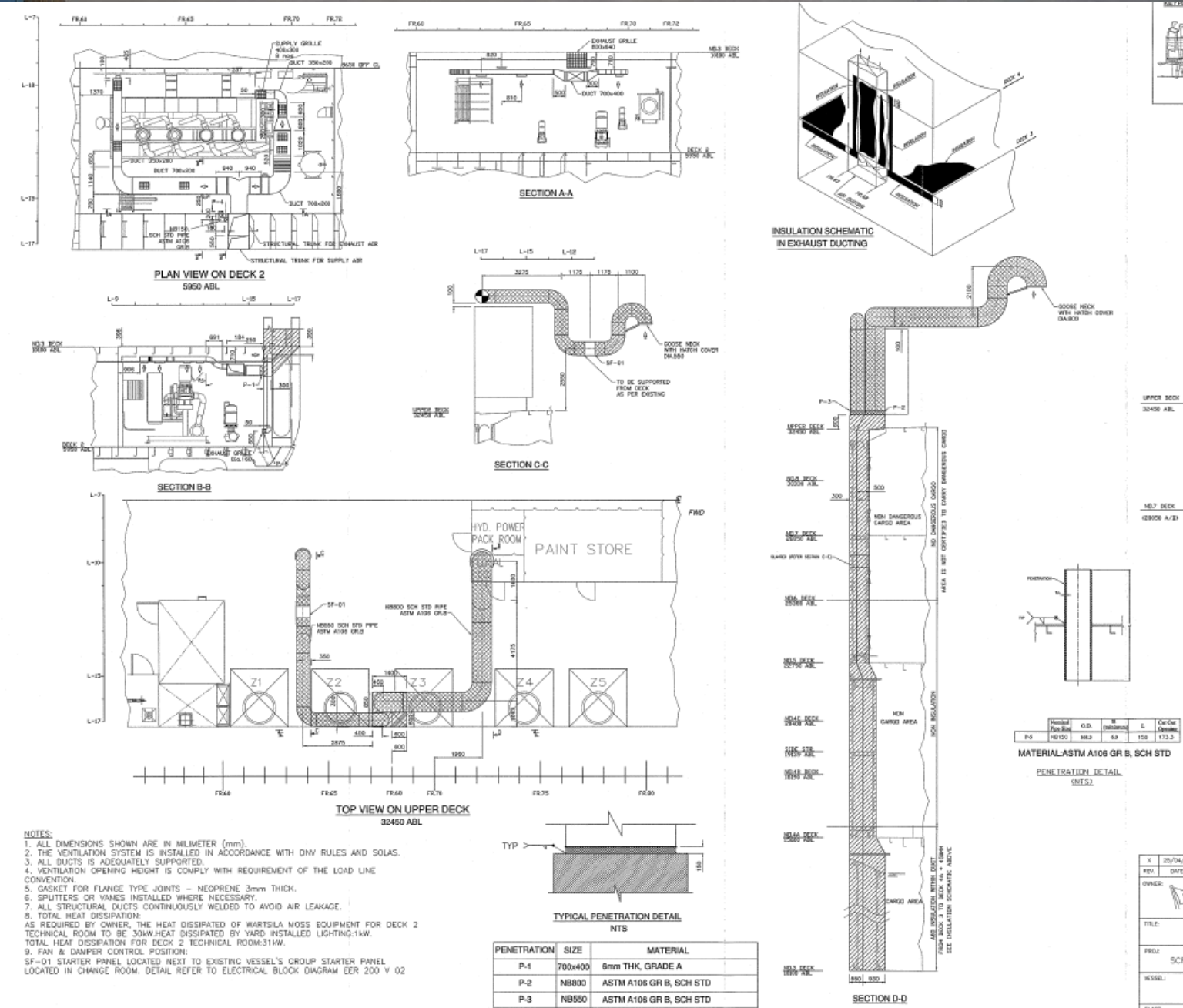
Prefabrication



Installation works and site management

- Site management is crucial, especial for installation of all the GRE piping.
- We have experienced huge operational issues due to bad piping (gluing process) leading to big sea water leakages.

Why good project management matters?



Scrubber installation onboard



Picture on left :
Scrubber installed on
the new funnel



Picture on right : GRE
Piping – A critical part in
scrubber installation

Approvals and commissioning



Tests



Approvals from flag class



Commissioning



Crew trainings



Handover



Start of lifecycle support

- Approval process could have impact due to limited resources
- Commissioning, there will for sure be lack of skilled commissioning engineers and one should secure this in contract.
- Would recommend service agreement with supplier including training of onboard personnel.

Summary

- Commercial
- Good team
- Project Plan

THANK YOU

Jon Helge Ulstein

Vessel Manager / Wilhelmsen Ship Management (Norway) AS
jon.helge.ulstein@wilhelmsen.com