



IMO 2020

EGCSA

Renaissance hotel, Heathrow

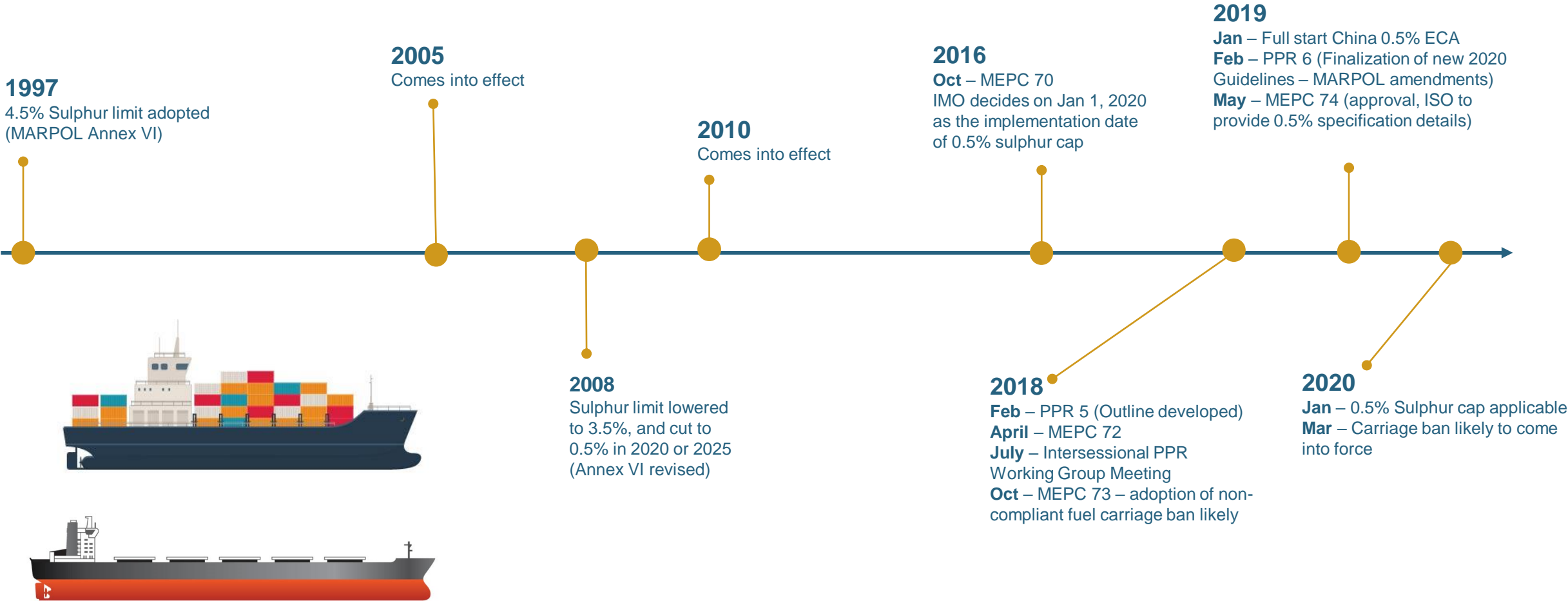
October 9th, 2018

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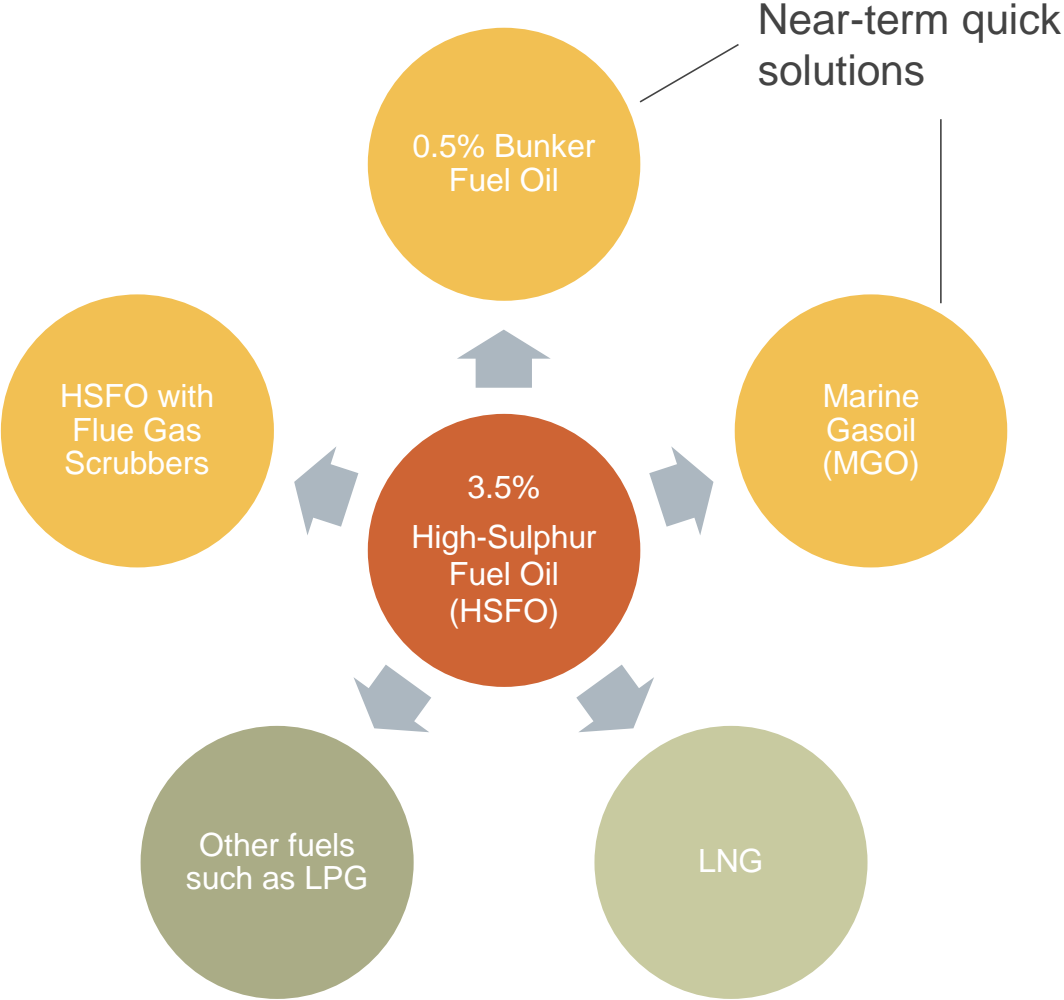
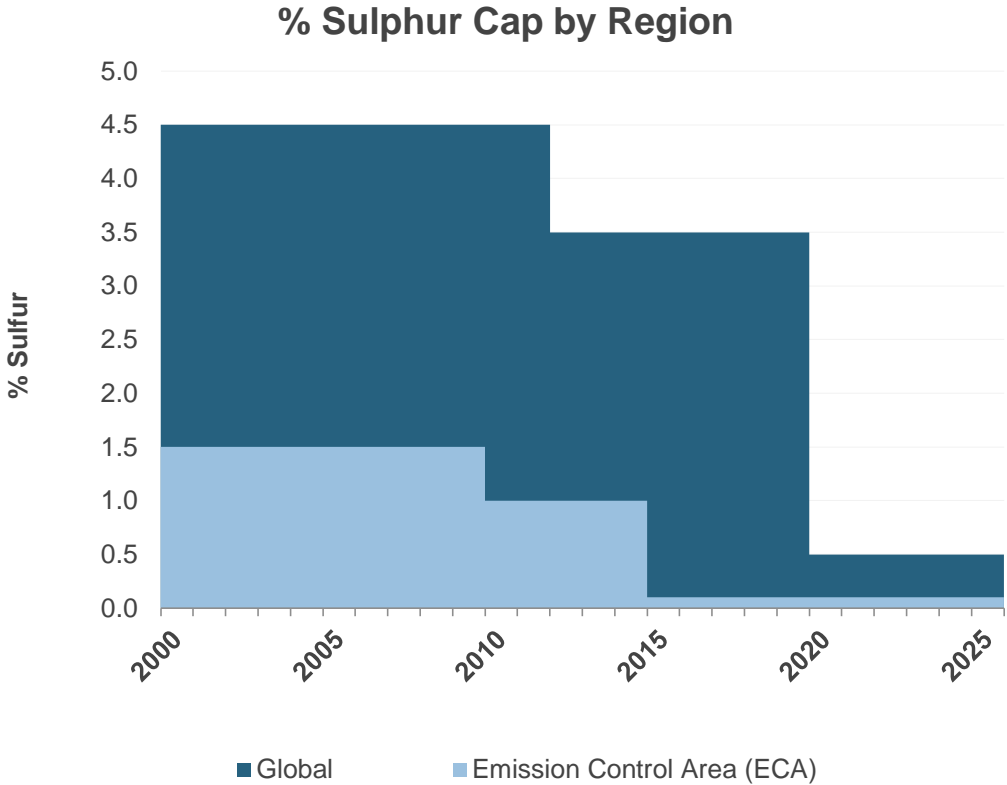
IMO 2020

Will impact everybody – nobody will be left out!

Marine Bunker Fuel Demand: Timetable of IMO's development of Guidelines/MARPOL Amendments on consistent implementation of 0.5% Sulphur limit



IMO 2020...Several Solutions, All Costly



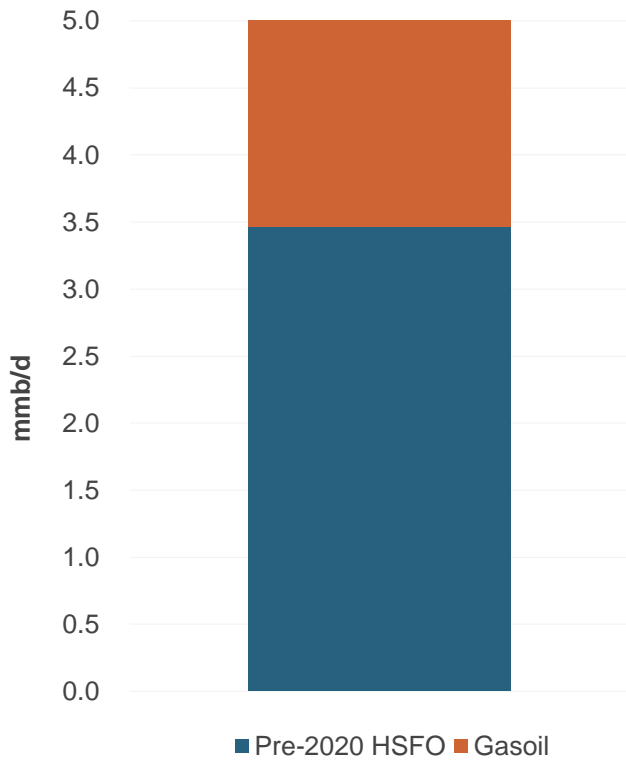
Global Marine Fuel Market Overview

Marine fuel demand total of 5 mmb/d total, of which 3.5 mmb/d is HSFO

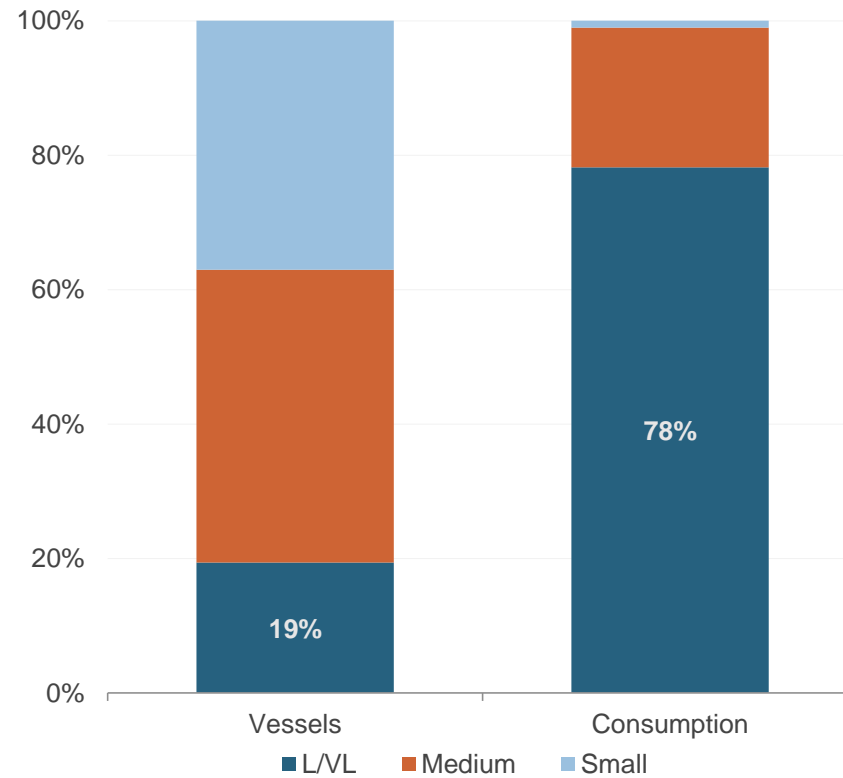
Just 20% of fleet consume 80% of marine fuel

Asia is the leading demand centre (2.2 mmb/d), followed by Europe (1.1 mmb/d)

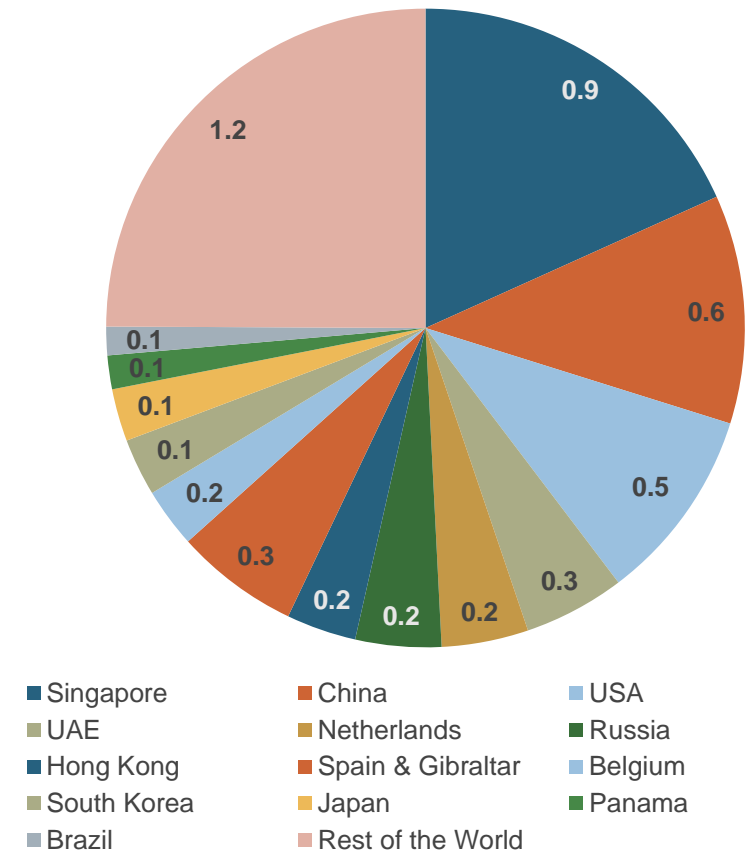
Global Marine Fuel Consumption



Global Marine Fuel Consumption by Vessel Size

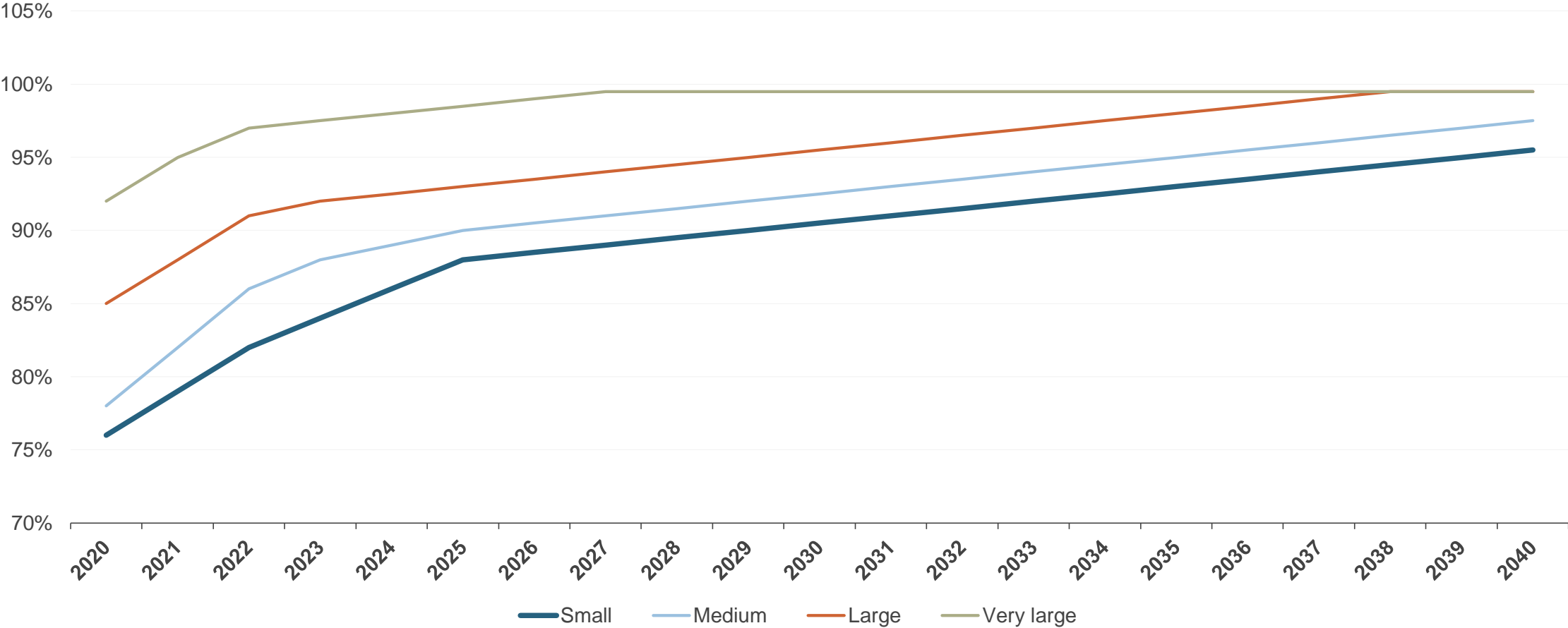


Top Bunker Fuel Sales Centres (mmb/d)



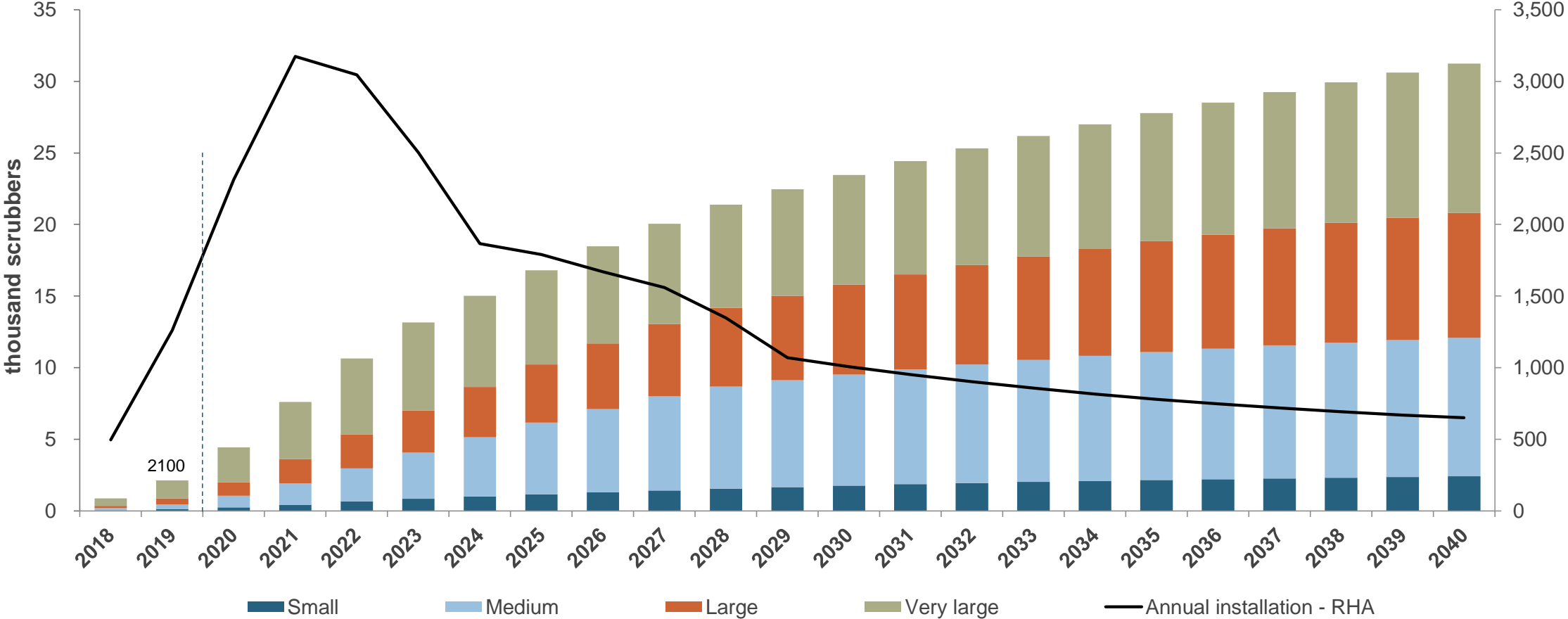
Compliance Largely Self-Regulated - But Likely High

Global Sulphur Cap Compliance by Vessel Size

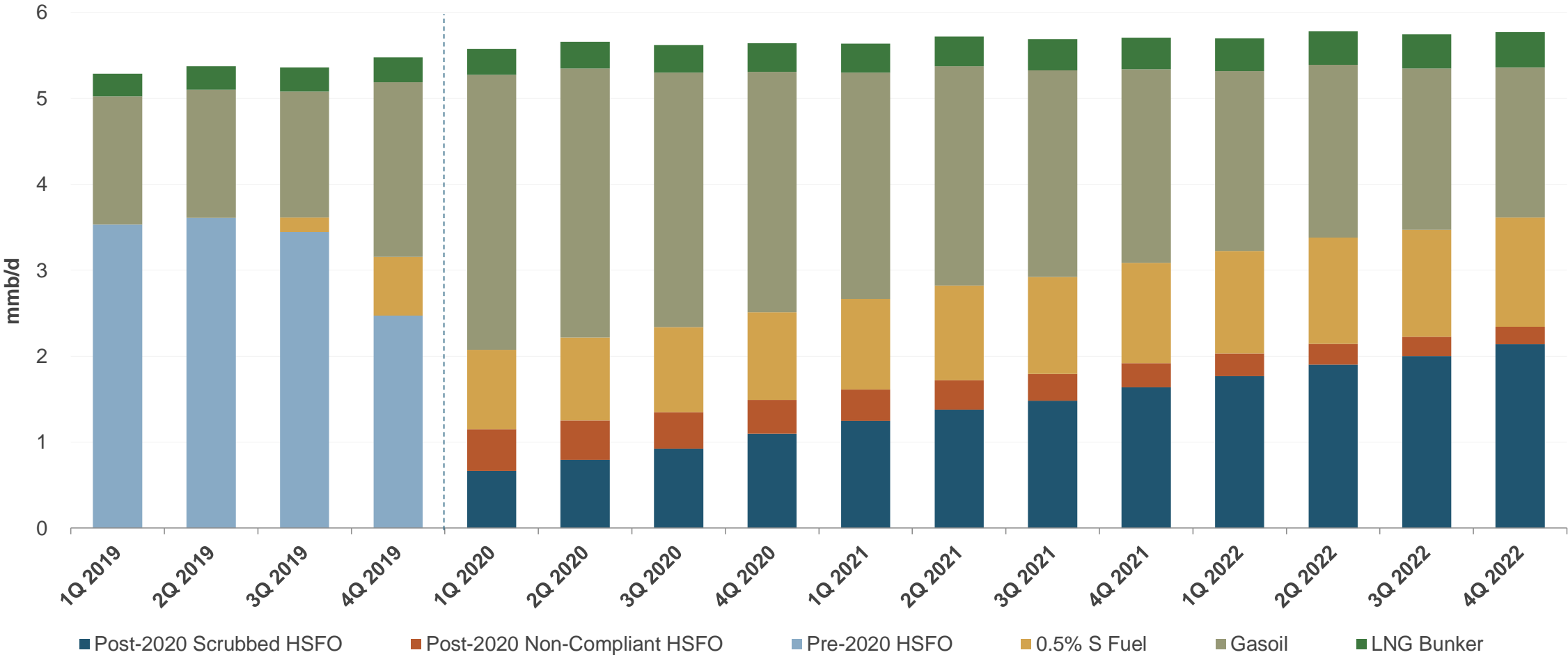


Scrubber Uptake Focused on Larger Vessels

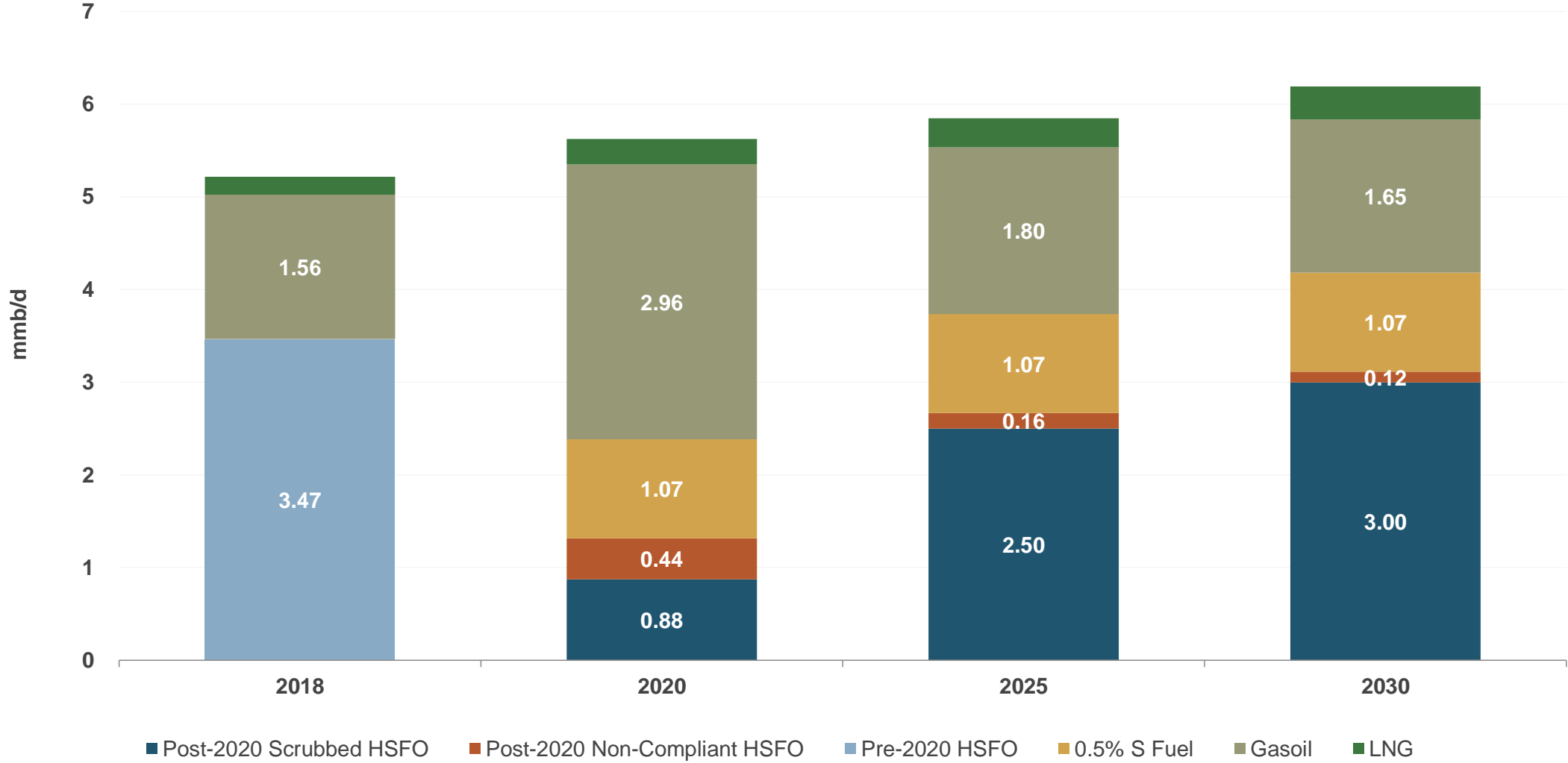
Installed Scrubbers by Vessel Category



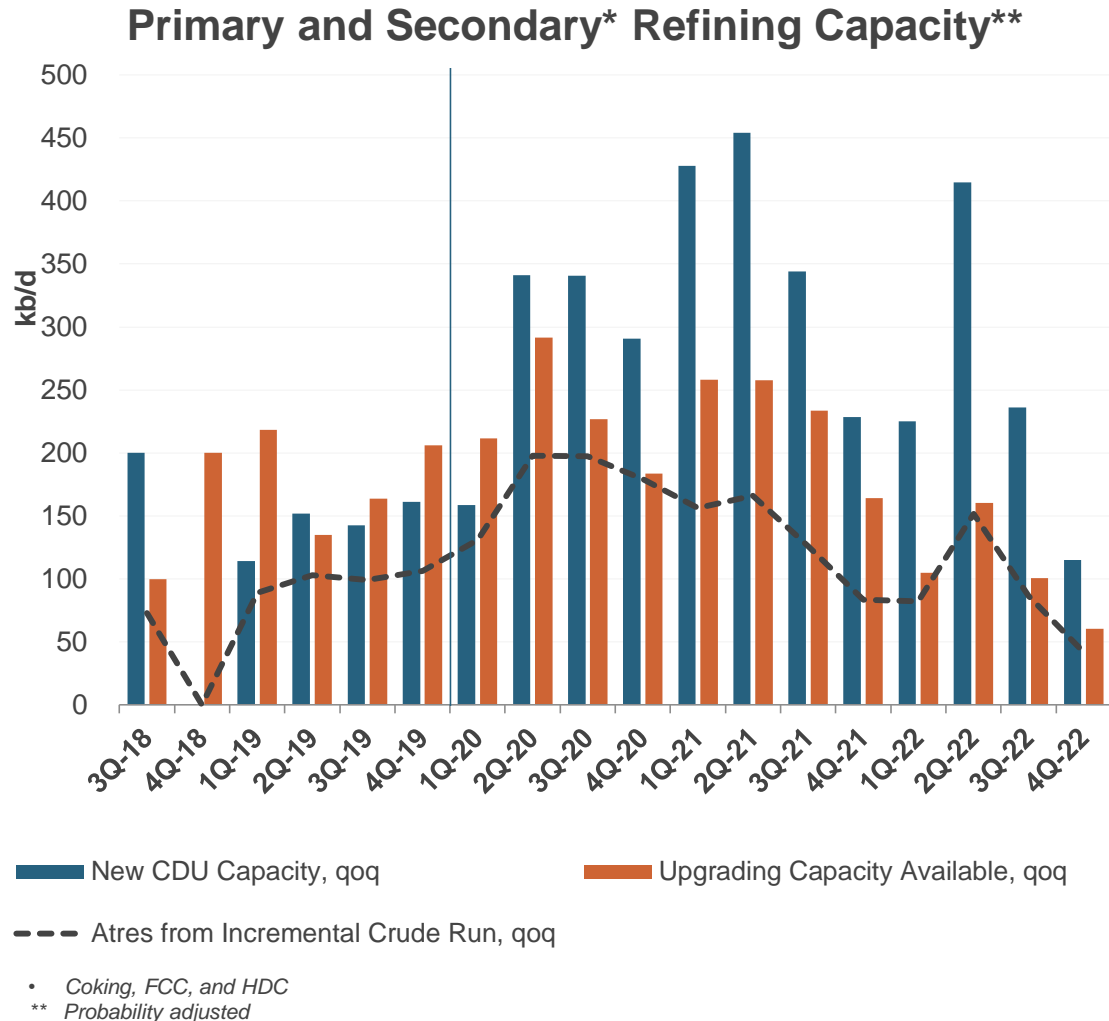
IMO2020: Forecast Bunker Fuel Demand Switching



IMO2020: Forecast Bunker Fuel Demand Switching



Refinery upgrading capacity available to process 'surplus' fuel oil



- Between mid 2018 and end 2021:
 - 3.4 mmb/d of CDU capacity will come on stream
 - 2.9 mmb/d of upgrading* capacity will start up
 - This is more than enough to cope with fuel oil from incremental CDU capacity
- Some of the biggest additions are:
 - Hengli, Rongsheng, Sinopec’s Guangdong, and CNOOC’s Shandong refineries in China
 - KPC’s CFP project and Saudi’s Jizan refinery in the Middle East
 - Turkey’s new STAR refinery
 - India’s Vizag refinery
 - Malaysia’s RAPID project
- At the right price:
 - Any currently under-utilised capacity and ...
 - Any “surplus” upgrading capacity will be available to process (cheap) fuel oil

IMO 2020 – Related (?) WOS Refinery Projects - Reducing Fuel Oil

Year	Region	Country	Location	Project	Comment
2017	Europe	Finland	Naantali/Porvoo	SDA, Neste	Commissioned in April, 2017
2017	Europe	Belgium	Antwerp	SDA & mild hydrocracker, Total	Commissioned in November, 2017
R 2018	Europe	Belgium	Antwerp	Coker, XOM	To be commissioned in early 2018
R 2018	Europe	Netherlands	Pernis	SDA, Shell	On schedule
2018	Europe	Norway	Slagen	VDU, XOM	Less fuel oil/more VGO, on schedule
2018	Europe	Netherlands	Rotterdam	Hydrocracker, XOM	On schedule
2018	Europe	Poland	Gdansk	VDU and coker, Grupa Lotos	Less fuel oil
2018	Europe	Sweden	Lysekil	Expanding VDU capacity, Corral	Less fuel oil
2H 2018	Europe	Spain	Castellon	Expanding VDU capacity, BP	Increase VGO production/lower fuel oil production
2020	Europe	Serbia	Panceva	Coker, INA/MOL	On schedule
2H 2020	Europe	Croatia	Rijeka	Coker, Gazpromneft	On schedule
2020+	Europe	Spain	Algeciras	CEPSA looking at building a 36 kb/d residue hydrocracker at a cost in excess of \$1billion.	Major commitment by CEPSA who will rely on financial backing from Mubadala. FID expected 1H18.
C 2020+	Europe	Germany	Wesseling	1. Solvent de-asphalter which will produce VGO. 2. Shell are also looking at increasing the amount of residue going to the existing hydrocracker	1. Whether the VGO is 0.5%S compliant will depend on the feedstock quality; may well require desulphurisation. This project is unlikely to be ready before 2020. 2. Project in the early stages of planning.
C 2020+	Europe	Belgium	Antwerp	20 kb/d Coker, Gunvor	Possible project
2021	FSU	Russia	Norsi	38 kb/d coker, Lukoil	Lukoil have announced they will have 7-9 kb/d of 0.5%S BFO available, probably VGO-type material
2020	North America	US/PADD3	Garyville	30 kb/d increase in coking capacity, Marathon	\$200 million project. IMO response; less fuel oil, more distillate
2021	North America	US/PADD3	Port Arthur	40 kb/d new coker, Valero	\$1 billion project, yet to be confirmed
2022	North America	US/PADD3	Galveston Bay	20 kb/d resid hydrocracker expansion, Marathon	Part of the STAR program to upgrade and join together the adjacent Galveston and Texas City refineries

C Gunvor (coker) and Shell (SDA) have cancelled their plans

R XOM (Antwerp, coker) and Shell (Pernis SDA) commissioned

- There are numerous projects in the FSU focussing on upgrading fuel oil. Although none are directly the result of the IMO regulations, fuel oil volumes will reduce and potentially HSGO, VGO, etc., could be made available for 0.5% S BFO.

IMO 2020 – Related (?) EOS Refinery Projects - Reducing Fuel Oil, More Clean Fuels

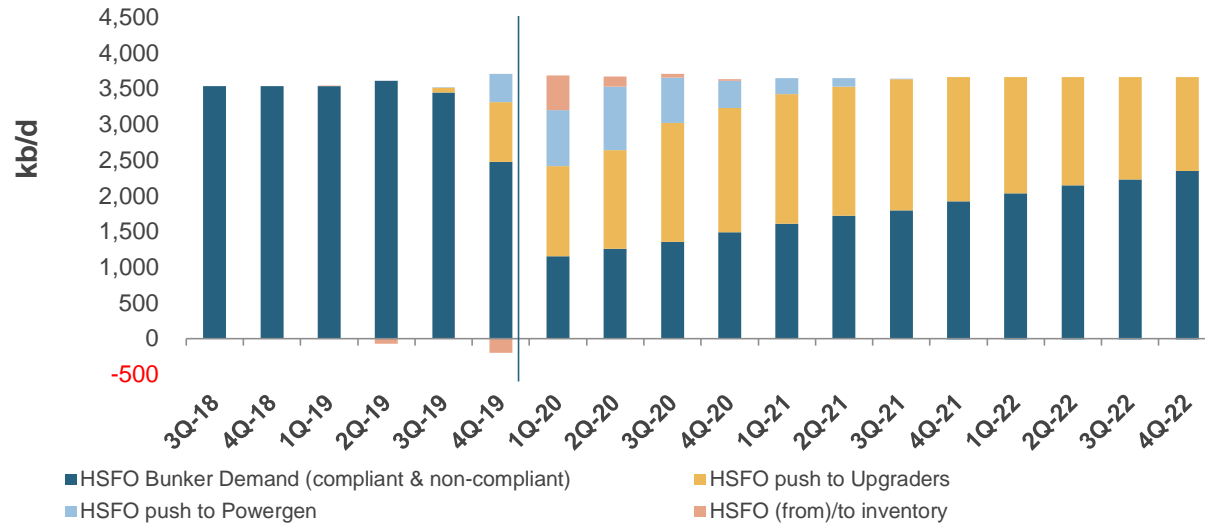
Year	Region	Country	Location	Project	Comment
2018+	Asia	South Korea	Daesan	Hyundai Oil Bank have said they are looking at debottlenecks of their coking and hydrocracking plants together with a new vac resid desulphurisation plant	Streamed a 80 kb/d SDA in August 2018. End 2018 which may well be possible for the debottlenecking. However, we think the vac resid plant will be post 2020.
* 2019	Asia	Japan	Sakai	2 kb/d Coker expansion, Cosmo	On schedule
* 2019	Asia	Japan	Chiba	5 kb/d resid desulphurisation expansion, Idemitsu	On schedule
* 2019	Asia	Japan	Yokkaichi	5 kb/d resid desulphurisation expansion, Showa	On shedule
2020	Asia	South Korea	Ulsan	40 kb/d vac resid desulphurisation	On schedule
2020	Asia	India	Vizag	HDC + RHDC + SDA	Refinery expansion with a clean fuels and zero fuel oil production focus. Due end 2020
2020+	Asia	Thailand	Sriracha, Thai Oil	Expansion and modernisation with no fuel oil being produced	Awaiting Final Investment Decision
2020+	Asia	South Korea	Ulsan	40 kb/d residue desulphurisation, SK Energy	At the design stage with no final decision yet made
2023	Asia	Singapore	Jurong	70 kb/d coker, Shell SRC	At the design stage with no final decision yet made; Current design is to produce some 90 kb/d of 1%S (potentially 0.5%S) FO for power generation and, possibl BFO. Remaining 150 kb/d desulphurised atres upgraded via RHDC.
2021+	Middle East	Kuwait	Al-Zour	150 kb/d RHDC and VLSFO (0.5%S) production, KPC	At the design stage with no final decision yet made; Current design is to produce some 90 kb/d of 1%S (potentially 0.5%S) FO for power generation and, possibl BFO. Remaining 150 kb/d desulphurised atres upgraded via RHDC.

- Refiners with atmospheric and vacuum residue desulfurisation capacity will potentially, be able to produce residual 0.5% S BFO. However, this product will need to compete financially with other potential demands such as upgrader feedstock, chemical feedstock, fuel for power generation, etc.
- The Middle East has over 700 kb/d of resid desulfurisation and Kuwait has indicated that ULSFO from its MAA/MAB and Al-Zour refineries could be made available for bunkers. Additionally, South Korea and Japan (with over 450 and 500 kb/d of resid desulfurisation, respectively) have the potential to make some available.
- ExxonMobil Singapore is mulling over a "multi-billion" dollar investment to reduce fuel oil production and increase the production of high quality lube oils. This could be a hydrocracker and coker investment. The FID is expected in 2019 with the units online in 2023/24.

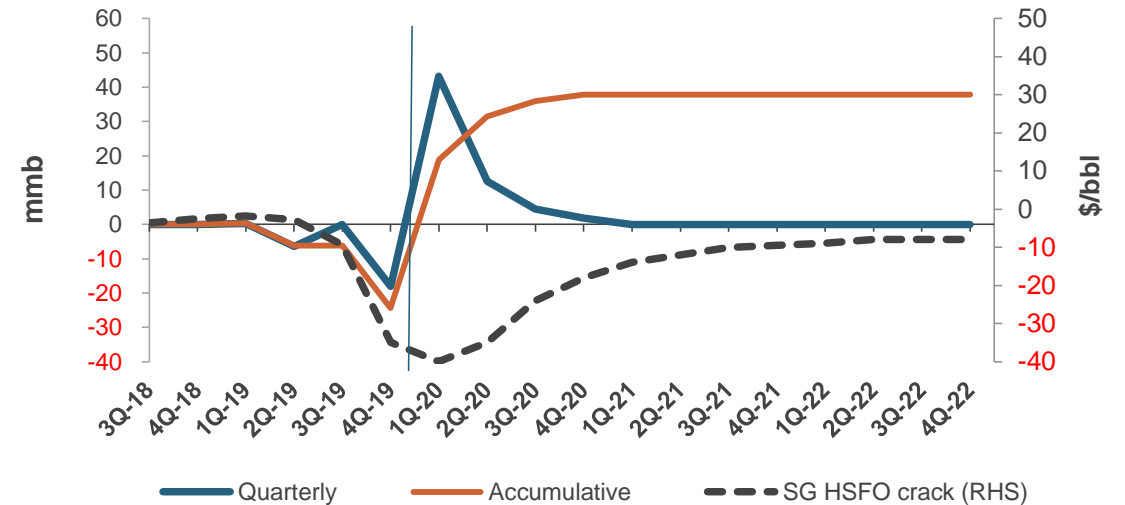
Managing the IMO fuel oil surplus... it looks like a 2 year problem!

HSFO price needs to drop enough to incentivise refiners to maximise upgrading, shippers to install scrubbers and generate new demand from the power generation sector

Managing HSFO around IMO 2020



HSFO Inventory Draw / Build & HSFO Crack

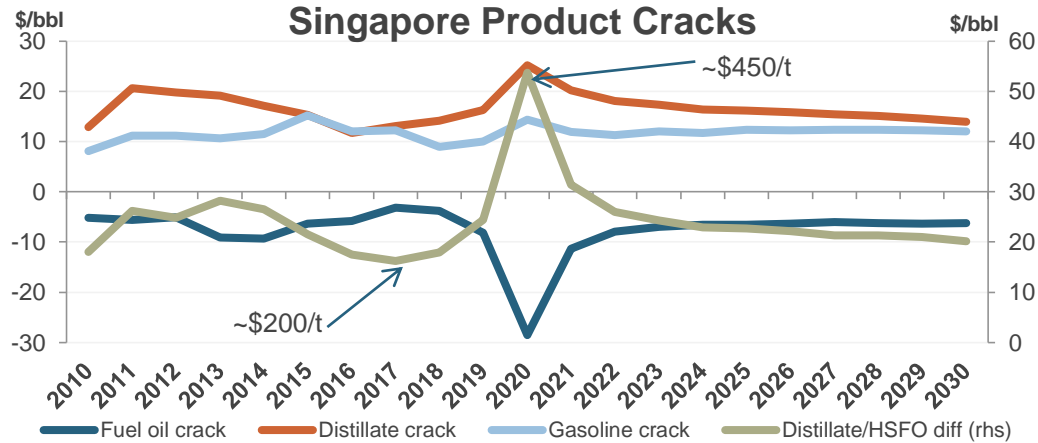


- HSFO stocks remain low near term and cracks strong due to the tight/supply demand balance as the crude slate lightens (US LTO, less Venezuelan, less Iranian crude) and upgrading plant commissions
- However, in 2H19 HSFO prices fall quickly as Jan 2020 approaches
- Shippers start the transition to 0.5%BFO during 2H19, especially during 4Q
 - Stocks of 0.5%S build while HSFO stocks fall as the market transitions
 - HSFO bunker demand falls, HSFO prices fall fast to incentivise refiners to process (much) more fuel oil (than normal)
- But it is not enough and the price has to fall further to incentivise new demand to open up ie fuel for power generation

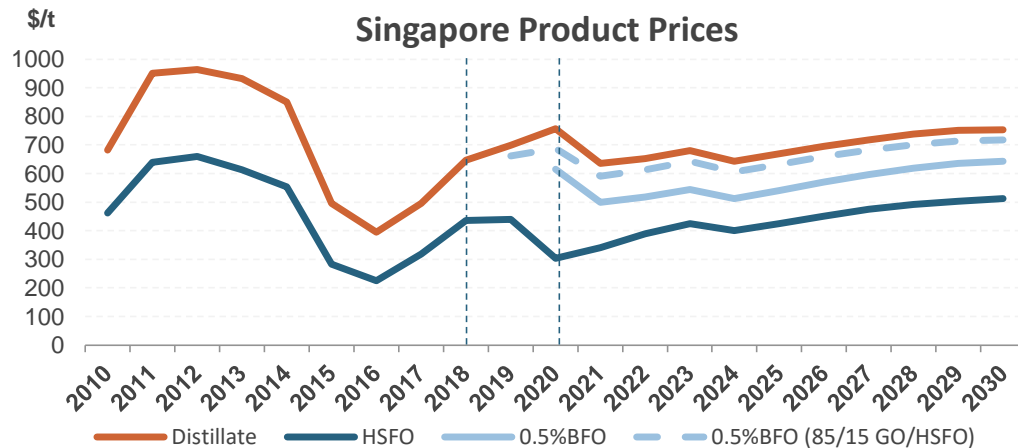
- Prices remain low in order to push product into power gen and refining
- But in the early quarters HSFO has to be put into stock as there is insufficient demand. Both currently under-utilised upgrading capacity and any new capacity is fully utilised.
- As new upgrading capacity comes on line the need to push HSFO into power gen diminishes and disappears altogether by 3Q21.
- As we move through 2021 and 2022, upgrading capacity continues to grow, as do the number of scrubbers in use. Consequently, HSFO demand increases and the surplus that has to be dealt with falls. The push into upgrading remains but falls to less than 1 mmb/d by end-2022.
- HSFO cracks rise slowly as the pressure on refiners ease. However, FO stocks remain high and these will need to be worked-off at a later stage.

Product Cracks Forecast

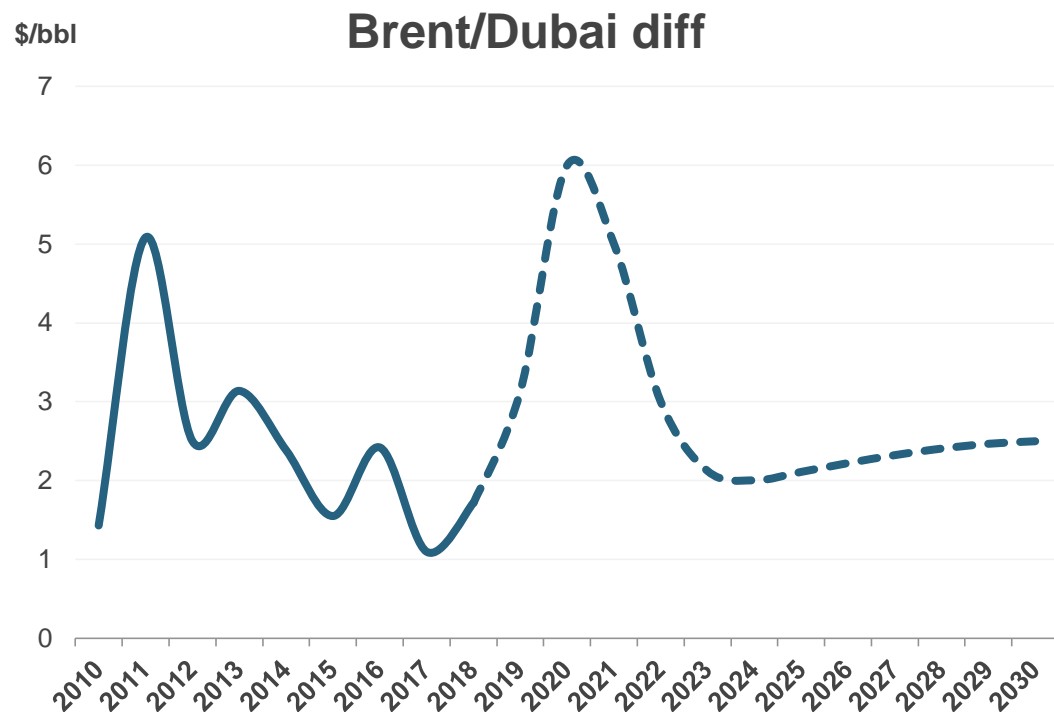
IMO2020 causes a huge shock in the products markets; markets settle down after 2-3 years



- 2H18/1H19 HFO supply/demand is tight as refineries commission upgrading projects and as the crude slate gets lighter:
 - Less Iranian and Venezuelan crude, more US LTO.
 - But with a backdrop of IMO2020.
- 2H19 sees fuel oil price weakening, as refining and shipping get ready for January 2020.
- Surge in distillate demand for compliant fuel, fuel oil demand collapses:
 - Distillate cracks strengthen, fuel oil cracks plummet.
 - Gasoline gets drawn into the mix.
- HFO released from the bunker pool needs to find a home in refineries and the powergen sector
 - Significant amount of upgrading capacity due on line 2018/22.
 - Russia, China, Middle East most likely to burn incremental fuel oil.
- Bunker fuel oil demand returns as scrubbers are installed; both on new builds and retrofits.
- Upgrading demand for fuel oil increases and is sustained as crude slate gets lighter, petchems and transport fuel demand remains robust.



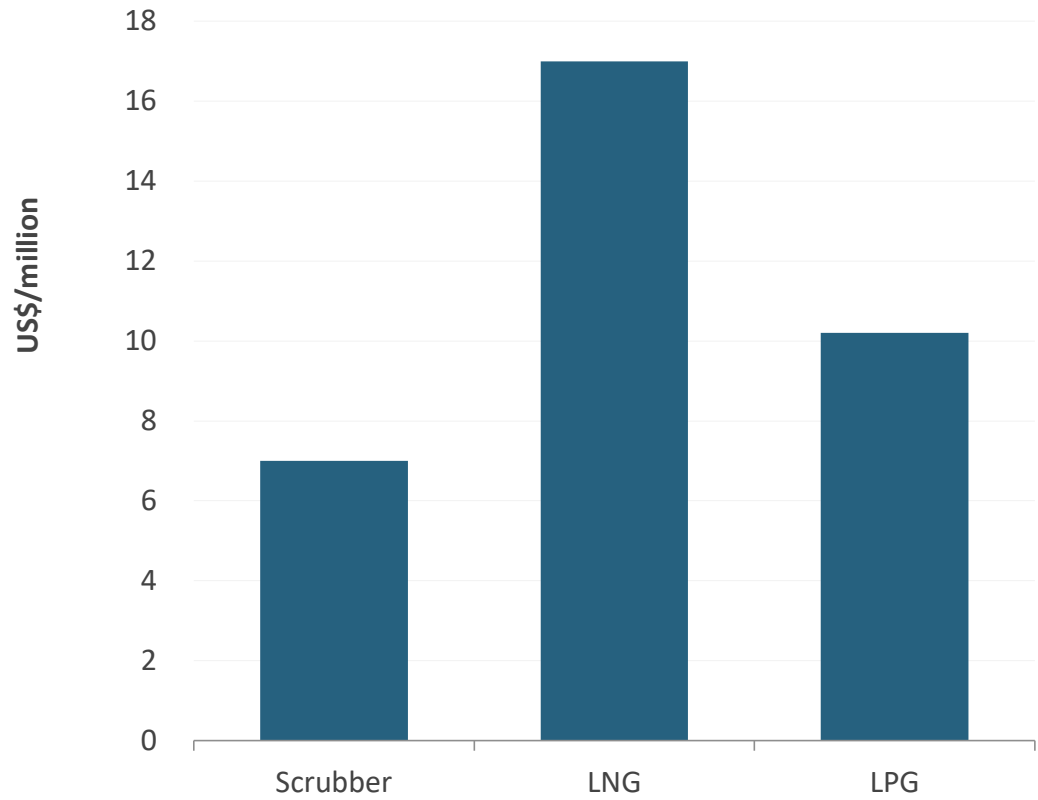
Crude Diffs Forecast



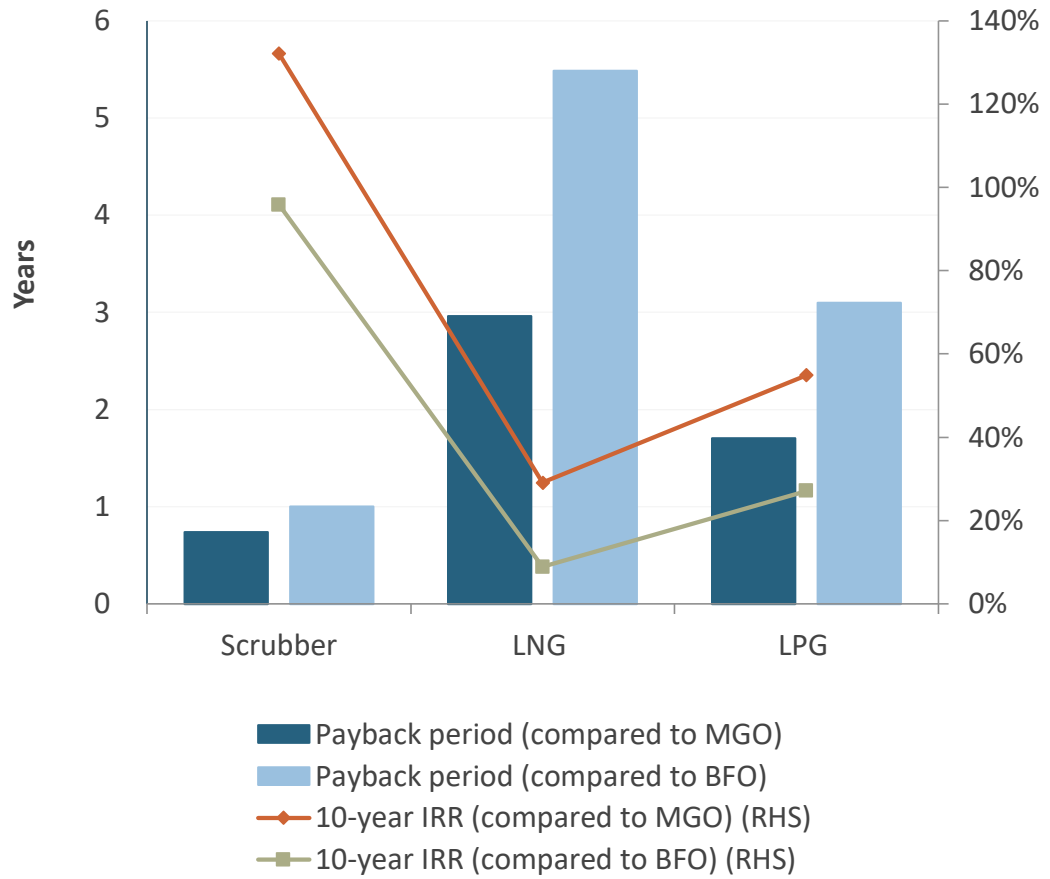
- Heavy and sour crudes suffer from low price of fuel oil.
- Without sophisticated upgrading, can't make 0.5%S BFO from such crudes.
- Conversely, lighter and sweeter crudes can more easily make the new fuel and also have higher yields of gasoline and distillate:
 - Wide variation in sweet crudes!
 - Ideally crude sulphur should be less than 0.3%.
- So, we have a "double whammy"!
- We see the diff widening to \$6/bbl but it could easily be higher.
- The diff narrows as fuel oil demand returns and any surplus is soaked up.

VLCC – IRR and Payback Period for the Various Options?

CAPEX for the Alternative Fuels, VLCC

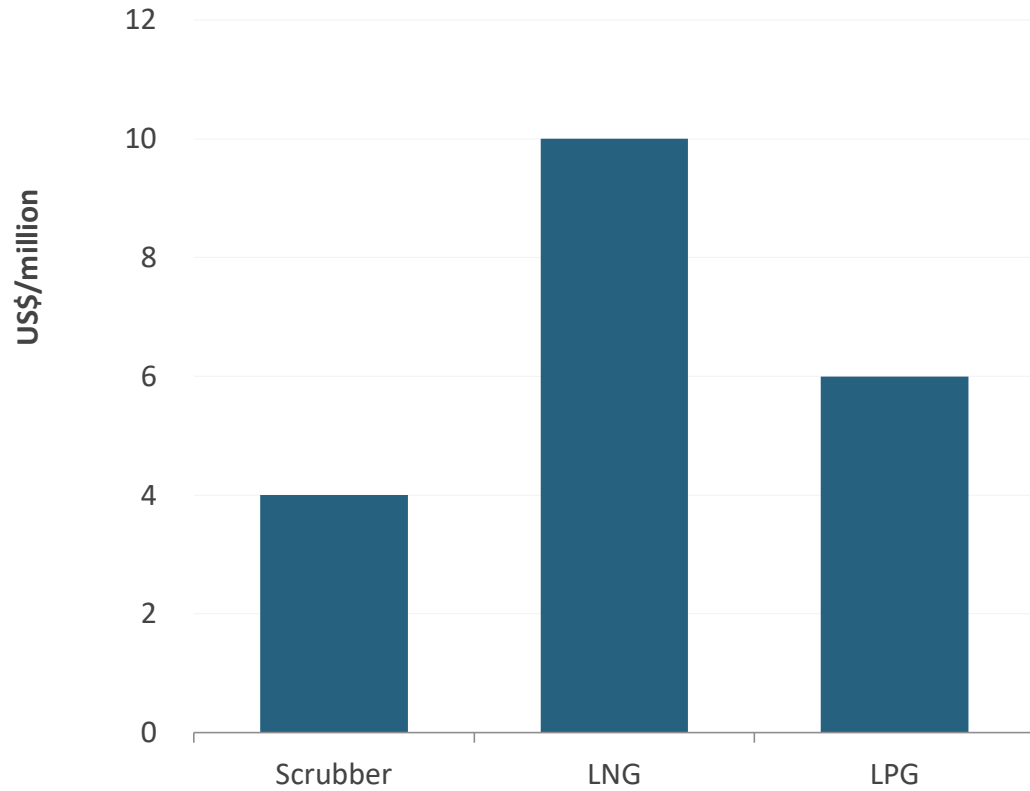


Return on Investment, VLCC

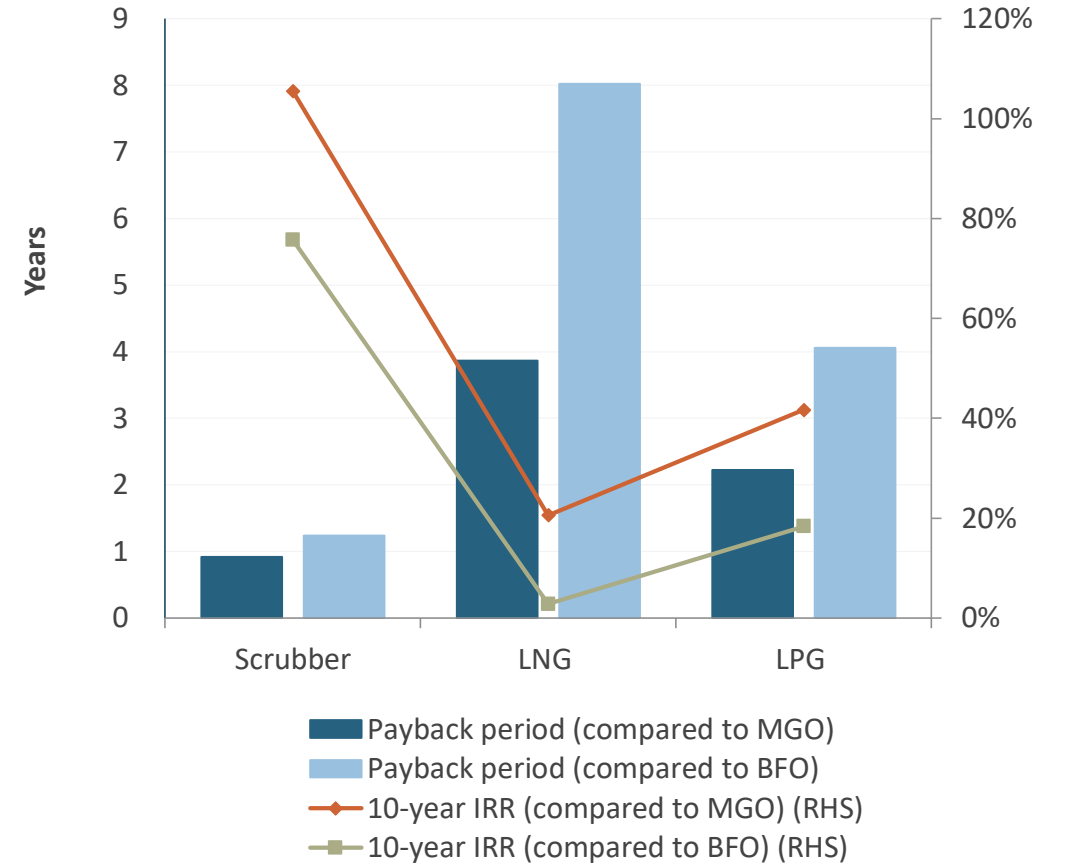


Aframax – IRR and Payback Period for the Various Options?

CAPEX for the Alternative Fuels, Aframax

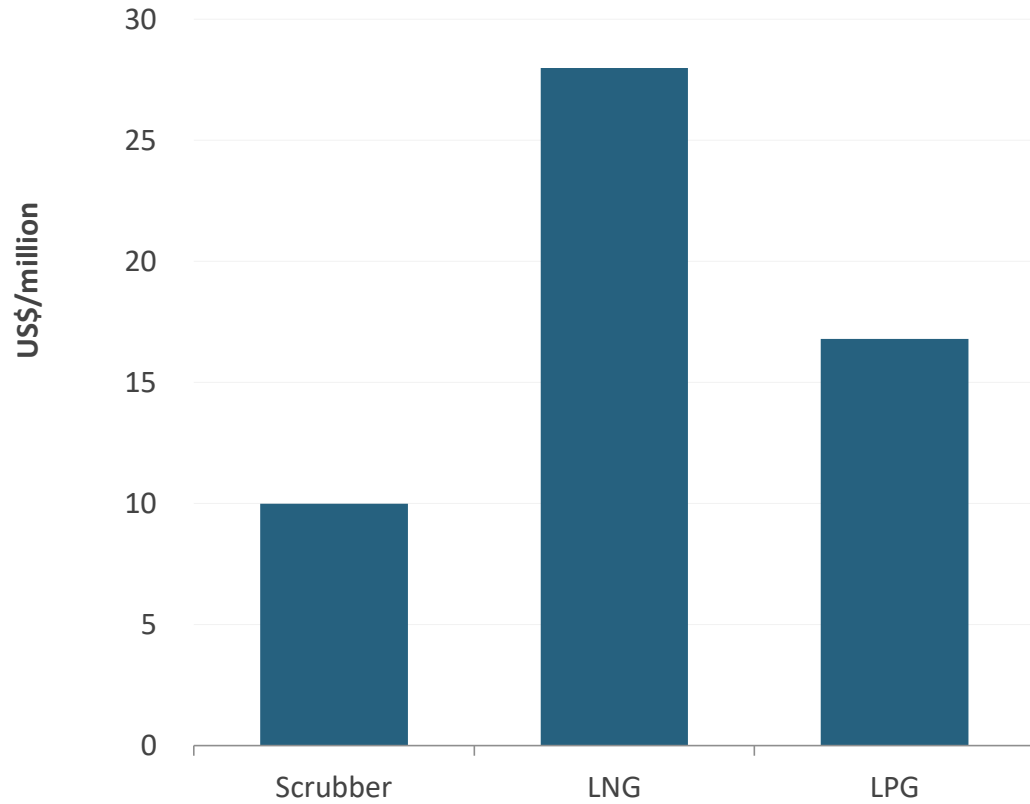


Return on Investment, Aframax

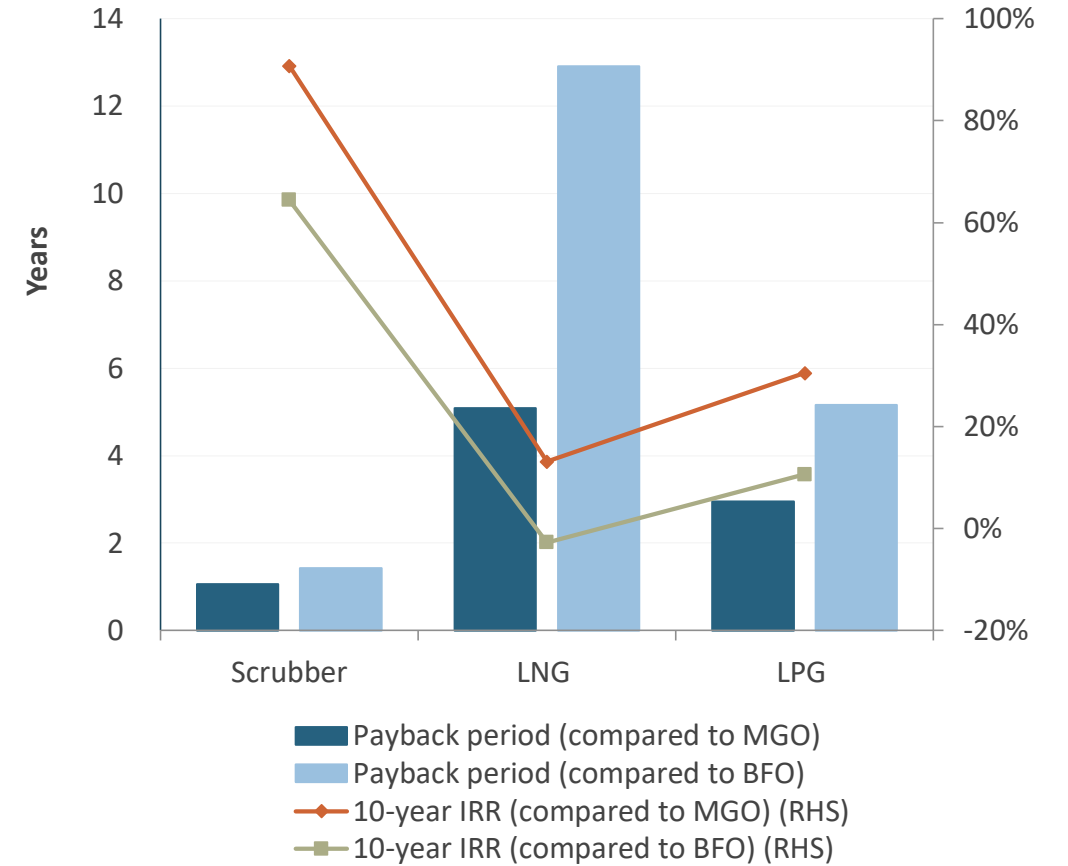


Container Vessel (19,000 TEU) - IRR and Payback Period for the Various Options?

CAPEX for the Alternative Fuels, Container Vessel

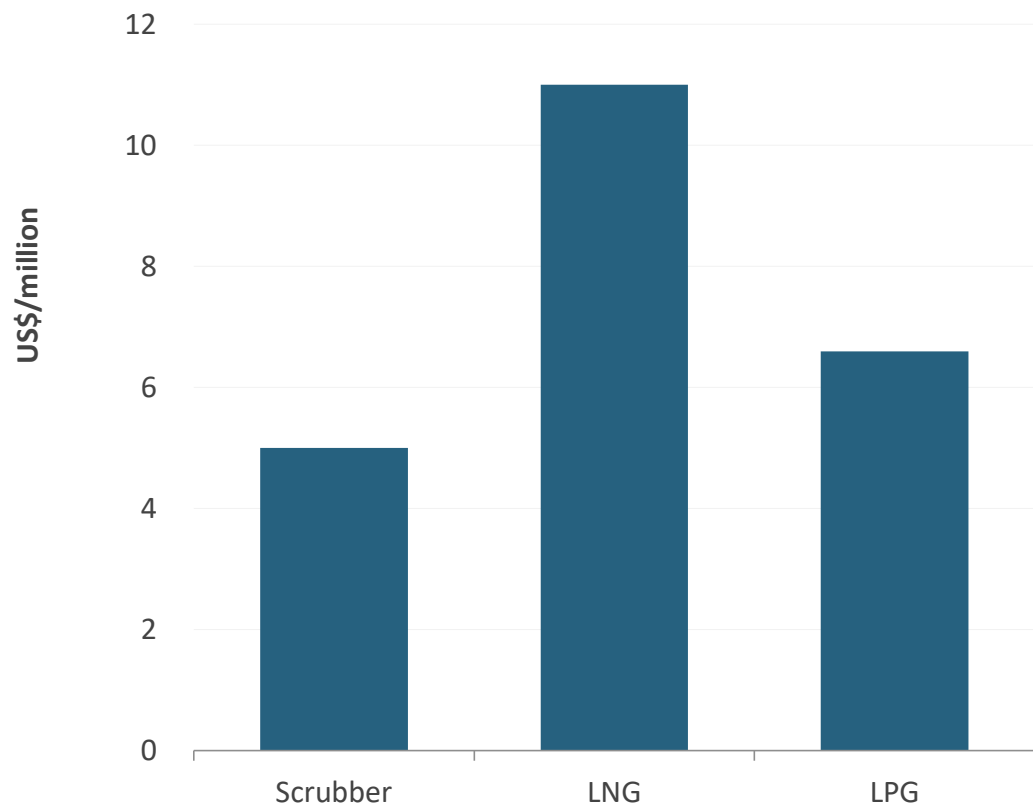


Return on Investment, Container Vessel

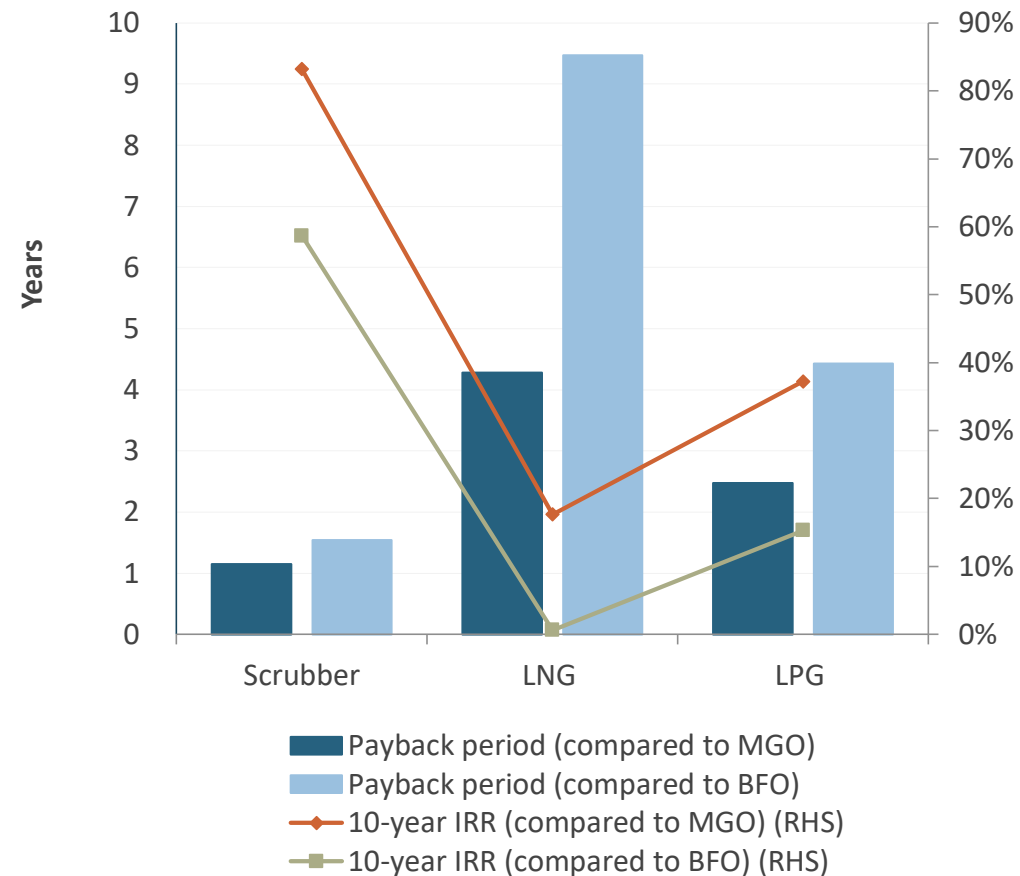


Bulk Carrier (Cape Size) – IRR and Payback Period for the Various Options?

CAPEX for the Alternative Fuels, Bulk Carrier

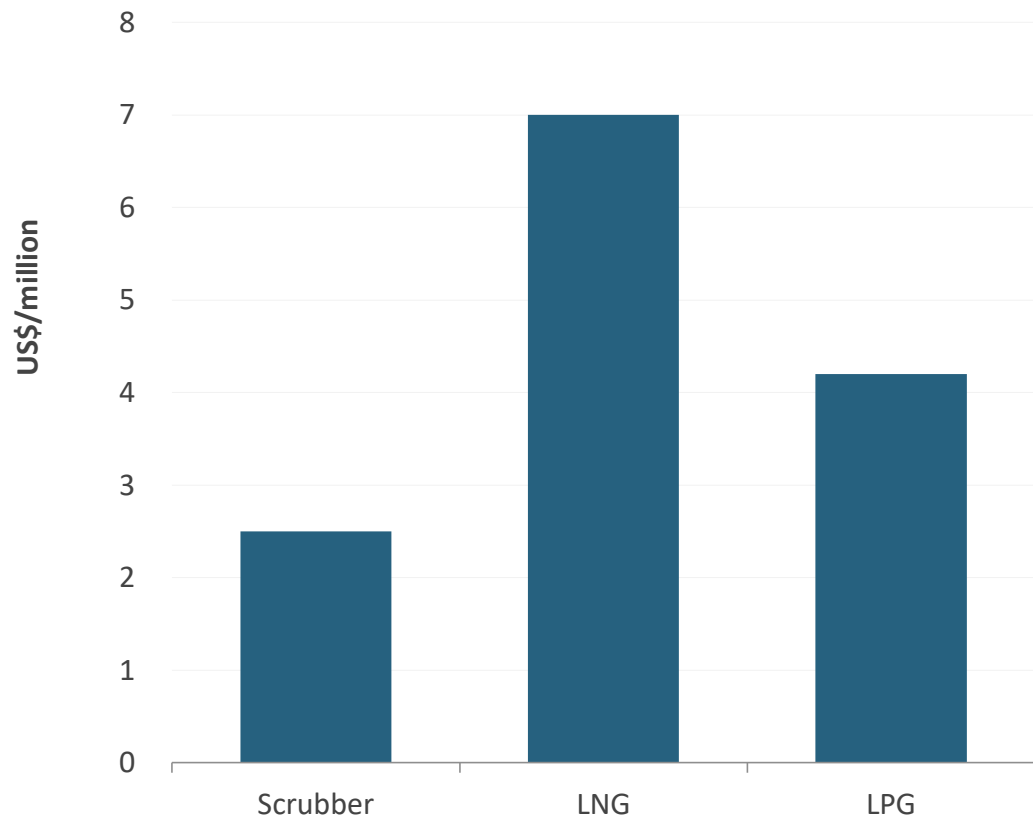


Return on Investment, Bulk Carrier (Cape Size)

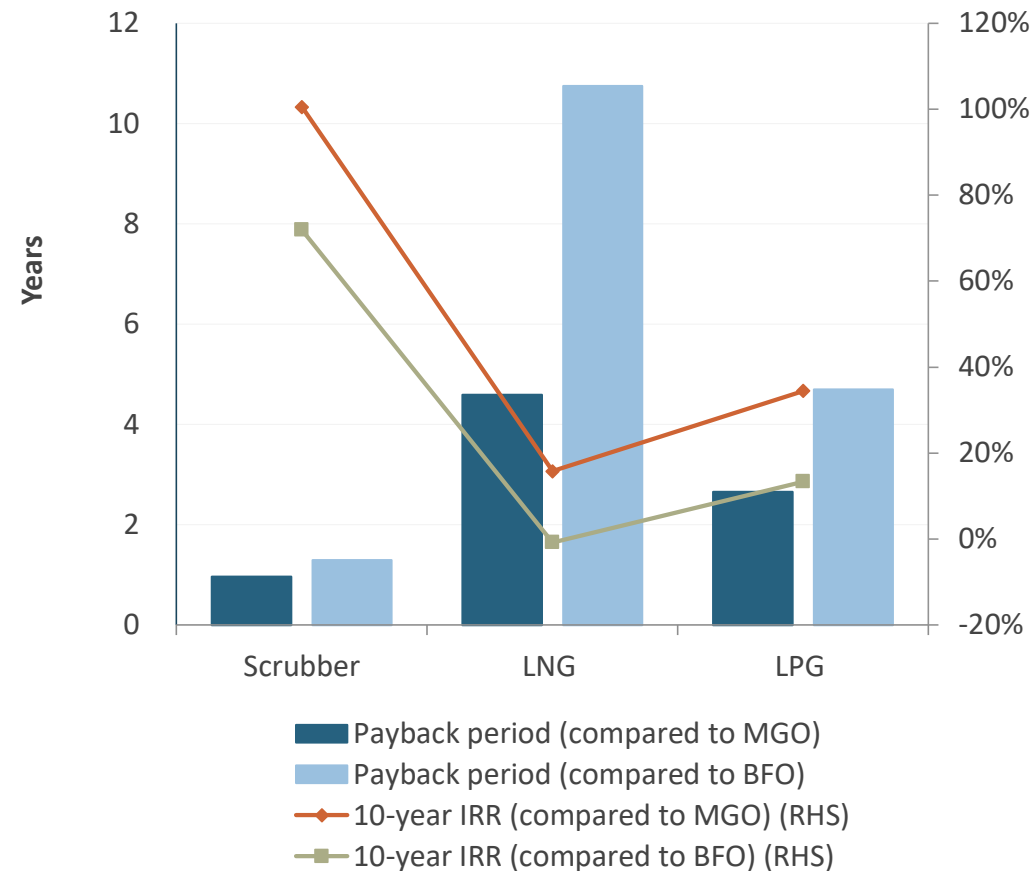


Bulk Carrier (Handymax) – IRR and Payback Period for the Various Options?

CAPEX for the Alternative Fuels, Bulk Carrier (Handymax)



Return on Investment, Bulk Carrier (Handymax)





Thank You

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