Bunker industry: A look at the near and distant future

- *The target is to reduce carbon intensity* ***by at least 40% by 2030.***
    - The strategy is due to be revised by 2023, but no concrete measures on how to achieve it have yet been decided.
- *The IMO's current strategy seeks to* ***reduce carbon intensity by at least 70%in 2050*** *and this will require significant changes within the next thirty years as to how power and propulsion is generated on board.*





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What are the options?

Methanol	LPG	Ammonia	Fuel Cells	Hydrogen	BioFuels	LNG

Well to Wake

Derived from fossil fuels?

Which future fuel would you use?

Fuel	Liquid density	Specific carbon content	Specific Energy content		Specific CO_2 emission (amount of fuel basis)		
	kg/l	kg_C/kg_{fuel}	kWh/kg_{fuel}	Btu/lb_{fuel}	Kg_{CO2}/kg_{fuel}	Kg_{CO2}/gal_{fuel}	lb_{CO2}/gal_{fuel}
Methane (natural gas)		0.75	15.4	23900	2.75		
Propane	0.510	0.82	13.8	21300	2.99	5.78	12.7
Butane	0.564	0.83	13.6	21100	3.03	6.47	14.3
LPG (wt of C3=C4)	0.537	0.82	13.7	21200	3.01	6.12	13.5
Gasoline	0.737	0.90	12.9	19900	3.30	9.20	20.3
Kerosene (Jet)	0.821	0.82	12.0	18500	3.00	9.33	20.6
Diesel	0.846	0.86	12.7	19605	3.15	10.1	22.3
Heavy fuel oil (No.6/Bunker C)	0.980	0.85	11.6	18000	3.11	11.6	25.5
Petroleum coke		0.89	9.4	14500	3.26	14.7	32.4
Coal:							
Anthracite		0.92	9.0	14000	3.37		
Bituminous		0.65	8.4	13000	2.38		
Subbituminous		0.4	6.8	10500	1.47		
Lignite		0.3	3.9	6000	1.10		
Coke		0.77	7.2	11200	2.82		
Peat (dry)[1)]		0.52	4.7	7300	1.91		
Ethanol fuel (E100)[2)]	0.789	0.52	8.3	12800	1.91	5.71	12.6
Methanol fuel (M100)[2)]	0.791	0.37	5.5	8500	1.37	4.11	9.1
Biodiesel (B100)[2)]	0.880	0.78	11.3	17400	2.85	9.48	20.9
Wood [1) 2)]		0.50	4.5	7000	1.83		
Bio energy [2)]							

https://www.engineeringtoolbox.com/co2-emission-fuels-d_1085.html

What factors do we need to really consider?

- Availability
- Reliable source of supply
- Energy Cost
- Energy Density
- Storage
- Capital Cost
- Available Infrastructure
- Operational Cost
- Safety
- Health Impact
- Complexity

Let's take a look at Energy Density

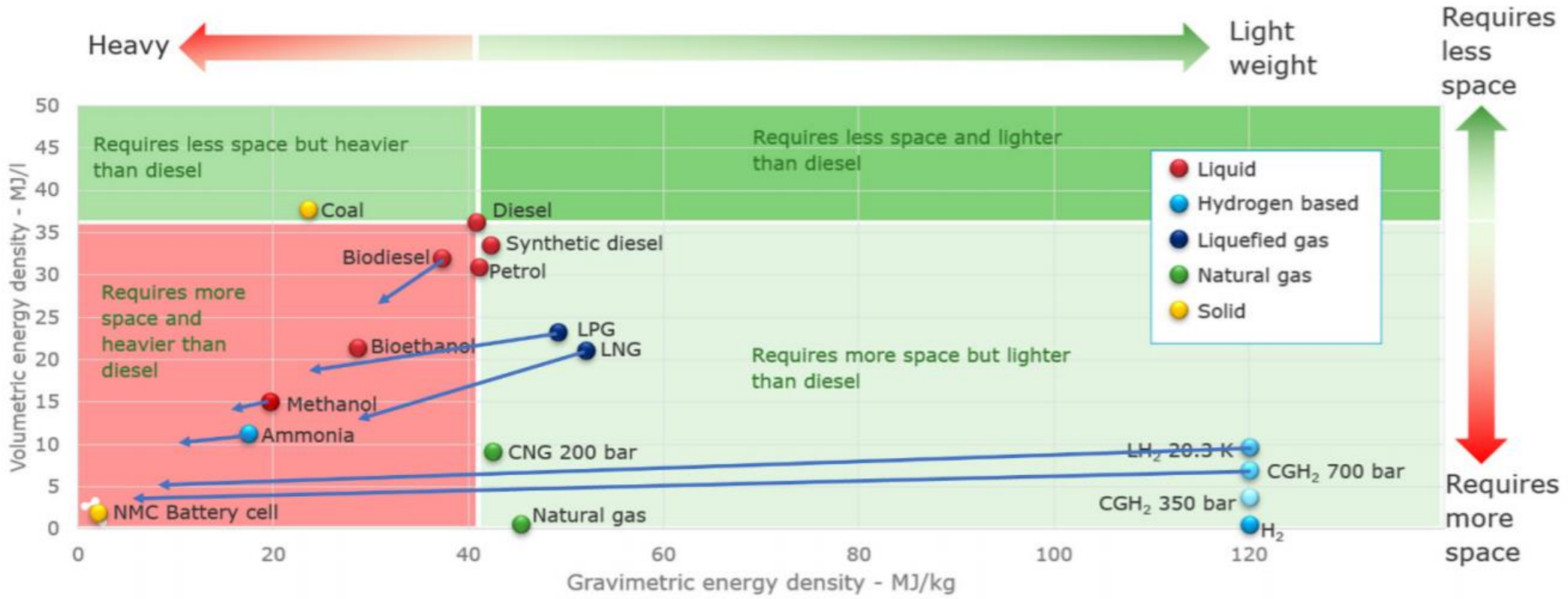

Figure 1-1: Energy densities for different energy carriers (inspired by /49/ /72/ and /73/). The arrows represent the impact on density when taking into account the storage systems for the different types of fuel (indicative values only)

2050 You have to be open to all options to find out a good solution!

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Ammonia

- DNV-GL have predicted that ammonia will be the most popular of the alternative fuels by 2050.
- Like hydrogen, most ammonia is currently made using natural gas. For it to be a viable option, it must in the future be manufactured through low-carbon processes. Ammonia can be burnt in dual-fuel internal combustion engine (MAN B&W report only minor modifications to its LPG fuelled engine are required) or as the energy source for fuel cells.
- There is precedence on using ammonia on vessels, but this has been limited to its use as a refrigerant. The concerns on its toxicity are well-known and it requires careful handling.

Electric and hybrid systems

- The limitations of current technology mean that a fully electric operation – using batteries or fuel cells – is only found on short-sea trades, such as domestic passenger ferries.
- A more common variation is the hybrid ship, the concept of which is very similar to that of a ‘plug-in’ hybrid car. The vessel is fitted with electric propulsion motors that are powered by lithium-ion batteries, which in turn are charged when plugged into a shore power supply or from onboard diesel-driven generators.

Scrubber

- Interim solution not the final solutions

Intersection with real life

- In our experience, cost and availability are two of the biggest factors around buying decisions.
- Regulatory changes, though tough, present an amazing opportunity.

Conclusion

- In order to reach the 2050 target set by the IMO, the industry must focus on **rooting out inefficiencies**, **utilizing on board wind** and **solar power**, **increasing LNG investments globally**, **working on fuel flexibility for engines**, **expanding capacity investments for biogas and synthetic fuels to be mixed with LNG**.

- In the future, there will be other fuels and technologies that will help us de-fossilise the shipping industry, such as **Ammonia, Methanol, fuel cells**, etc. However, today the combustion engine with LNG is the only way to put a real concrete dent in the GHG emissions.