



Alternative Marine Fuels  
*National Marine Safety Association Annual Meetings*

June 2023

[clearseas.org](https://clearseas.org)

# A.P. Moller - Maersk accelerates Net Zero emission targets to 2040 and sets milestone 2030 targets

12 January 2022

Decarbonisation

Sustainability

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## MSC commits to net zero by 2050

Chief Soren Toft makes pledge as family-owned business is set to become world's biggest shipping group



## CMA CGM Group Targets Carbon Neutrality by 2050

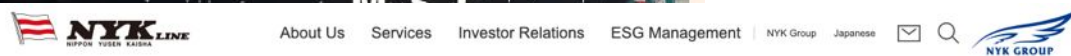


(file photo)

PUBLISHED JUN 3, 2020 6:44 PM BY THE MARITIME EXECUTIVE

CMA CGM Group became the latest large shipping company to accelerate its goals to achieve carbon neutrality.

# HOW?



TOP > News Releases > 2021 > NYK Announces Target of Net-Zero Emissions by 2050 for Oceangoing Businesses

Press Release

### NYK Announces Target of Net-Zero Emissions by 2050 for Oceangoing Businesses

Sep. 30, 2021

NET ZERO BY 2050?

NET-ZERO 2050

Hydrogen?

Ammonia?

Methane?

Methanol?

Biofuel?

# DIFFERING VIEWS ON THE PATH - WHY?

## Maersk books six more methanol-fuelled boxships at HHI

BUSINESS DEVELOPMENTS & PROJECTS

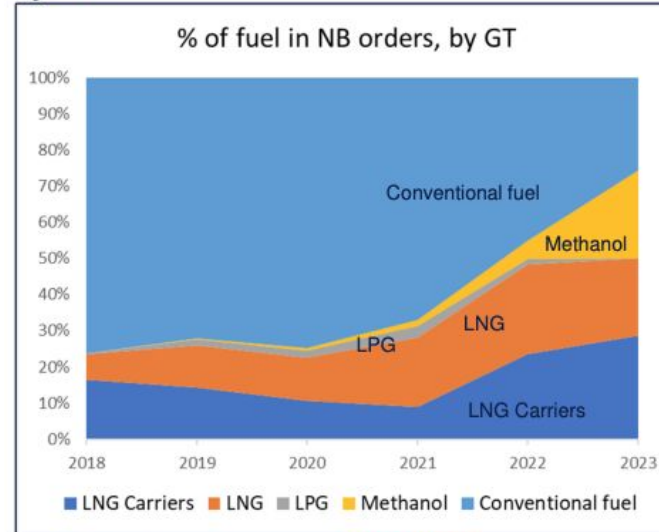
October 5, 2022, by Jasmina Ovcina Mandra



Image credit: Maersk

Danish shipping giant A.P. Moller – Maersk has ordered an additional six large ocean-going vessels that can sail on green methanol.

By GT:



Source: DNV Alternative Fuels Insight - <https://afi.dnv.com/>.

Note: 2023 figures are based on January 2023 orders only



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## Japan's MOL, JERA to Study Transportation of Ammonia Fuel

Emily Chow November 21, 2022



©MOL via Jera

Japan's Mitsui O.S.K. Lines Ltd. (MOL) said on Monday it had signed a memorandum of understanding (MoU) with JERA, the country's biggest power generator, to study transporting ammonia for using it as a fuel.

The study will include looking at ammonia shipments to JERA's Hekinan power station in the Aichi prefecture, which is scheduled to start commercial operations towards the end of the decade, MOL said in the statement.

"With ammonia emerging as a next-generation clean energy source that does not emit carbon dioxide during combustion, large-scale demand for ammonia is expected in the future,

From LNG to e-methane, an effective solution now to prepare for the future



## ZIM's First LNG-powered Containership Begins Maiden Voyage

MarineLink March 9, 2023



(Photo: ZIM)

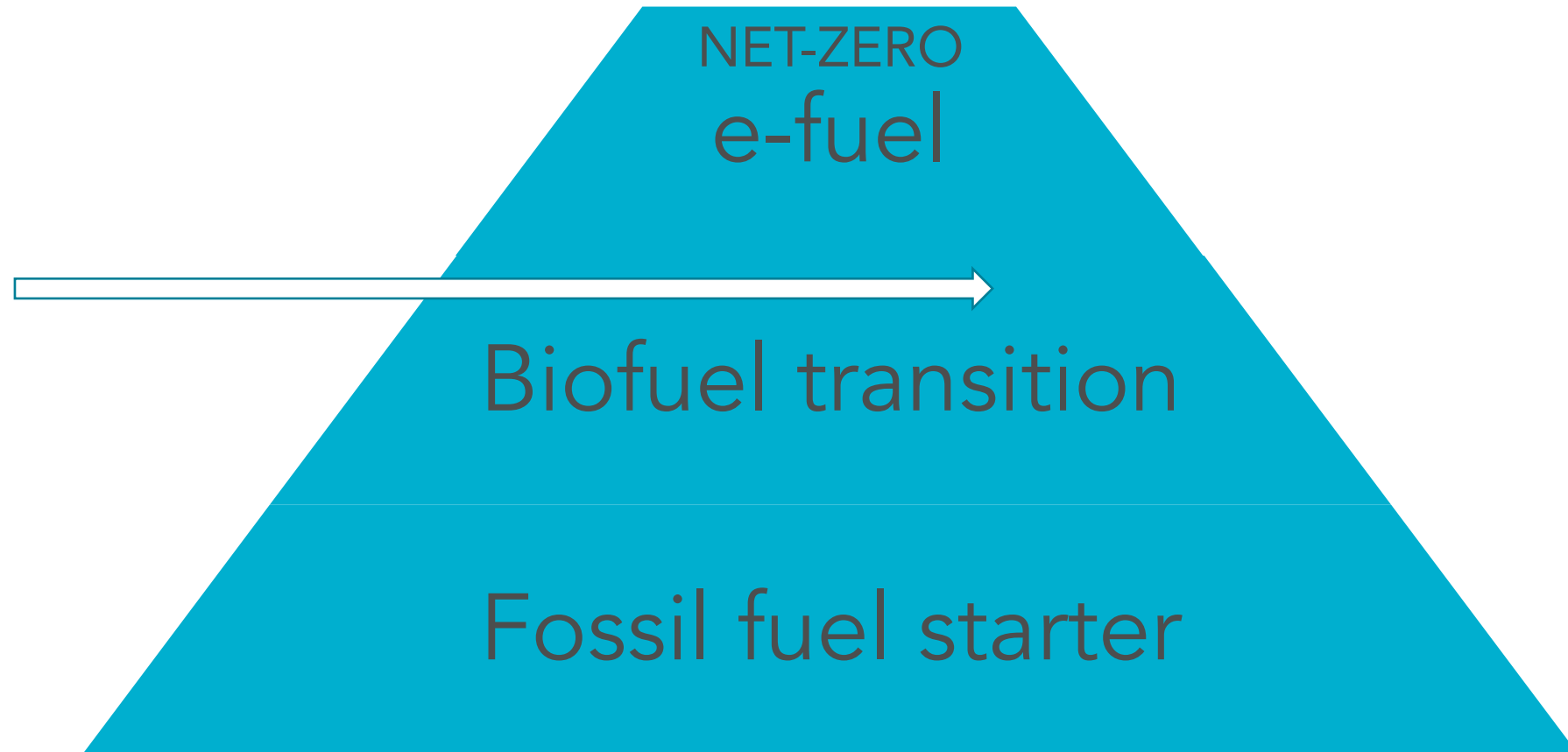
Israeli container carrier ZIM announced its first vessel fueled by liquefied natural gas (LNG) has set sail on its maiden voyage.

The 15,000 TEU dual-fuel box ship Zim Sammy Ofer, built by South Korea's Samsung Heavy Industries, is the first of 10 vessels ordered in a long-term chartering agreement between ZIM and Seaspan Corporation.

The Neo-Panamax vessel is 366-meters long with a 51-meter beam. The vessel has a max service speed of 22.5 knots, a dual-fuel main engine with output of 46,000kW at 80 rpm, and an Energy Efficiency Design Index to meet the tightened emission standards in the future.

The vessel was named after the late shipping magnate Sammy Ofer, who passed away in 2011.

# DECARBONIZATION PARTHWAY ELEMENTS



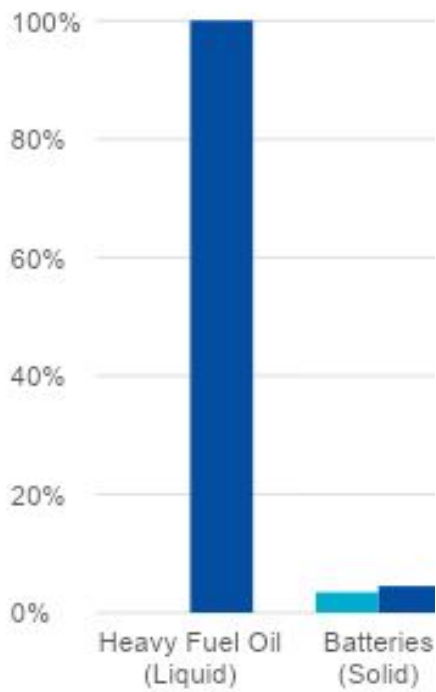
One fuel – same chemical formula

# ELECTRIFICATION



# BATTERIES

Relative Energy Density  
Equivalent range of 1 m3



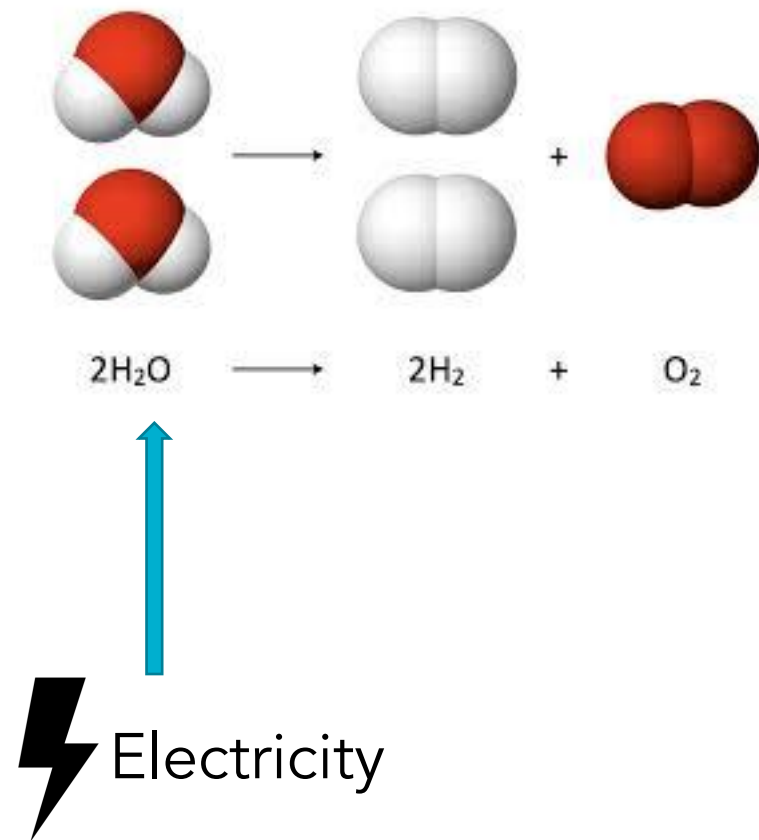
Robert Allan Ltd.



Electrify the fuel



# ELECTROLYSIS



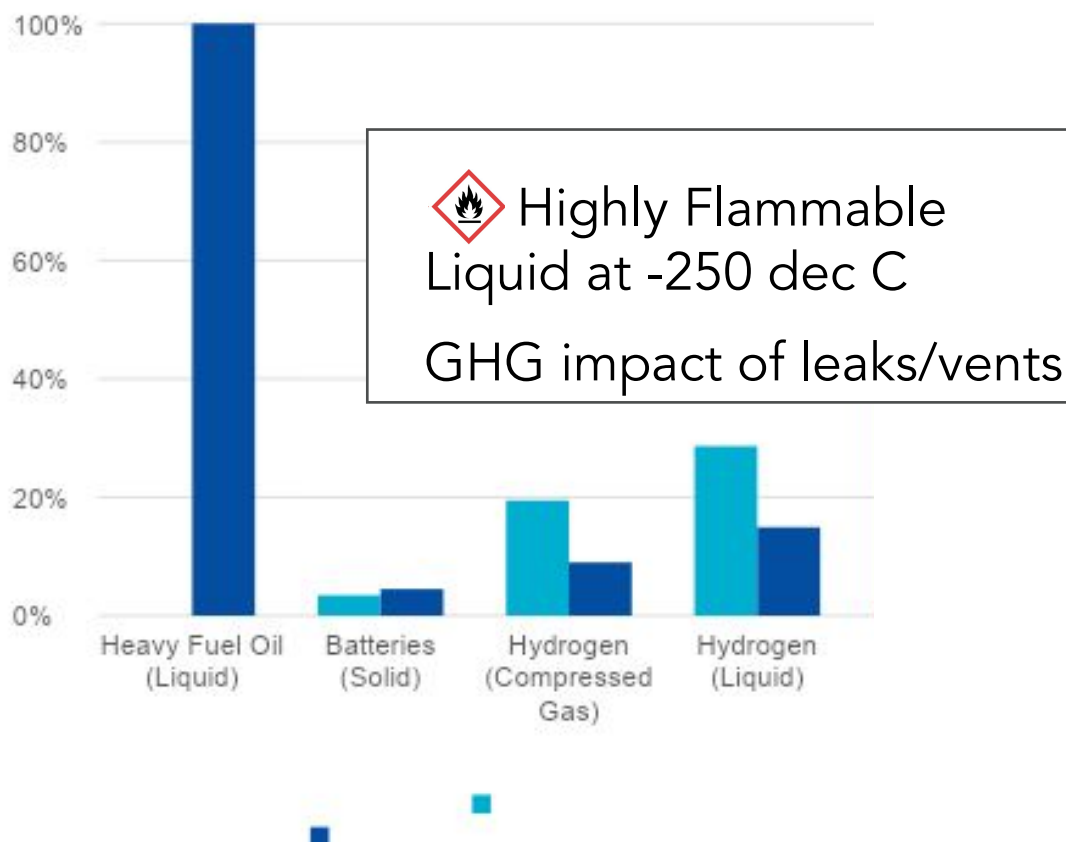
# HYDROGEN FUEL

## Hydrogen ‘twice as powerful a greenhouse gas as previously thought’: UK government study

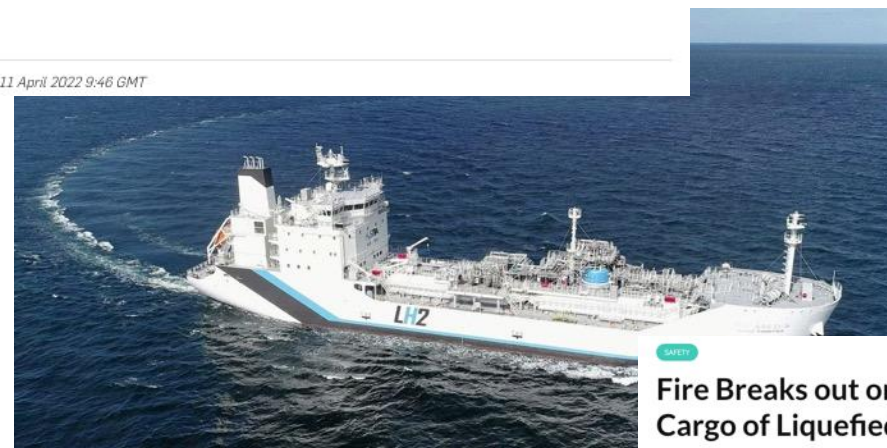
Report highlights importance of preventing leakage from future H2 infrastructure

8 April 2022 14:43 GMT UPDATED 11 April 2022 9:46 GMT

Relative Energy Density  
Equivalent range of 1 m3



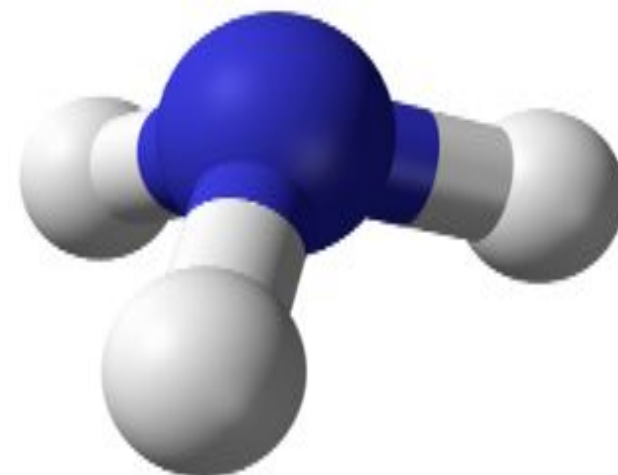
Source: DNV 2019



**Fire Breaks out on World's First Cargo of Liquefied Hydrogen Ship Australia**  
April 5, 2022 1 comment 3 min read

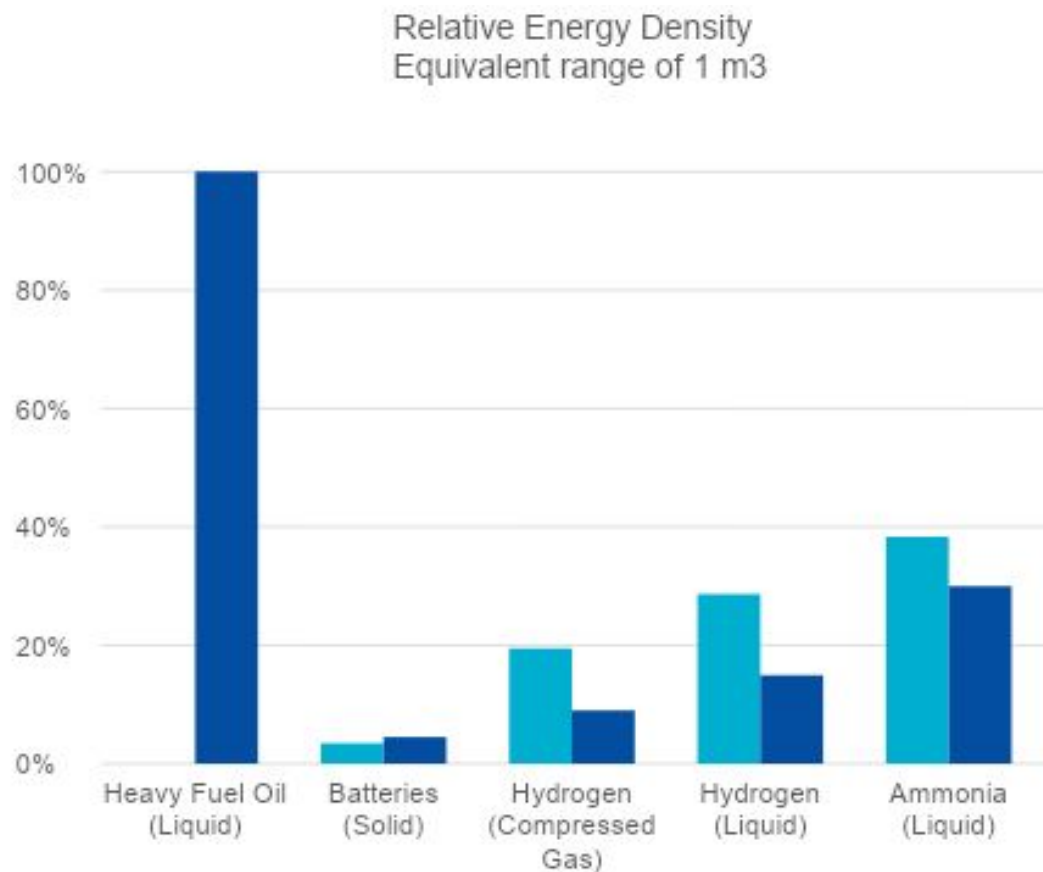


Japanese-Australian HESC project, January 2022 (HESC)



The ammonia molecule (formula NH<sub>3</sub>)

# AMMONIA FUEL



Source: DNV 2019

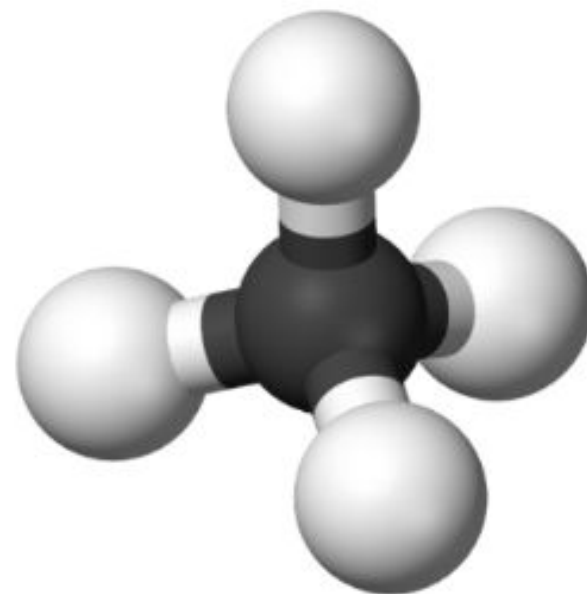
 Toxic

Liquid at -28 dec C

N<sub>2</sub>O GHG emissions?

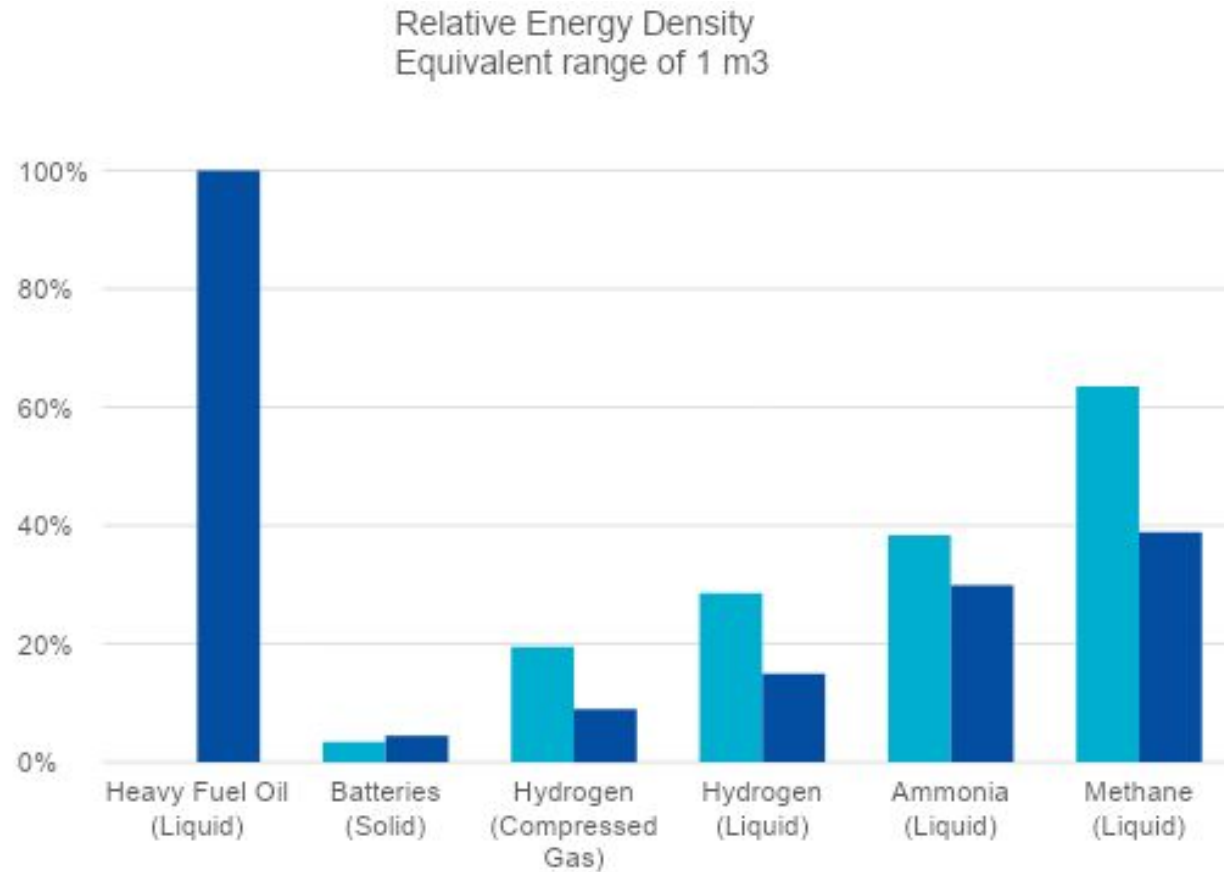
No biofuel

# METHANE FUEL



The methane molecule (formula CH<sub>4</sub>)

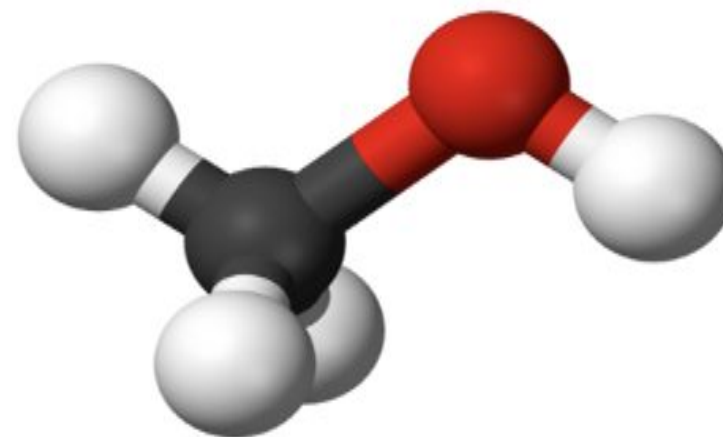
# METHANE FUEL



Liquid at -160 dec C  
Powerful greenhouse gas

Source: DNV 2019

# METHANOL

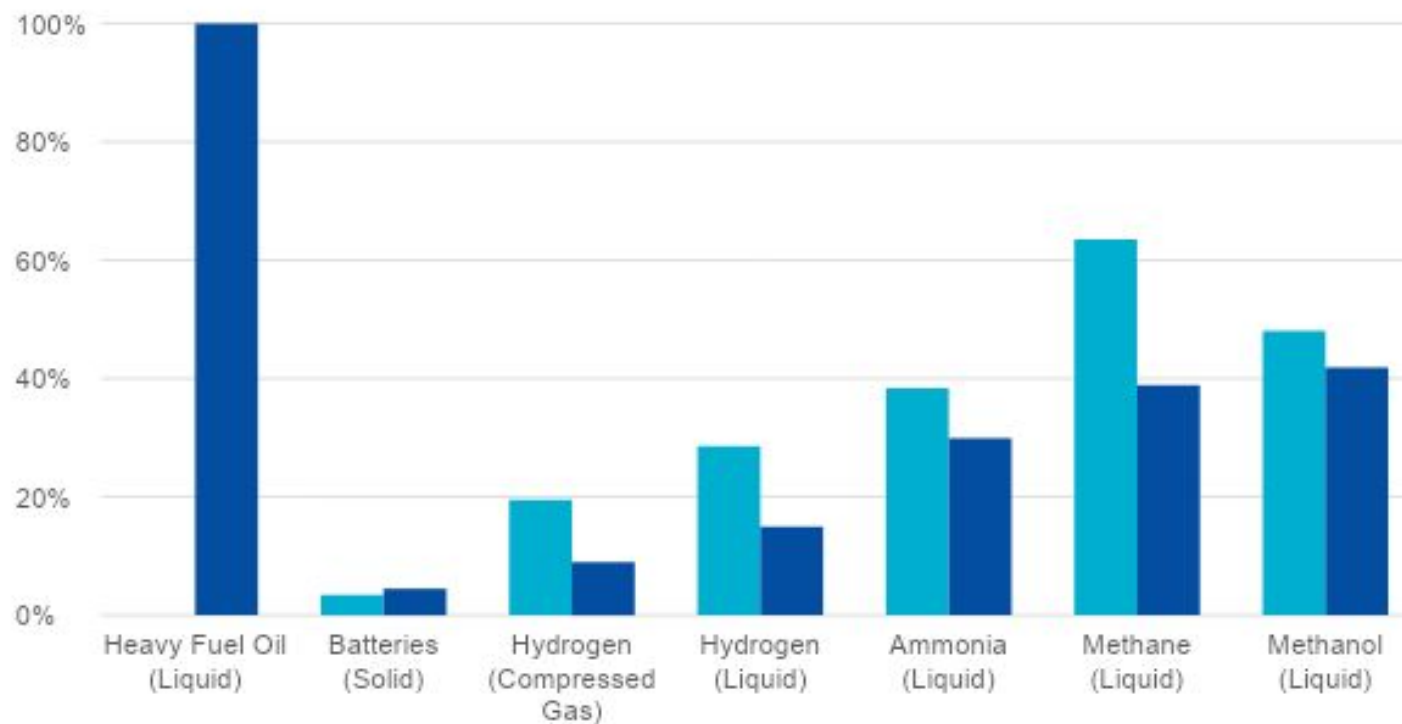


**methanex**  
the power of agility 

The methanol molecule (formula  $\text{CH}_3\text{OH}$ )

# METHANOL FUEL

Relative Energy Density  
Equivalent range of 1 m3



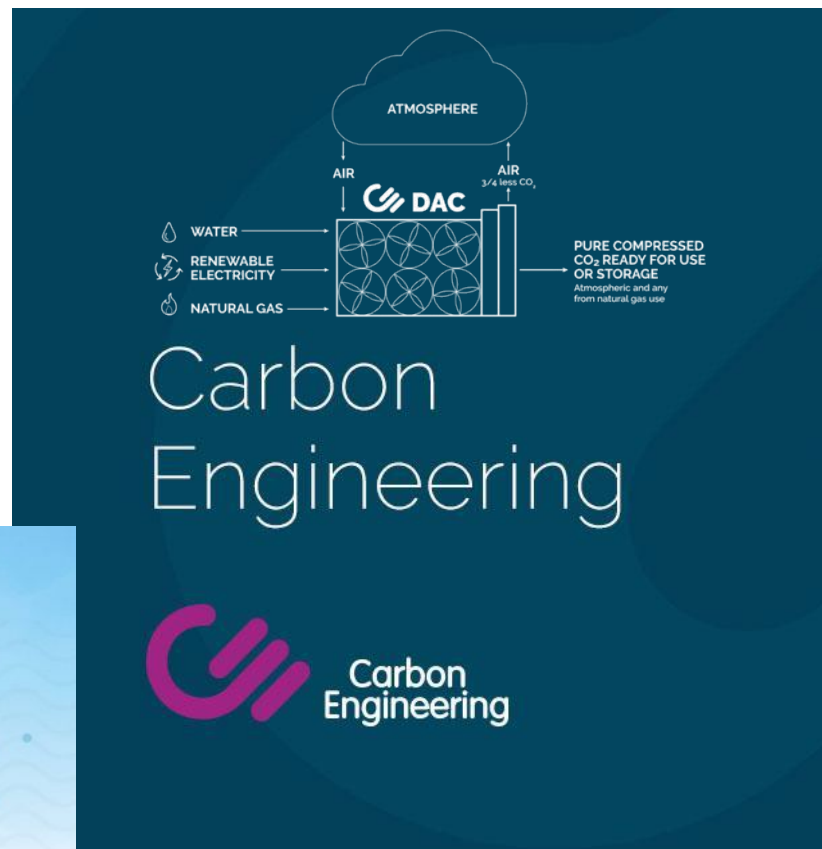
⚠ Toxic

Liquid at 25 dec C

Source: DNV 2019



# DIRECT AIR CAPTURE OF CARBON



# BIOGENIC CO<sub>2</sub> AS AN ALTERNATIVE



Adapted from DRAX BECCS

## Anaergia to supply biogenic CO<sub>2</sub> to European Energy for e-methanol production as fuel for Maersk ships

BUSINESS DEVELOPMENTS & PROJECTS

August 18, 2022, by Naida Hakirevic Prevljak

Canada-based clean energy producer Anaergia has signed an agreement with Denmark's wind and solar energy producer European Energy for the supply of liquefied biogenic carbon dioxide (CO<sub>2</sub>).



# CHALLENGE OF SCALING-UP GREEN HYDROGEN



MARKETS BUSINESS INVESTING TECH POLITICS CNBC TV INVESTING CLUB PRO

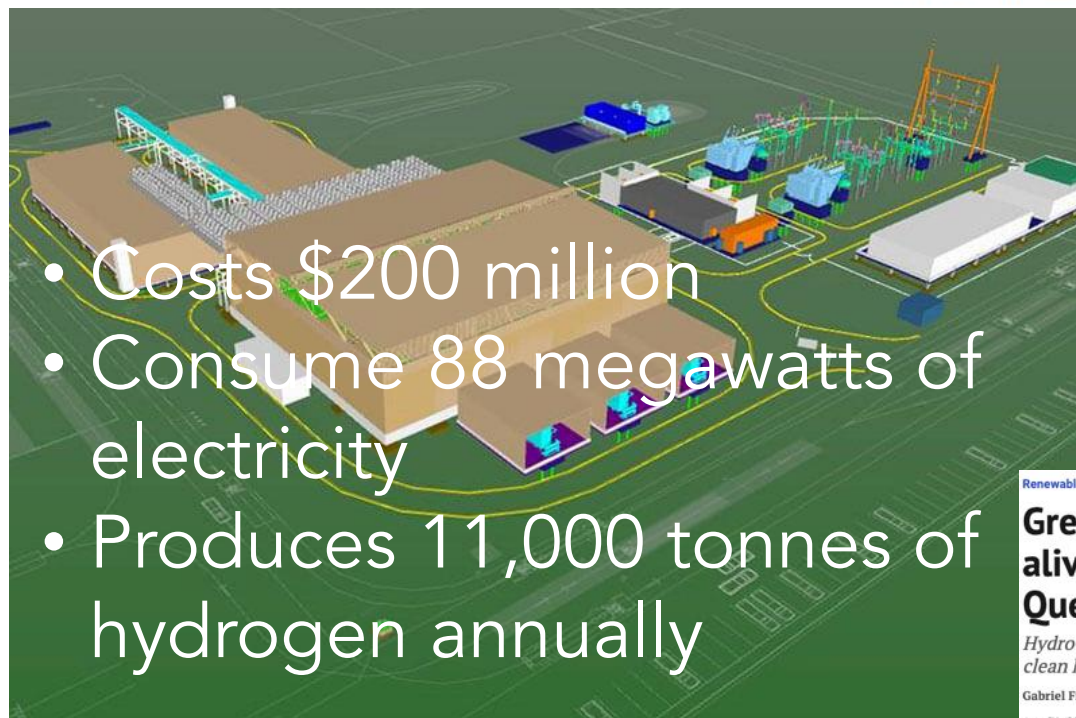
SUSTAINABLE ENERGY

## Canada is set to have one of the world's biggest green hydrogen plants

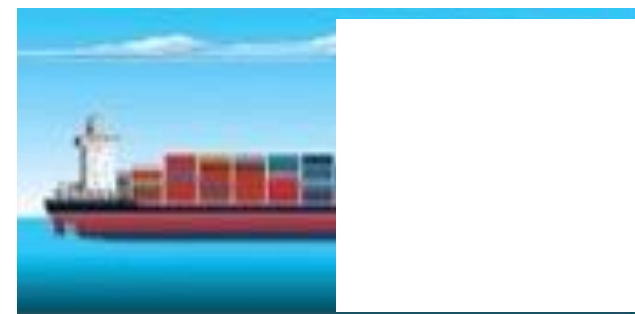
PUBLISHED TUE, JAN 19 2021-10:20 AM EST | UPDATED SUN, JAN 24 2021-8:40 AM EST

Anmar Frangoul

SHARE    



- Costs \$200 million
- Consume 88 megawatts of electricity
- Produces 11,000 tonnes of hydrogen annually



Renewables / FP Energy / Commodities

### Green hydrogen project still alive despite Hydro-Québec exit, Quebec minister says

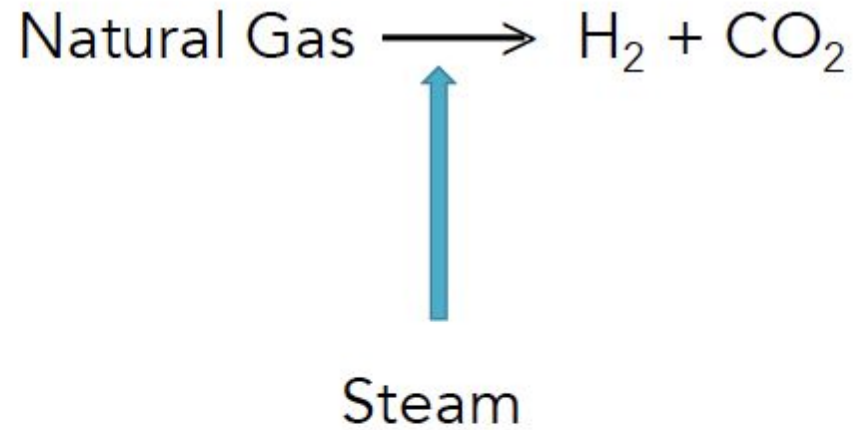
Hydro-Québec has dropped out of a proposed \$1.2-billion clean hydrogen and biofuels project near Montreal

Gabriel Friedman

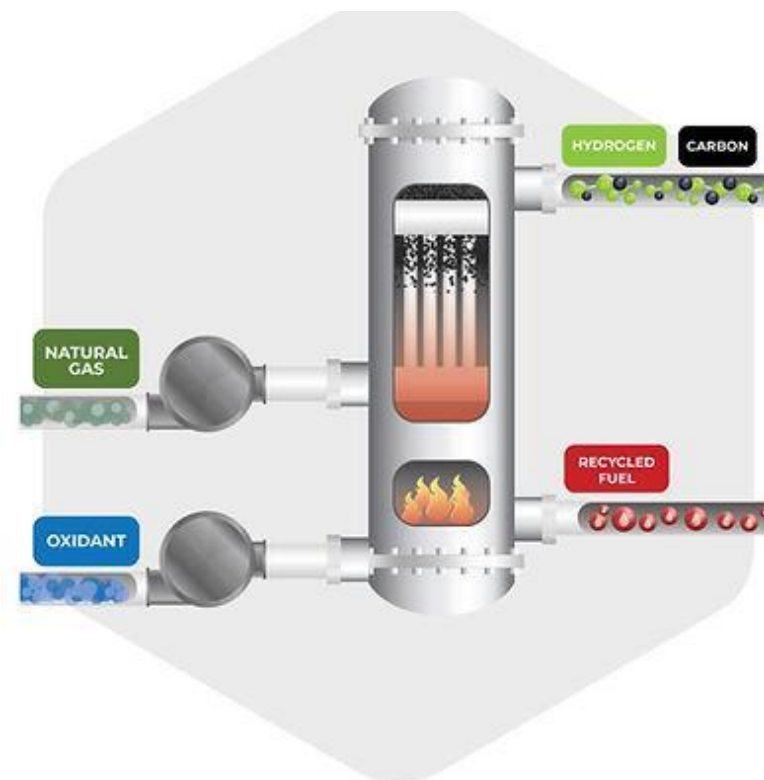
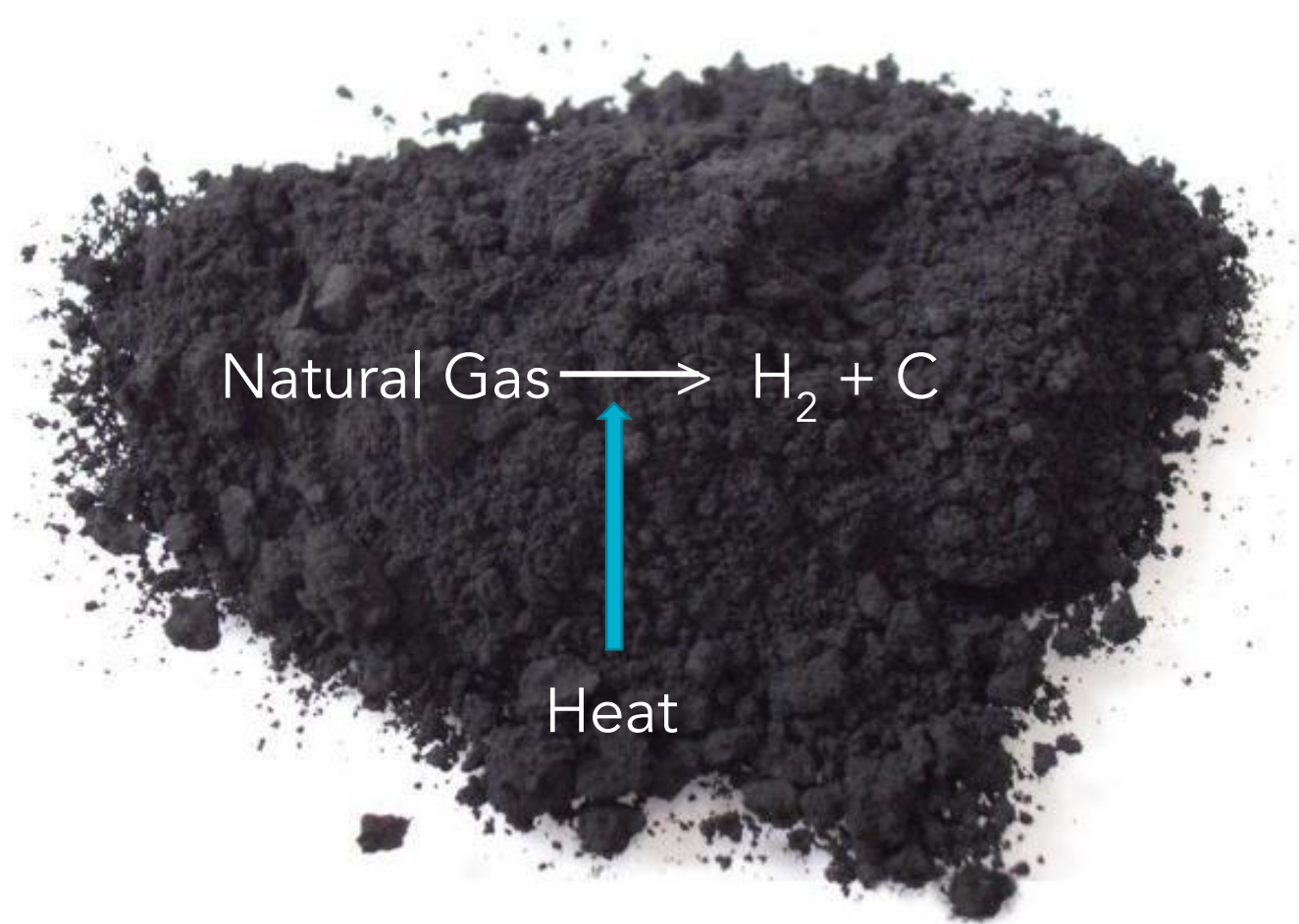
Aug 31, 2022 • August 31, 2022 • 4 minute read

# FOSIL HYDROGEN WITH CARBON CAPTURE?

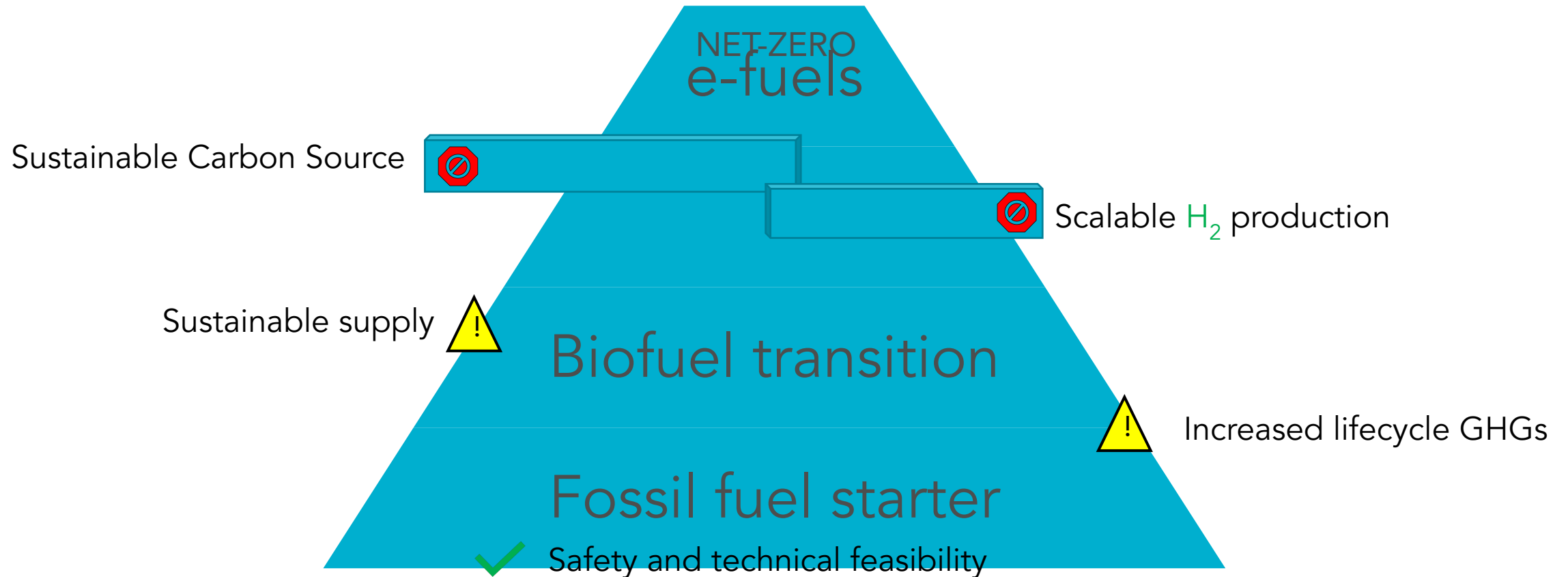
## Steam Methane Reforming (SMR)



# HYDROGEN FROM PYROLYSIS ALTERNATIVE?



# CHALLENGES ALONG THE PATH



# ALTERNATIVE MARINE FUELS

- The transition has already started
- The path is complicated and there will be multiple options
- Safety is paramount to achieving decarbonization

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QUESTIONS