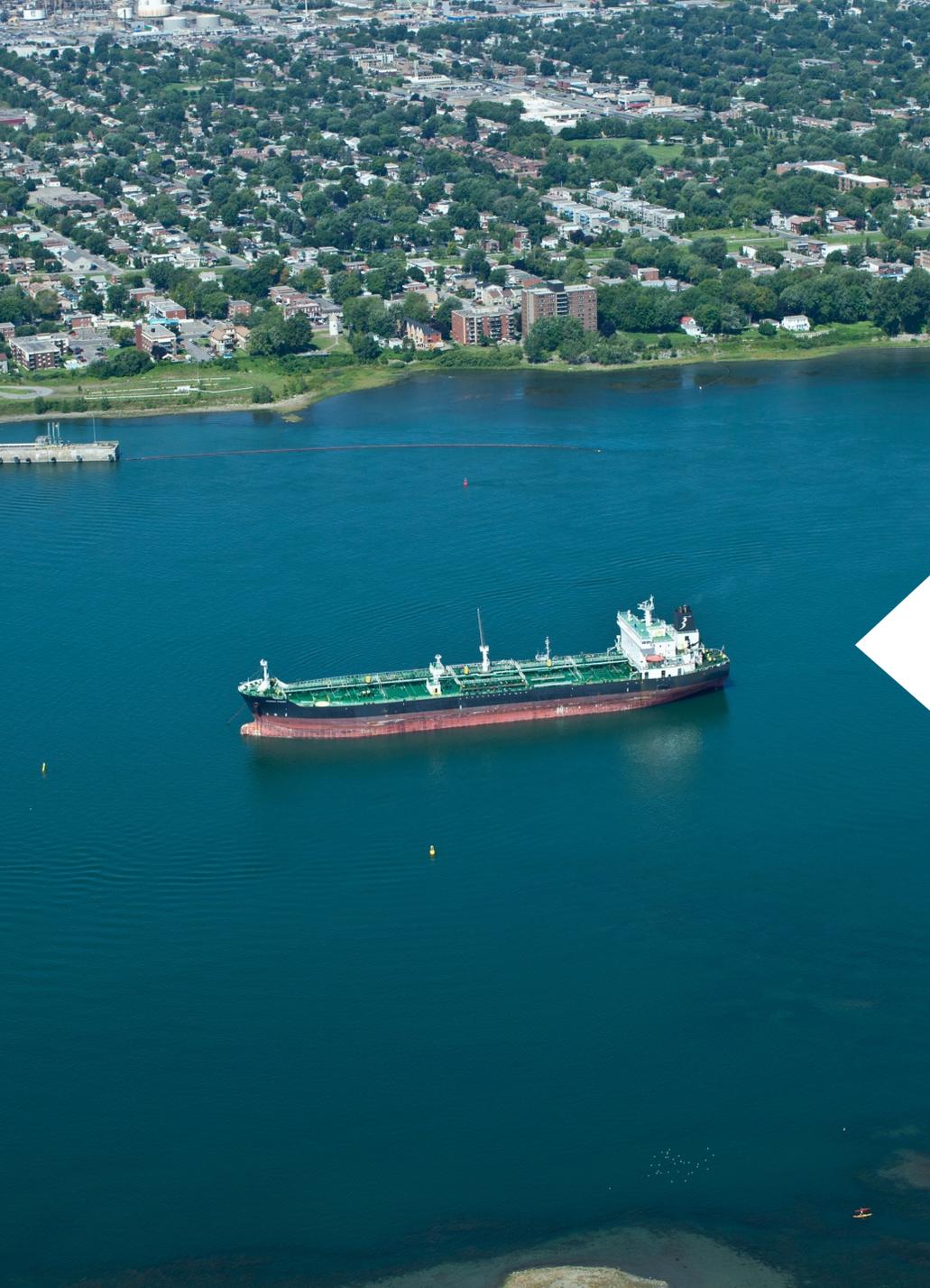




Making progress towards net-zero shipping through alternative fuels  
(hydrogen-based)

**Paul Blomerus**  
***Executive Director***

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



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# ACTING ON OUR MANDATE

## RESEARCH • INFORM • ENGAGE

Provide objective information to decision makers and the public on the topic of safe and sustainable marine shipping, to:

- Improve knowledge of key issues
- Make debate and discussion more inclusive and constructive
- Increase understanding of risks, benefits and best practices
- Support fact-based decision making
- Clarify complex issues to counter misinformation and disinformation
- Identify knowledge gaps and act to fill them using a holistic approach

### **Audience**

- General public
- Industry decision makers and government policy makers
- Indigenous and coastal communities

# COMMUNICATING COMPLEX ISSUES

## Key Issues Pages

 OIL TANKERS	 SHIP WASTE	 RESPONDING TO OIL SPILLS
 UNDERWATER NOISE	 MARINE SHIPPING & YOU	 WHO PAYS FOR AN OIL SPILL
 INVASIVE SPECIES	 AIR POLLUTION	 LNG

## Monthly Blog Posts

#CLEARFACTS BLOG:  
MARINE SHIPPING ISSUES, SIMPLIFIED

We help answer common questions about marine shipping in Canada.

March 1, 2022

**IN THEIR OWN WORDS: REFLECTIONS ON CLEAR SEAS' INDIGENOUS INTERNSHIP PROGRAM**

Clear Seas launched an internship program in 2021 to build respectful relationships with Indigenous communities by listening to and addressing priorities through research projects led by Indigenous post-secondary students.

[Read more](#)

March 1, 2022

**LIQUEFIED NATURAL GAS AS A MARINE FUEL IN THE ARCTIC: PANACEA OR POISON?**

Clear Seas convenes a roundtable to gather perspectives on the use of LNG as fuel for marine shipping in Canada's north.

[Read more](#)

February 25, 2022

**STRANDED AT SEA: COVID-19 AND ITS TOLL ON MARINERS**

The global pandemic, and increased demand by consumers and industry, has disrupted the supply chain and revealed an occupational health and safety crisis among seafarers.

[Read more](#)



MEOPAR  
October 2, 2020

**CANADIAN MARINE SHIPPING RISK FORUM**

In the fall of 2019, the Marine Environmental Observation, Prediction and Response Network (MEOPAR) launched the Canadian Marine Shipping Risk Forum (CMSRF), in collaboration with Clear Seas and exactEarth

[Read more](#)

- Workshops
- Webinars
- Newsletters
- Infographics
- GIS web data

## Research Reports

									
DALHOUSIE UNIVERSITY May 6, 2022 SUPPORTING INUIT RIGHTS AND MARINE USE	CLEAR SEAS April 28, 2022 ASSESSING SHIPPING RISK IN CANADA	MEOPAR December 23, 2021 MARINE SHIPPING TRENDS IN THE CANADIAN ARCTIC	CLEAR SEAS July 12, 2021 MARITIME COMMERCIAL INCIDENTS AND ACCIDENTS	CLEAR SEAS March 2, 2021 VESSEL TRAFFIC IN CANADA'S PACIFIC REGION	ANGUS REID INSTITUTE November 30, 2020 2020 PUBLIC OPINION POLL: CANADIANS' ATTITUDES TOWARDS MARINE SHIPPING	CLEAR SEAS October 6, 2020 ASSESSING SENSITIVITY OF COASTAL AREAS TO OIL SPILLS	CLEAR SEAS July 9, 2019 AVAILABILITY OF TUGS OF OPPORTUNITY IN CANADA'S PACIFIC REGION	CLEAR SEAS September 13, 2018 EMERGENCY TOWING VESSEL NEEDS ASSESSMENT	CLEAR SEAS March 5, 2018 VESSEL DRIFT AND RESPONSE ANALYSIS FOR CANADA'S PACIFIC COAST

An aerial view of a container ship's deck, showing a dense arrangement of multi-colored shipping containers (blue, red, yellow, green, and brown) stacked in neat rows. The ship is sailing on a deep blue ocean under a bright blue sky with scattered white and grey clouds. The perspective is from a high angle, looking down the length of the ship towards the horizon.

NET-ZERO BY 2050?

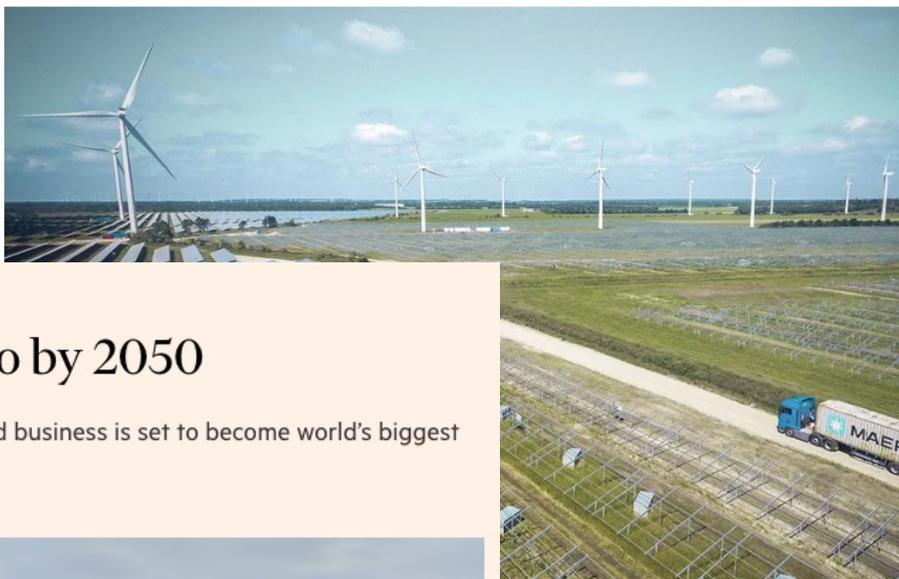
# A.P. Moller - Maersk accelerates Net Zero emission targets to 2040 and sets milestone 2030 targets

12 January 2022

Decarbonisation

Sustainability

Share



## 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?

Shipping + Add to myFT

## 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



MSC says its CO2 emissions last year were 44.3% lower than in 2008 © Rodrigo Garrido/Reuters

# ELECTRIFICATION

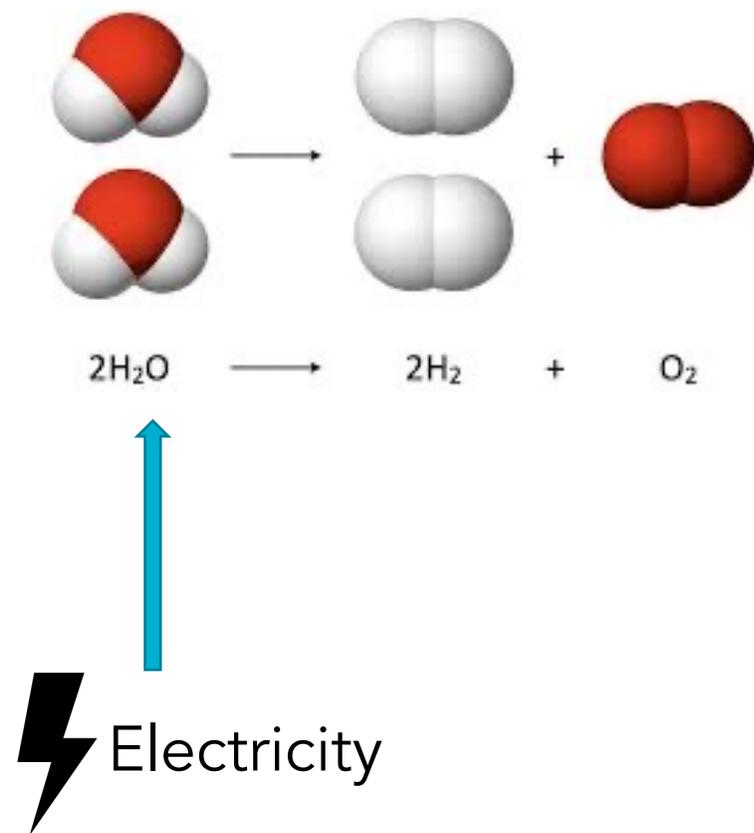
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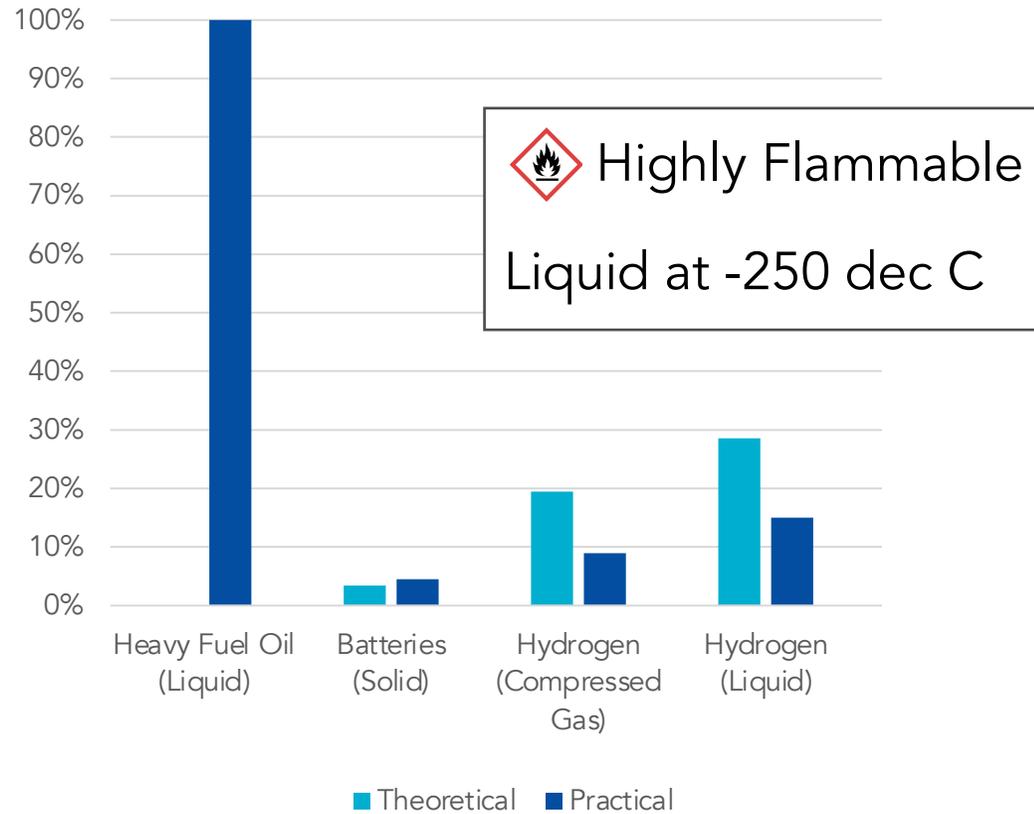
Electrify the fuel

# ELECTROLYSIS



# HYDROGEN

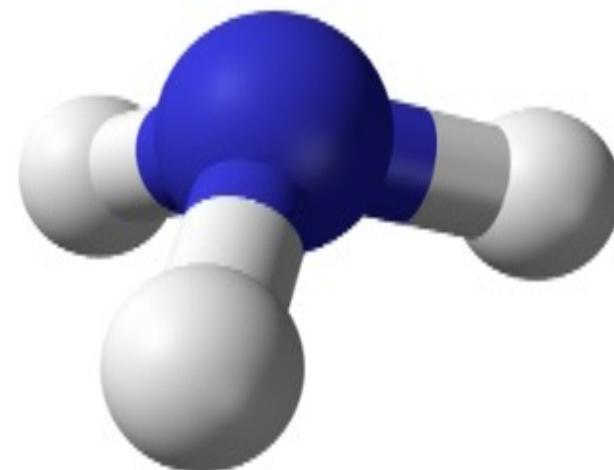
Relative Energy Density  
Equivalent range of 1 m<sup>3</sup>



Source: DNV 2019

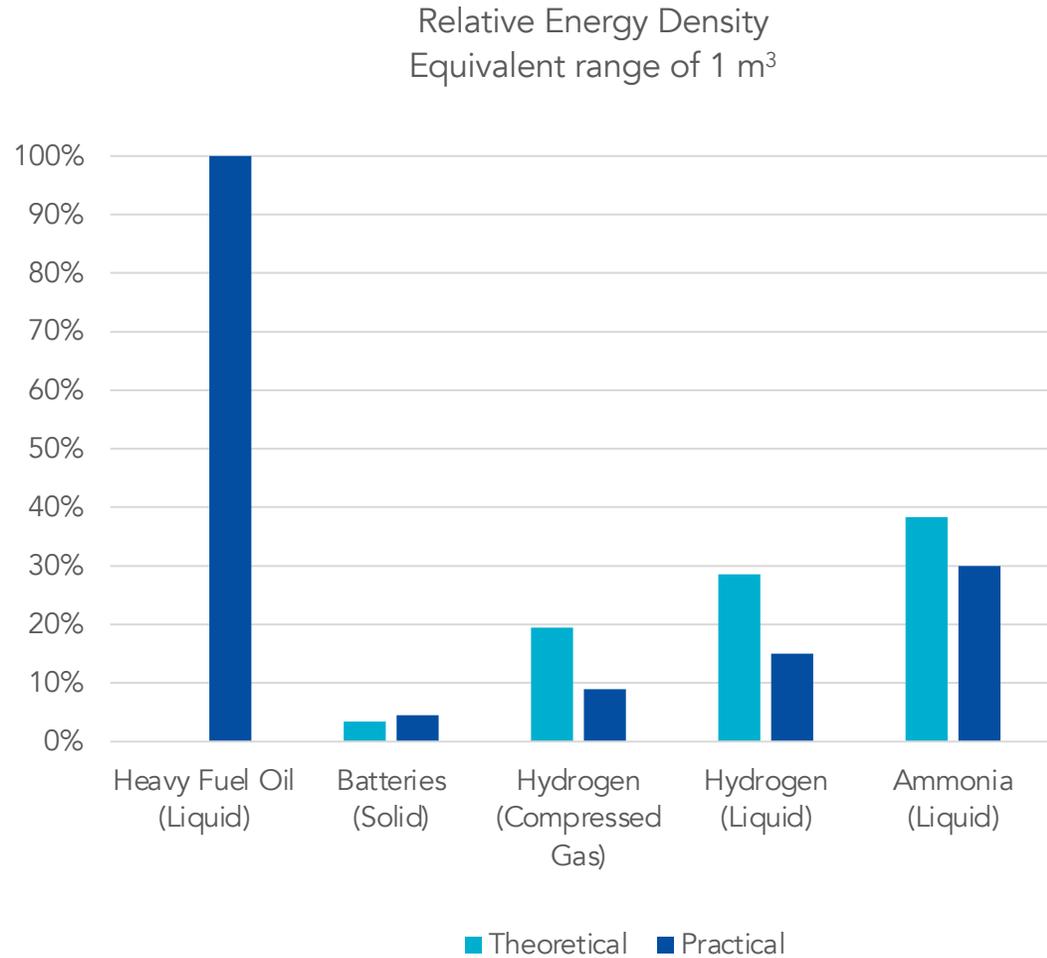


Japanese-Australian HESC project, January 2022 (HESC)



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

# AMMONIA

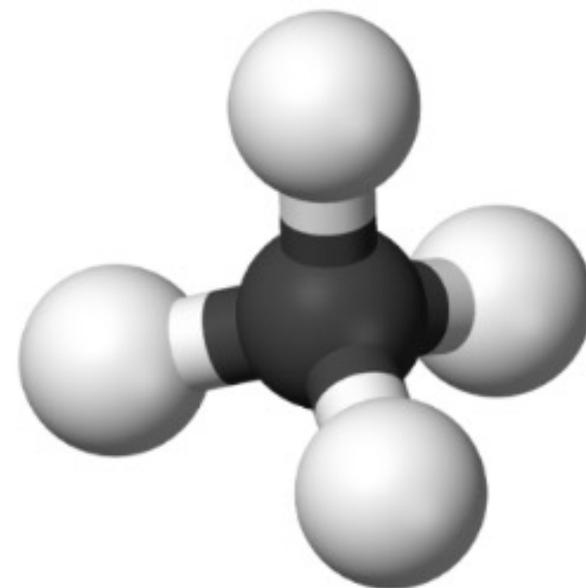


 Toxic

Liquid at -28 dec C

Source: DNV 2019

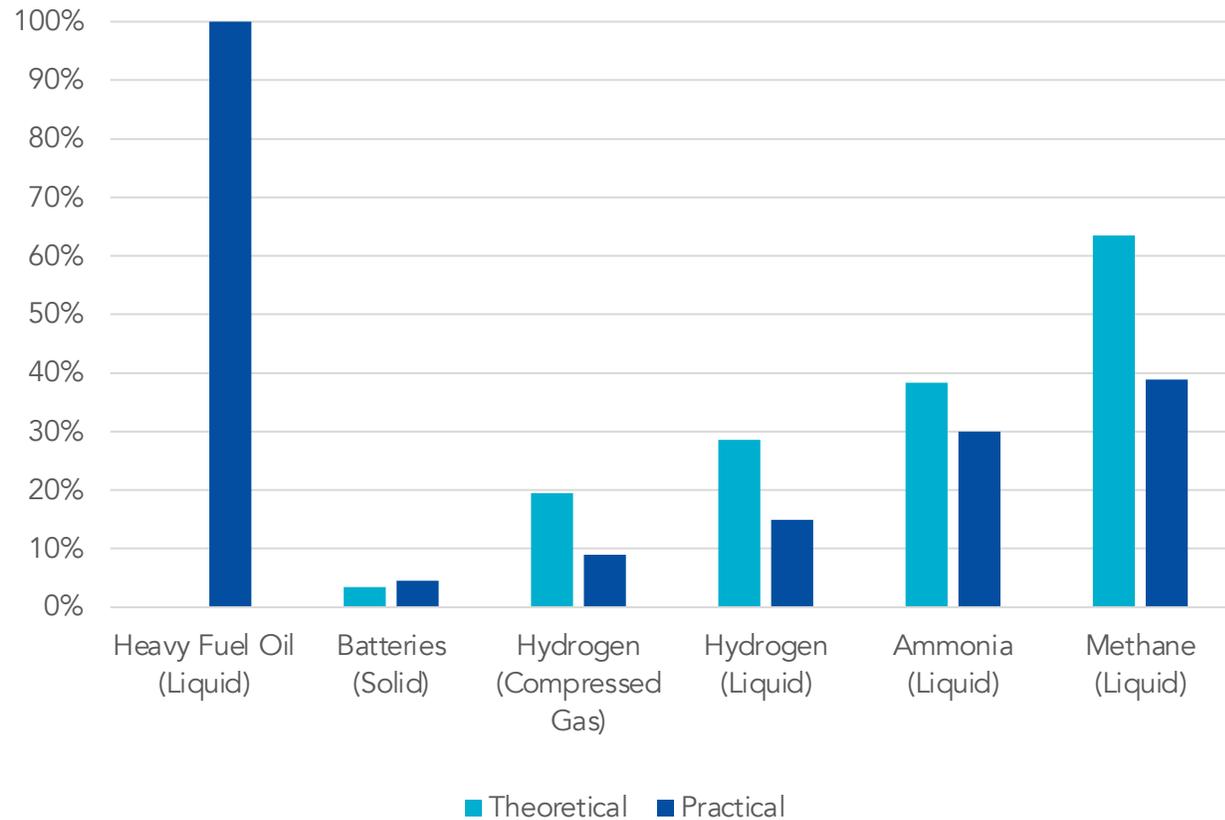
# METHANE



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

# METHANE

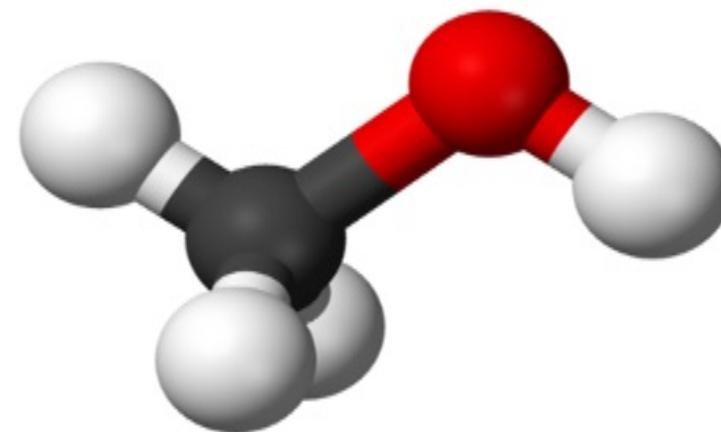
Relative Energy Density  
Equivalent range of 1 m<sup>3</sup>



Liquid at -160 dec C  
Powerful Greenhouse Gas

Source: DNV 2019

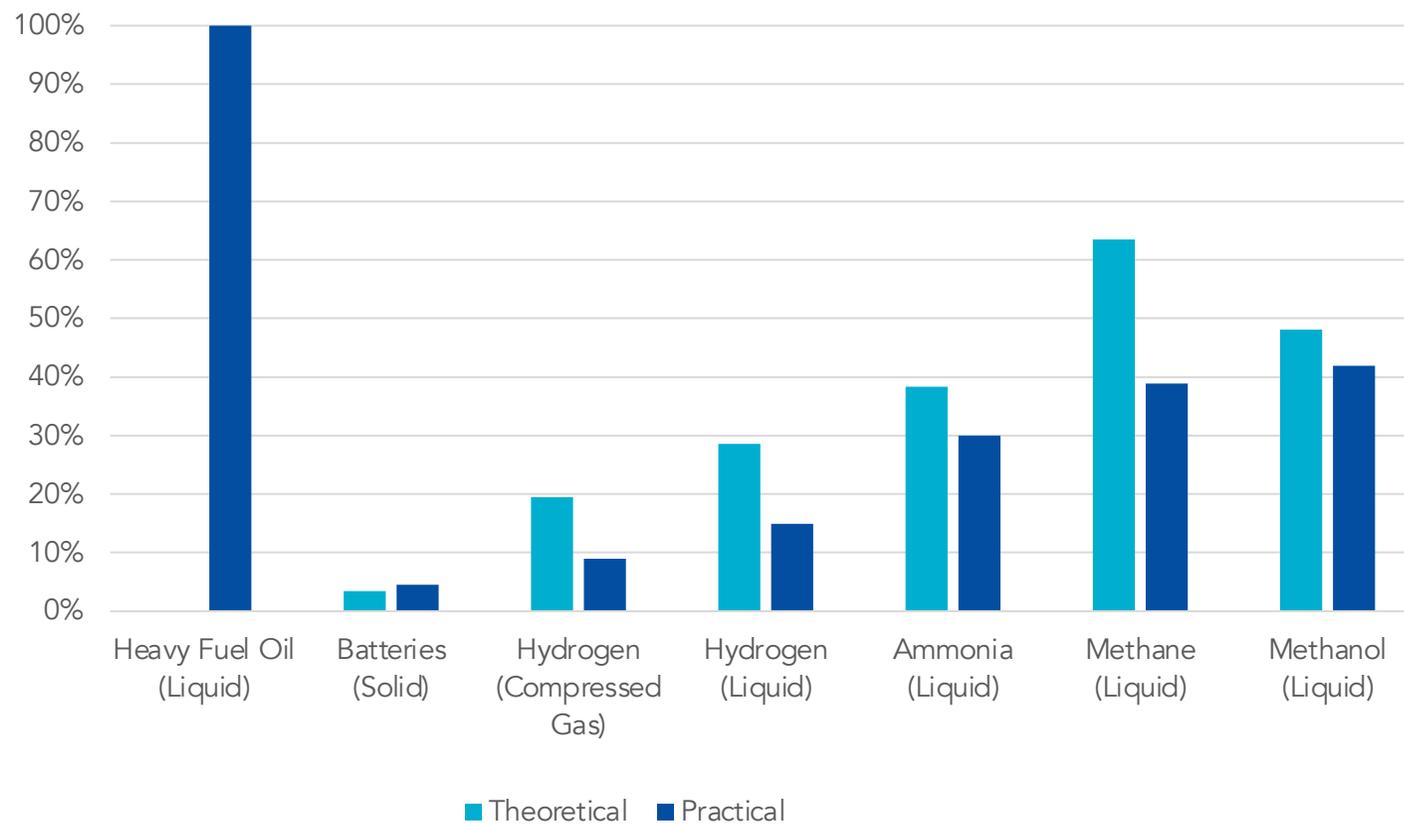
# METHANOL



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

# METHANOL

Relative Energy Density  
Equivalent range of 1 m<sup>3</sup>



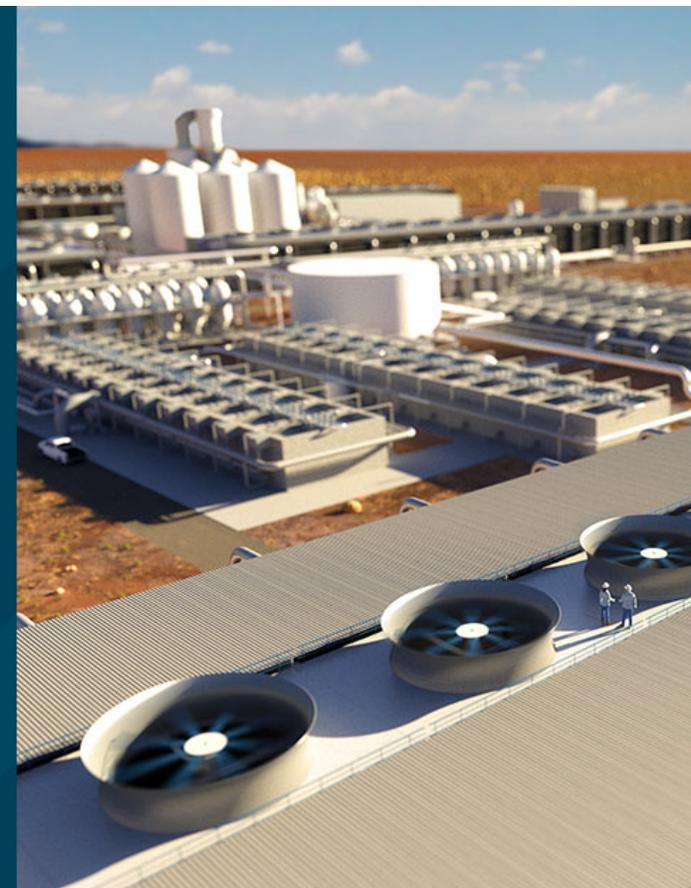
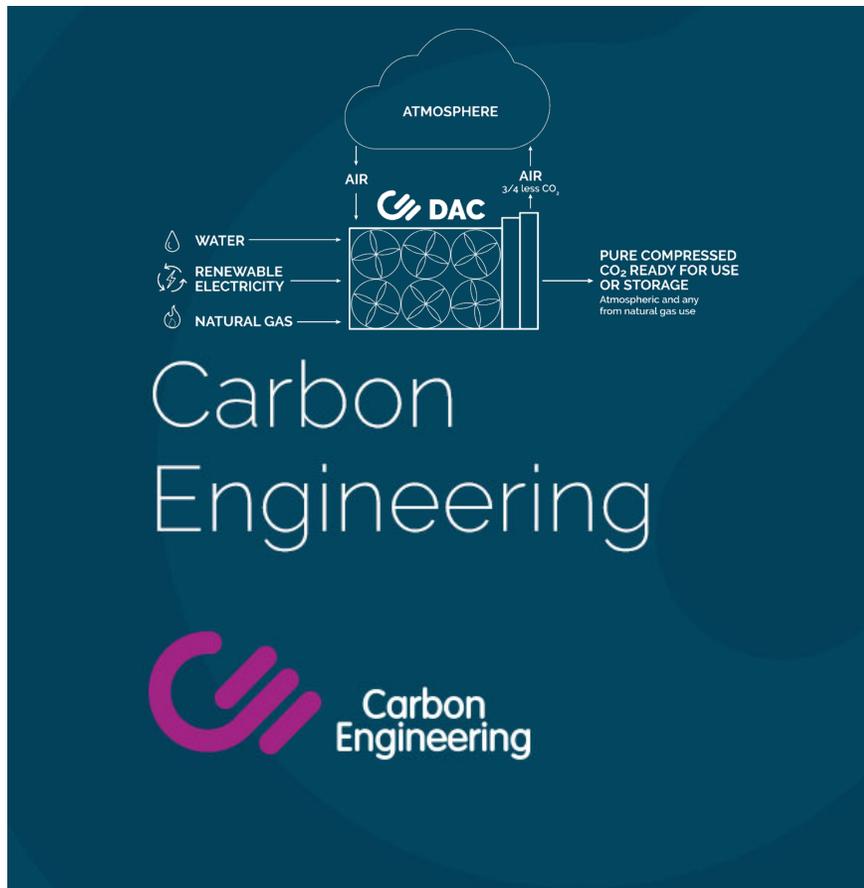
Source: DNV 2019



Toxic

Liquid at 25 dec C

# DIRECT AIR CAPTURE OF CARBON



# CHALLENGE OF SCALING-UP GREEN HYDROGEN



MARKETS BUSINESS INVESTING TECH POLITICS CNBC TV INVESTING CLUB PRO

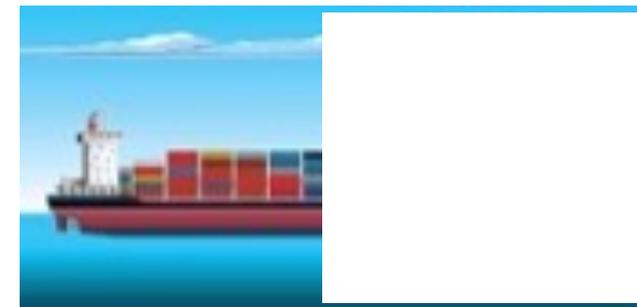
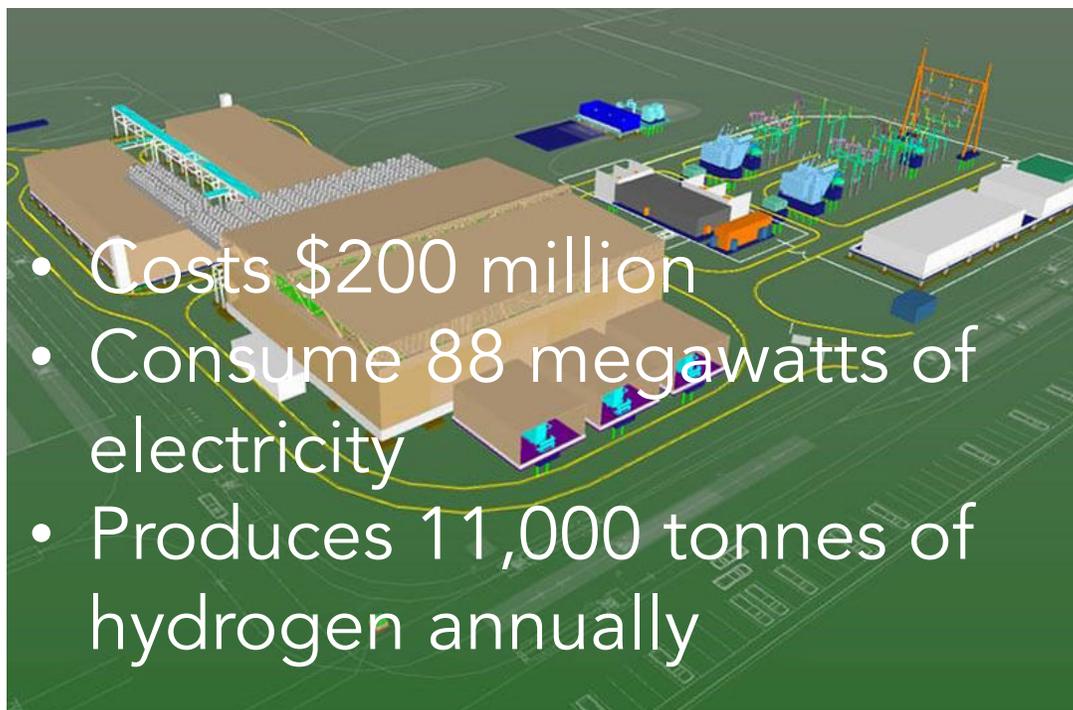
SUSTAINABLE ENERGY

## 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

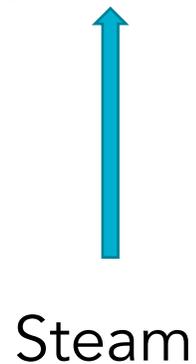
Anmar Frangoul

SHARE [f](#) [t](#) [in](#) [✉](#)

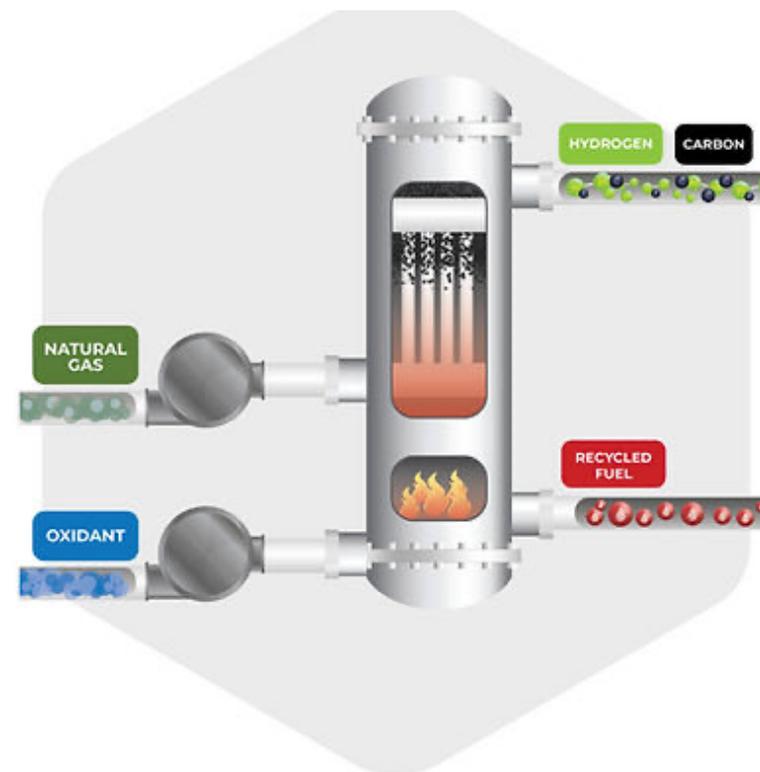
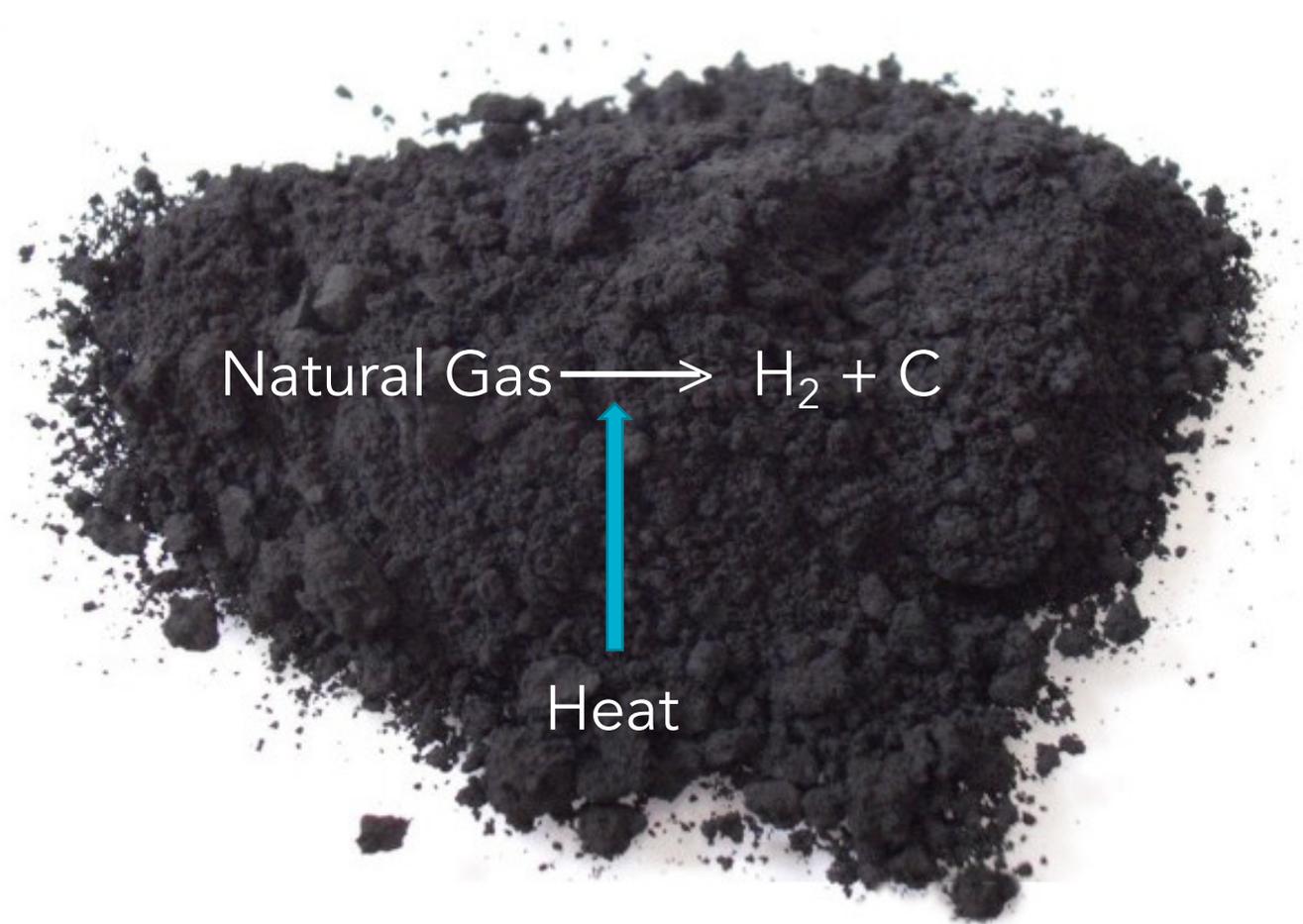


# FOSIL HYDROGEN WITH CARBON CAPTURE?

Steam Methane Reforming (SMR)



# HYDROGEN FROM PYROLYSIS?



# MORE WORK TO GET TO ZERO EMISSIONS FUEL

Ship and engine technology	✓
Manufacture and transportation	✓
Bunkering	✓
Scalable sustainable Hydrogen source?	⚠
Scalable sustainable Carbon source?	⚠
Fossil fuel equivalents with higher GHGs	⊘

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Paul Blomerus  
Executive Director | Directeur exécutif  
355 Burrard St., Suite 630 Vancouver, BC V6C 2G8  
Phone: (778) 730-1375  
[paul.blomerus@clearseas.org](mailto:paul.blomerus@clearseas.org)

Centre pour le transport maritime responsable **CLEAR SEAS** Centre For Responsible Marine Shipping  
[clearseas.org](http://clearseas.org) | [Twitter](#) | [Facebook](#) | [LinkedIn](#)

An aerial photograph of ocean waves, showing white foam and deep blue water. A dark blue callout box with a downward-pointing arrow is centered in the lower half of the image. The word "QUESTIONS" is written in white, uppercase, sans-serif font inside the box.

QUESTIONS

# CLEAR SEAS NEW RESEARCH PRIORITY AREAS

1. Maritime Industry Progress on UN SDGs
2. GHG Emissions Footprint of Canadian Marine Trade
3. Small Tug Safety
4. Port State Control Inspections for Marine Safety – statistical analysis
5. Understanding Shipping Risk in Canada's Atlantic Region – tugs of opportunity changes
6. Role of Safety Management System in Shipping – does it need refreshing?
7. Changes in Risk for Shipping HNS
8. Demonstrating the Benefits of an Integrated and Data-informed Supply Chain
9. TMSA and SIRE System Applications to Other Ship Types
- 10 Reducing Crew Fatigue in Marine Shipping