METHANOL INSTITUTE

Charting a course for methanol marine fuels

ASME-USCG Workshop on Marine Technology and Standards

October 16-17, 2017

01 WHO WE ARE

History

- The Methanol Institute (MI) was first formed in 1989 to represent US methanol producers in Washington

- 28 years later, MI is truly a global trade association supporting the expansion of the methanol industry in every corner of the world from offices in:

Singapore | Washington | Brussels | Beijing

OUR 2017 MEMBERS

MI STRATEGIC PARTNERS

- American Chemistry Council
- Solar Fuels Institute
- National Biodiesel Board
- Gasification & Syngas Technologies Council
- Asian Clean Fuels Association
- China Nitrogen Fertilizer Industry Association
- Chinese Association of Alcohol & Clean Ether Fuels & Automobiles
- China Ministry of Industry and Information Technology
- Peking University Center for New Global Energy Strategy Studies
- Gulf Petrochemicals and Chemicals Association
- International DME Association
- European Chemical Industry Council (CEFIC)
- Formacare
- German Regenerative Methanol Network
- International Methanol Producers & Consumers Association
- European Sustainable Shipping Forum (ESSF)
- International Bunker Industry Association
- Dangerous Goods Advisory Council

02 MARINE FUELS

Marine Fuel Drivers

- ✓ **Scale**: Marine sector consumes 370 million metric tonnes of bunker fuel per year
- ✓ **Sustainability**: There needs to be a viable pathway to low- & no-carbon marine fuels
- ✓ **Price**: Need to be price competitive with current bunker fuels and other alternatives such as LNG
- ✓ **Supply:** Fuel needs to be available globally
- ✓ **Safety:** Ship operators need to be assured of safe handling on-board vessel and for bunkering

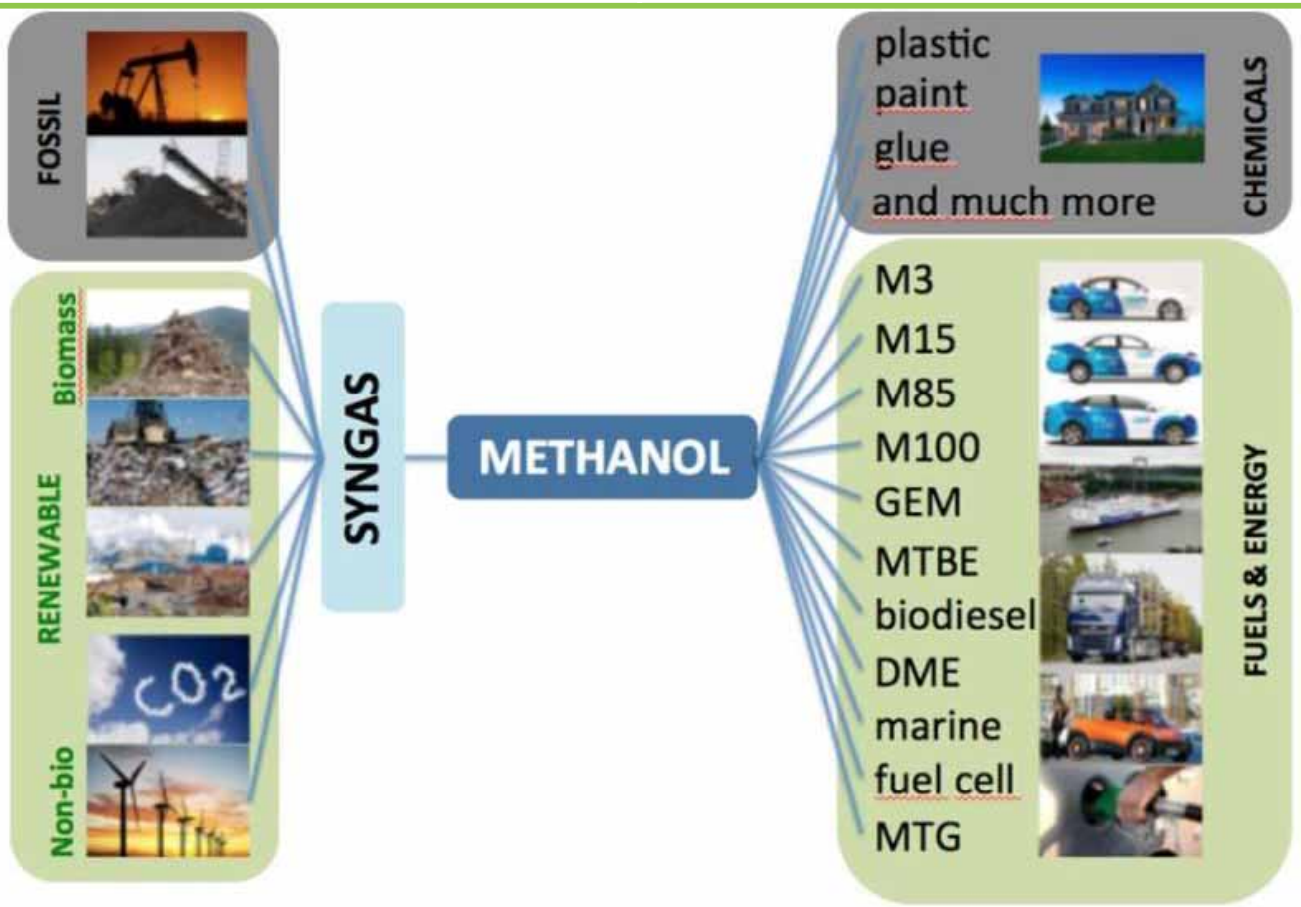
The Clear Alternative Marine Fuel

Diesel Bunker Fuel

Methanol Marine Fuel

Feedstock: Abundant/Sustainable

Market: Large/Diverse

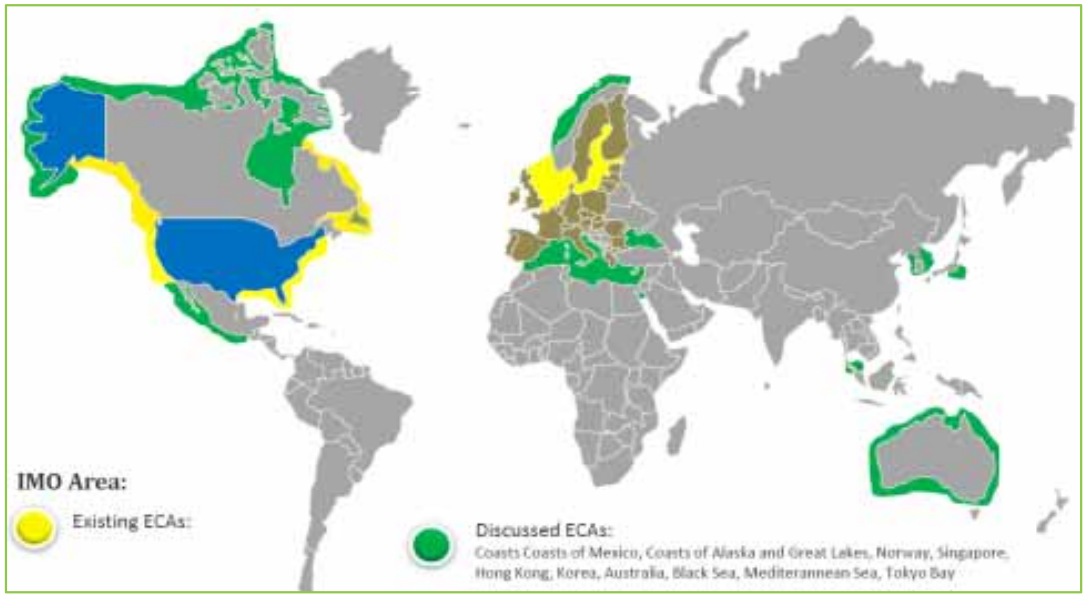


Status of different technologies

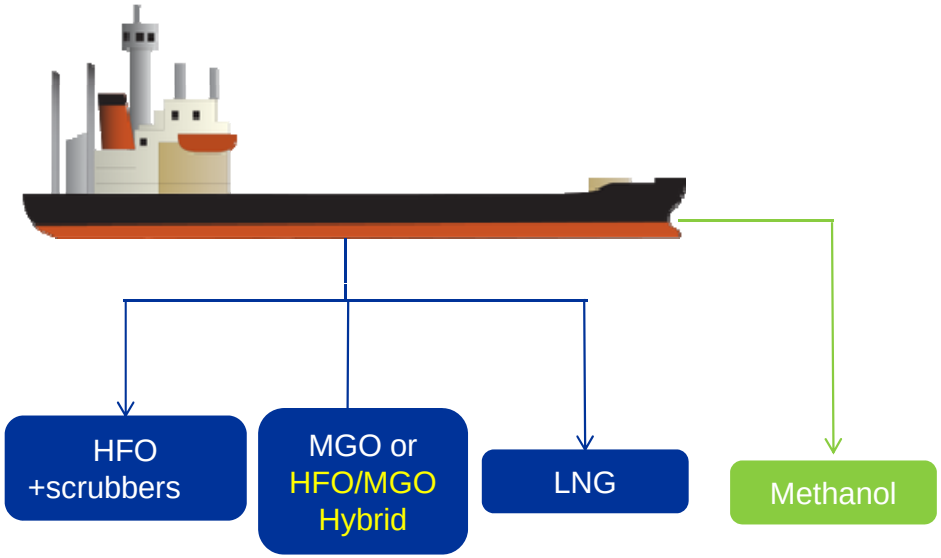
Methanol category	Commercial	Feasibility	On hold/stopped
Bio-methanol	**BioMCN (biogas), Enerkem (Can), Oberon,** NewFuel (biogass)	**Enerkem (NL/US),** LowLands Methanol, Södra	**BioMCN (glycerine),** Chemrec, Range Fuels, Schwarze Pumpe, Värmlands Metanol, Woodspirit
Renewable methanol	**Carbon Recycling International,** innogy	Port of Antwerp, Infraserv, Liquid Wind, STEAG, Swiss Liquid Future, ZASt	
Hybrid methanol		OPTIMeoH	
Low carbon methanol	**Methanex, QAFAC, SABIC,** GPIC	Carbon2Chem, FRESME, Swerea	

Emissions regulations driving market

- The International Maritime Organization has adopted regulations for SOx and NOx that are transforming the shipping industry
- While 2020 global SOx reductions may be met with low sulfur fuels, the combination of SOx and NOx reductions driving shipboard solutions
- Next up: Greenhouse gas emissions



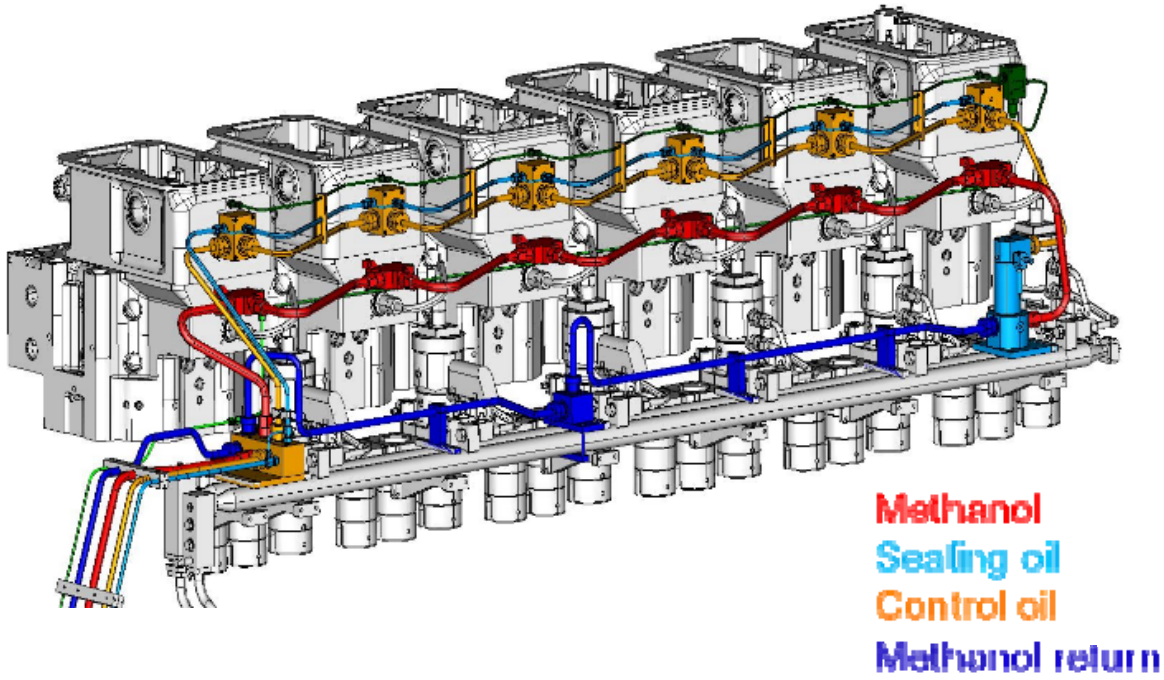
Options available to ship owners



Methanol Commercial Projects

- **March 2015 (Sweden):** Stena *Germanica* features Wärtsilä medium-speed 4-stroke methanol-fueled marine engine
- **2016 (Global):** Methanex's Waterfront Shipping – seven (7) vessels with low-speed 2-stroke MAN methanol/diesel engines
- **2H-2016 (Sweden/China):** ScandiNAOS Green Pilot Boat conversion

Wärtsilä Methanol-Diesel engine piping



Source: Wärtsilä

Emissions Reductions

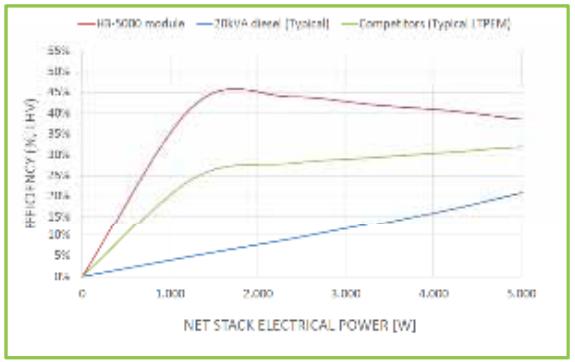
Methanol is among the lowest emission fuels for marine engines

Source: Stena Lines -- Emission reductions when compared to alternative fuels currently available (fuel oil)

Methanol fuel cells for “hotel load”

- As part of Germany’s Pa-X-ell project ship builder Meyer Werft installed a Serenergy high temperature PEM 90-kW methanol fuel cell system demonstrator on board the Viking *Mariella*

- Modular units form basis of a higly efficient and decentralized network on board

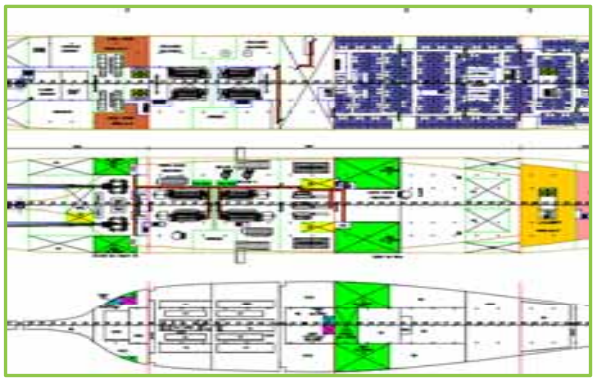


Methanol fuel cells for propulsion

- *MS innogy* launched in August as world's first methanol fuel cell powered vessel for CO2 neutral and zero particulate sailing

- Features 35 kW methanol fuel cell system from SerEnergy used to recharge a battery pack for all day sailing on on a German lake

MethaShip



- Nationally funded German research project
- Goal: Examine the potential of methanol as a fuel for cruise ships and RoPax ferries
- Physics of methanol surpassess other alternative fuels
- Most promising LCA when renewably produced

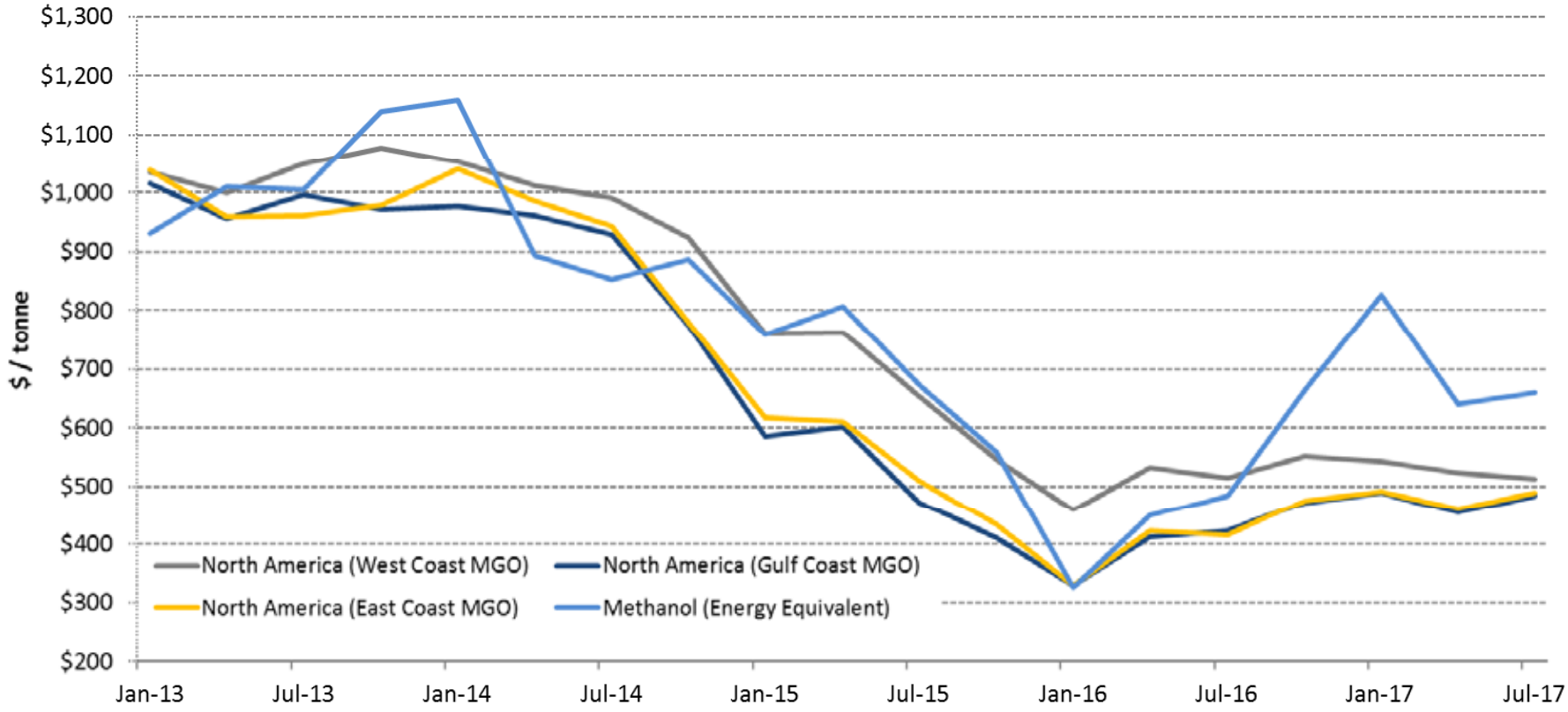
- For cruise ships, integrated storage tanks using double bottom save space
- Infrastructure will play major role with decision makers
- HAZID of bunkering by inland waterway chemical tanker

LeanShips

- Demonstrate **high-speed** diesel engine converted to dual fuel operation
- Maintain 100% diesel capability
- Possible retrofit solution
- Smaller vessels

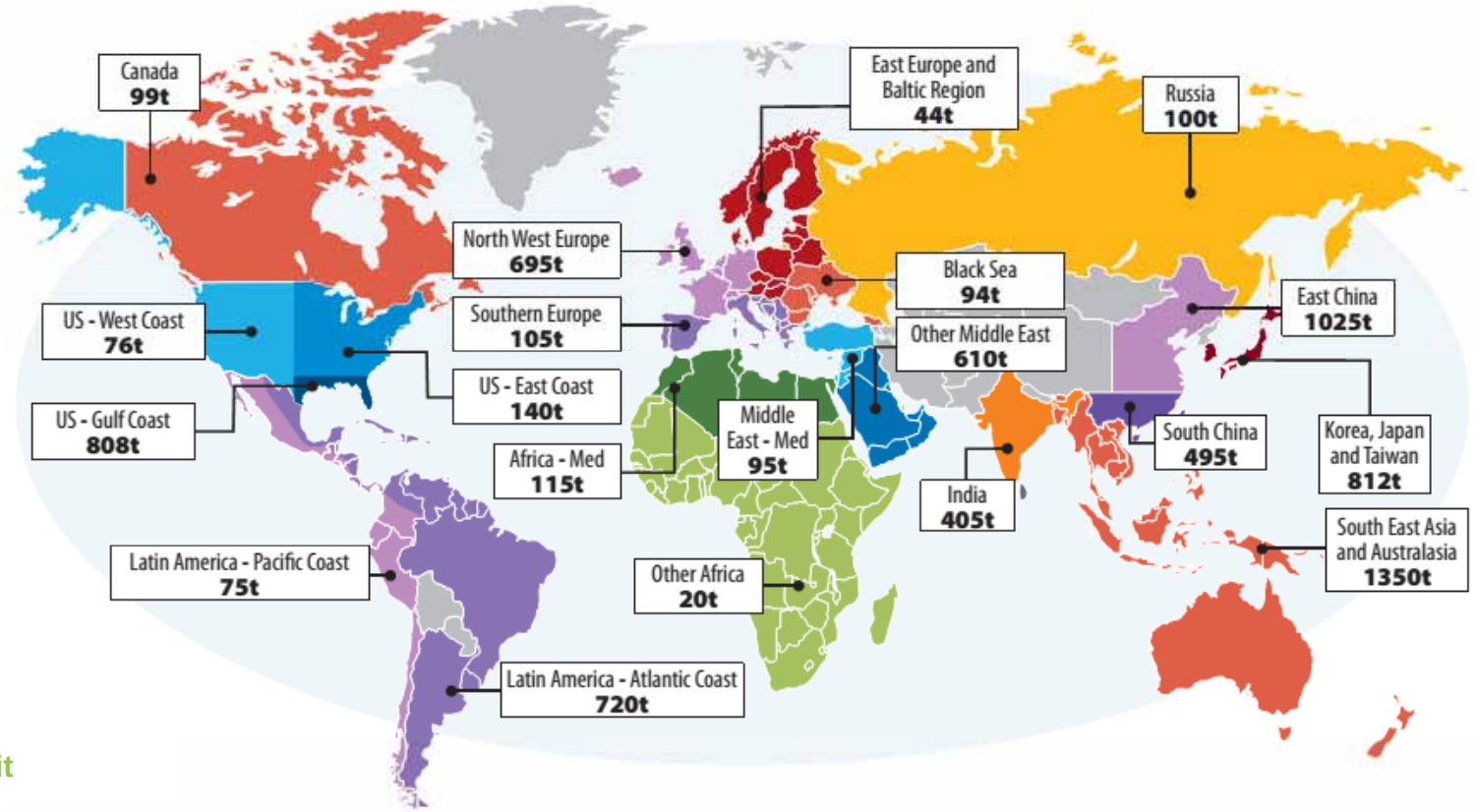
- Test and map Volvo Penta engine's potential on power, efficiency, emissions
- Conduct Lifecycle Carbon Assessment using methanol in small waterplane area twin hill and trialing suction hopper dredger
- Dissemination of methanol's market potential

Methanol/MGO Price Competition



Source: Argus

Available in many ports around the world



Source: IHS Markit

Methanol storage capacity estimates (thousand tons)

Methanol is widely available and easy to handle

- Liquid at atmospheric pressure
- Available in many ports around the world and along rivers
- Low infrastucture cost
- Flexible, modular system
- Environmentaly friendly as it's **biodegradable**

MI Engagement: IMO

- **IBC Code**
  - Changes to methanol's hazard profile under IBC Chapter 21 added a D3 "T rating for methanol target organ toxicity along with C3 "2" rating for inhalation toxicity would indicate methanol is "toxic" under Chapter 17, which would trigger specific carriage requirement under IBC Chapters 15, 17 and 21
  - MI,DGAC, Intertanko submitted a paper ESPH for their October meeting calling for no changes in carriage requirements for methanol

- **IGF Code**
  - The draft report of the correspondence group for Amendments to the IGF Code and Guidelines for Low-Flashpoint Fuels considered at CCC4 meeting in London on 11-15 September
  - Decision to move forward with adoption targeted for CCC5 in September 2018

INTERNATIONAL MARITIME ORGANIZATION

MI Engagement: Lloyd's Register

- **Marine Fuel Calculator**
  - MI has engaged Lloyd's Register to develop a calculator ship operators can use to understand the CAPEX, OPEX and other metrics of the various options for complying with IMO rules, including methanol
- **Methanol Marine Fuel and Safe Bunkering Guidelines**
  - As part of the Methaship project, and in cooperation with MI, Lloyd's Register is also developing a marine fuel and safe bunkering guidelines report that will be shared with the IMO

Methanol…

- is plentiful, available globally
- can be made 100% renewable
- runs well in existing engine technology and has potential for further optimization
- complies with increasingly stringent emission reduction regulations
- requires only minor modifications to current bunkering infrastructure
- is biodegradable!
- safe handling can rely on long history and experience in shipping and industry
- shows slight regional price variation
- ***NEEDED: Vessels, vessels, vessels***

04 CONTACTS

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