Methanol marine fuel developments around the world

Eelco Dekker, Chief EU Representative
Methanol Institute
Gothenburg, May 3rd, 2018
Who we are
A global industry association

- First formed in 1989, the Methanol Institute (MI) serves as the trade association for the global methanol industry.

- MI represents the world’s leading methanol producers, distributors and technology companies from offices around the world.

**MI provides value to its members by:**
- Ensuring safe handling of methanol and its derivatives
- Promoting methanol growth by furthering methanol as an essential chemical commodity and an emerging source of clean and renewable energy
- Influencing global regulatory and public policy initiatives that impact the methanol industry
### 2018 Members

<table>
<thead>
<tr>
<th>Atlantic Methanol</th>
<th>Mitsubishi International Corporation</th>
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<tbody>
<tr>
<td>MHTL</td>
<td>Metafrax</td>
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<td>Mitsu &amp; Co.</td>
<td>MOL</td>
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<td>OCI</td>
<td>Muntajat</td>
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<td>Petronas</td>
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<td>Qafac</td>
<td>Southern Chemical Corporation</td>
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<td>Sipchem</td>
<td>Vitusa Products™</td>
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<td>Ecofuel</td>
<td>Nakhodka Fertilizer Plant</td>
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<td>Exxon Mobil</td>
<td>Tricon Energy</td>
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<td>G2X Energy</td>
<td>Double Green Bridge</td>
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<td>Johnson Matthey</td>
<td>Coogee Energy</td>
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<td>Methanol Institute</td>
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<td>Mitsubishi Gas Chemical America, Inc</td>
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Committee structure

- Marine Fuels Committee
- Best Practices & Safety
- Marketing & Contacts
- R & D
- Technical Support
- Strategic Partnerships
- Legislative & Regulatory Affairs Committee
- Market Development Committee
- Global Reach
- Product Stewardship Committee
- R & D
- Global Fuel Blending Committee
- Legislative & Regulatory Affairs Committee
- Strategic Partnerships
- Legislative & Regulatory Affairs Committee
- Bootleg Alcohol Prevention Sub-Committee

- Safe Handling tools
- Health effects research
- Training
- Conversion technology
- Environmental
- Economics
- Advocacy

- Technical assistance
- Market research
- Development
- Research
- Commerciality
- Specifications
- Bridging science to regulatory
- Public policy
- Derivative support
- Awareness
- Education
- Prevention
- Health effects research
- Training
- Conversion technology
- Environmental
- Economics
- Advocacy

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2018 goals and objectives for marine

Marine Fuels

• Encourage and support pilot demonstrations of methanol marine fuels in multiple markets, to validate environmental and technical merits

• Develop methanol maritime technical workshops

• Lead social media campaigns in support of methanol as a marine fuel

• Monitor national/international regulations of marine sector to advocate for methanol as alternative fuel
Driving forces for methanol marine fuel

- Supply
- Demand
- Legislation
Renewable methanol supply
**Broad feedstock range, many applications**

- **Feedstock**
  - Natural gas: ~65%
  - Coal: ~35%
  - Biomass & renewables: <1%

- **Conversion**
  - Methanol synthesis

- **Derivatives**
  - Formaldehyde: 27%
  - Acetic acid: 9%
  - MTBE: 8%
  - MTMA: 2%
  - Gasoline blending: 9%
  - DME: 8%
  - Biodiesel: 3%
  - Methanolamines: 3%
  - Chloromethanes: 2%
  - Other: 7%
  - Solvents: 4%
  - MTO: 18%

- **Products**
  - Appliances
  - Automotive
  - Construction
  - Electronics
  - Fuel
  - Paint
  - Pharma
  - Other

- **Markets**
  - And more...

Source: IHS
Several renewable production pathways

1. Biomass (wood, MSW, etc)
   - Fermentation
     - Biogas
       - Biomethane
       - Reformer
     - Gassification
     - Syngas
       - Reactor and distillation
         - Bio-methanol
         - Renewable methanol

2. (Renewable) electricity
   - Electrolysis
     - Hydrogen
     - Carbon capture
     - CO₂

3. CO₂

4. CO₂
At different stages of development

<table>
<thead>
<tr>
<th>Methanol category</th>
<th>Commercial</th>
<th>Feasibility and R&amp;D</th>
<th>Stopped or On-hold</th>
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<tr>
<td><strong>Bio-methanol</strong></td>
<td>• BioMCN (NL)</td>
<td>• Biogo (GER)</td>
<td>• BioMCN (glycerine) (NL)</td>
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<td>• Chemrec (SE)</td>
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<td>• New Fuel (DEN)</td>
<td>• LowLands Methanol (NL)</td>
<td>• Range Fuels (USA)</td>
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<td>• Oberon (USA)</td>
<td>• Södra (SE)</td>
<td>• Schwarze Pumpe (GER)</td>
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<td><strong>Renewable methanol</strong></td>
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<td>• Blue Fuel Energy (CAN)</td>
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<td>• Innogy (GER)</td>
<td>• CRI (CN)</td>
<td>• Woodspirit (NL)</td>
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<td>• Infraserv (GER)</td>
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<td>• Port of Antwerp (BE)</td>
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<td>• Swiss Liquid Future (CH)</td>
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<td>• ZAS8t (GER)</td>
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<td><strong>Hybrid methanol</strong></td>
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<td></td>
<td>• Haldor Topsoe (DEN)</td>
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<td>• OPTIMeoH (GER)</td>
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<td><strong>Low carbon methanol</strong></td>
<td>• GPIC (BAH)</td>
<td>• Carbon2Chem (GER)</td>
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<td>• FRESME (SE)</td>
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<td>• QAFAC (QAT)</td>
<td>• NCF (CN)</td>
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<td>• SABIC (KSA)</td>
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03 Methanol marine fuel demand
Examples of vessels running on methanol

**COMBUSTION ENGINE**
- 7x +4x chemical tankers
  - MOL, WL, Marinvest
- 1x 2 stroke MAN
- 1x 4 stroke Wärtsila
- new build

**FUEL CELL**
- 1x Pilot boat
  - Swedish Maritime Admin.
- 1x
  - high speed Scania, Volvo, a.o.
- retrofit

**PROJECT and R&D**
- 1x Tourist boat
  - Innogy
  - Serenergy fuel cell stacks
- 1x Ferry
  - Viking Line
  - SI hybrid, dual fuel, etc.
  - new build & retrofit

- 1x ROPAX ferry
  - Stena Line

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- retrofit

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MAN two stroke engines positive results

March 20, 2018, MAN workshop Copenhagen

- Approx. 20,000 service hours on methanol
- Most challenges solved
- Remaining challenges expected to be solved soon
- Methanol: water mixture reduces NOx below Tier III levels
- Four new vessels on order
Methaship methanol use for cruise ships

German funded research project with the aim to examine the potential of methanol as a fuel for cruise ships and RoPax ferries

• Excellent physical properties (storage, handling)
• Excellent environmental properties
• Availability of infrastructure

Closing workshop May 28, Hamburg
Lean ships looks at high speed engines

Part of a bigger Horizon 2020 project, the team aims to demonstrate high-speed diesel engine converted to dual fuel operation, and maintain 100% diesel capability. The outcome could offer a possible retrofit solution, including for smaller vessels. Testing is performed on a Volvo Penta D7 engine at Ghent University.
And several other projects

- HyMeth Ship preparing H2020 grant preparation
- MI leading international consortium of stakeholders for Interreg application to use methanol for inland waterways
- Government expressed interest in methanol bunkering to displace diesel for inland waterways
- Feasibility of methanol for inland waterways and fishing
- What if....? Suggestions welcome
03 Legislation and regulation
The International Maritime Organization has adopted regulations for SOx and NOx that are transforming the shipping industry. While SOx reductions may be met with low sulfur fuels, the combination of SOx and NOx reductions is driving shipboard solutions.
Changes to IBC and IGF code focus for engagement with 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
Providing support in answering common questions

**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
Government support for methanol?

The Netherlands is currently one of the few countries - if not the only - where bio-methanol can be used in shipping as an opt-in for meeting the biofuel mandate. Post 2020 shipping is part of the RED II energy targets, so that should create more opportunities.

The Green Award certification scheme provided financial and non-financial benefits depending on the environmental performance of a vessel. Banks provide beneficial rates and many ports offer reductions of port dues.

Other opportunities include a.o.:
04 Moving forward
In order to go full steam ahead....

More OEMs will have to start providing methanol technology as an option in their portfolio

Appropriate rules and regulations will have to be implemented to enable the use of methanol as a marine fuel

All stakeholders in the value chain will have to see the benefits to their respective businesses

We will all have to actively spread the word to increase awareness and generate more interest (http://www.methanol.org/marine-fuel/)
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