



***SIEW Roundtable: Methanol as a  
Marine Fuel***

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Development (AP/ME)

***October 31, 2019  
Singapore***

# MEMBERS

Tier 1



Tier 2



شركة قطر الإضافات البترولية المحدودة  
Qatar Fuel Additives Company Limited



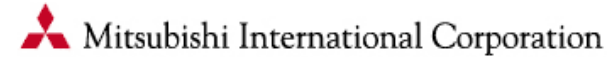
PETRONAS



Tier 3



Ecofuel



Tier 4



Advent



HALDOR TOPSOE



CLARIANT



OLAHMOTORS

VITUSA PRODUCTS INCORPORATED

Nebraska Public Power District

# INDUSTRY OVERVIEW

01

# METHANOL

## An essential ingredient of modern life

Energy/Fuel substitution markets - represent the fastest growing demand segment for methanol (~45% demand)

Chemical markets - essential ingredient used in countless industrial and consumer products (~55% demand)



Methanol can be found in products that we use every day:

Roof panels  
Adhesives  
Lumber

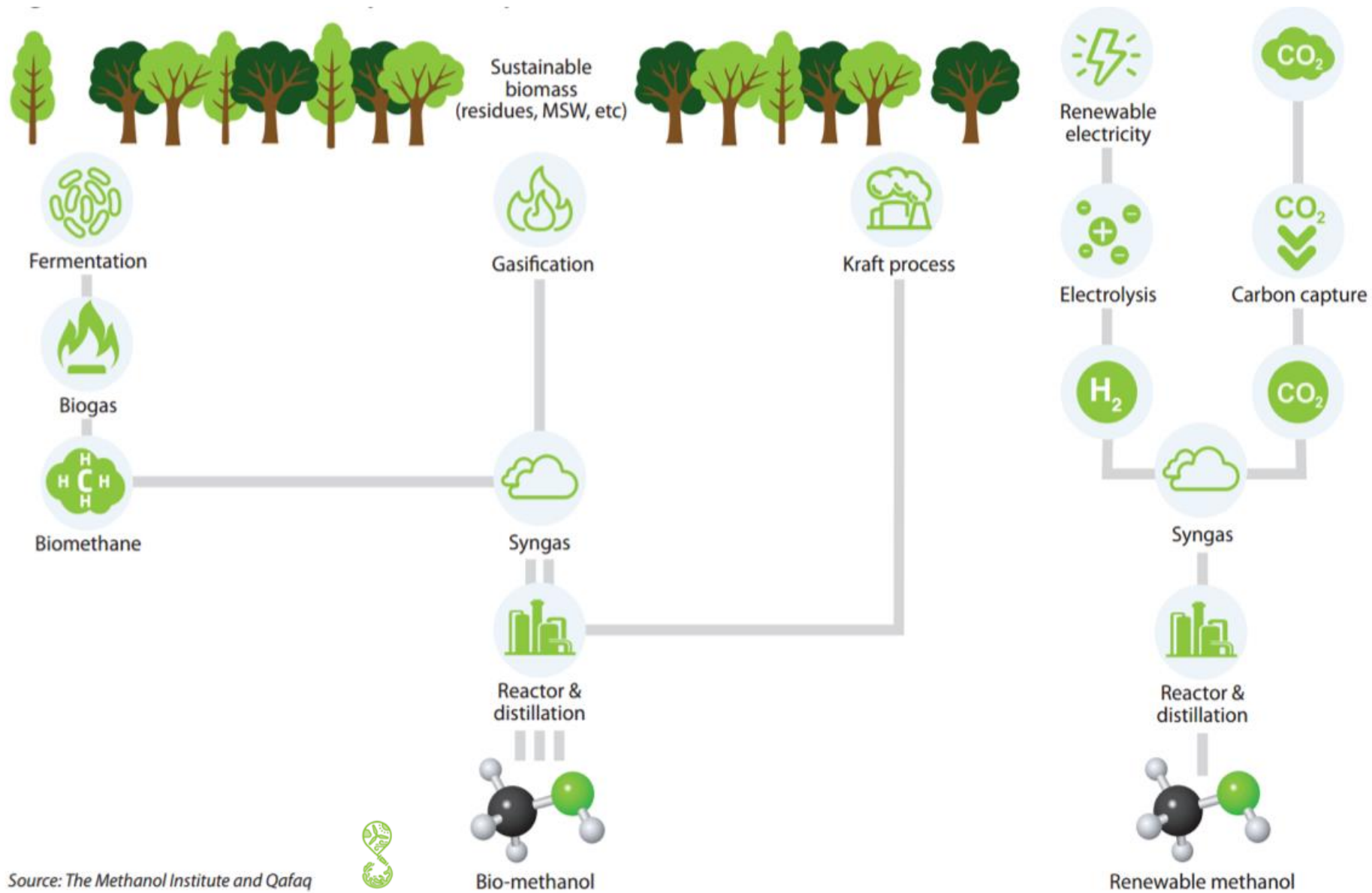
Paint  
Insulation  
Carpeting  
Synthetic fibres  
Plastics  
Particle boards

Refrigerants

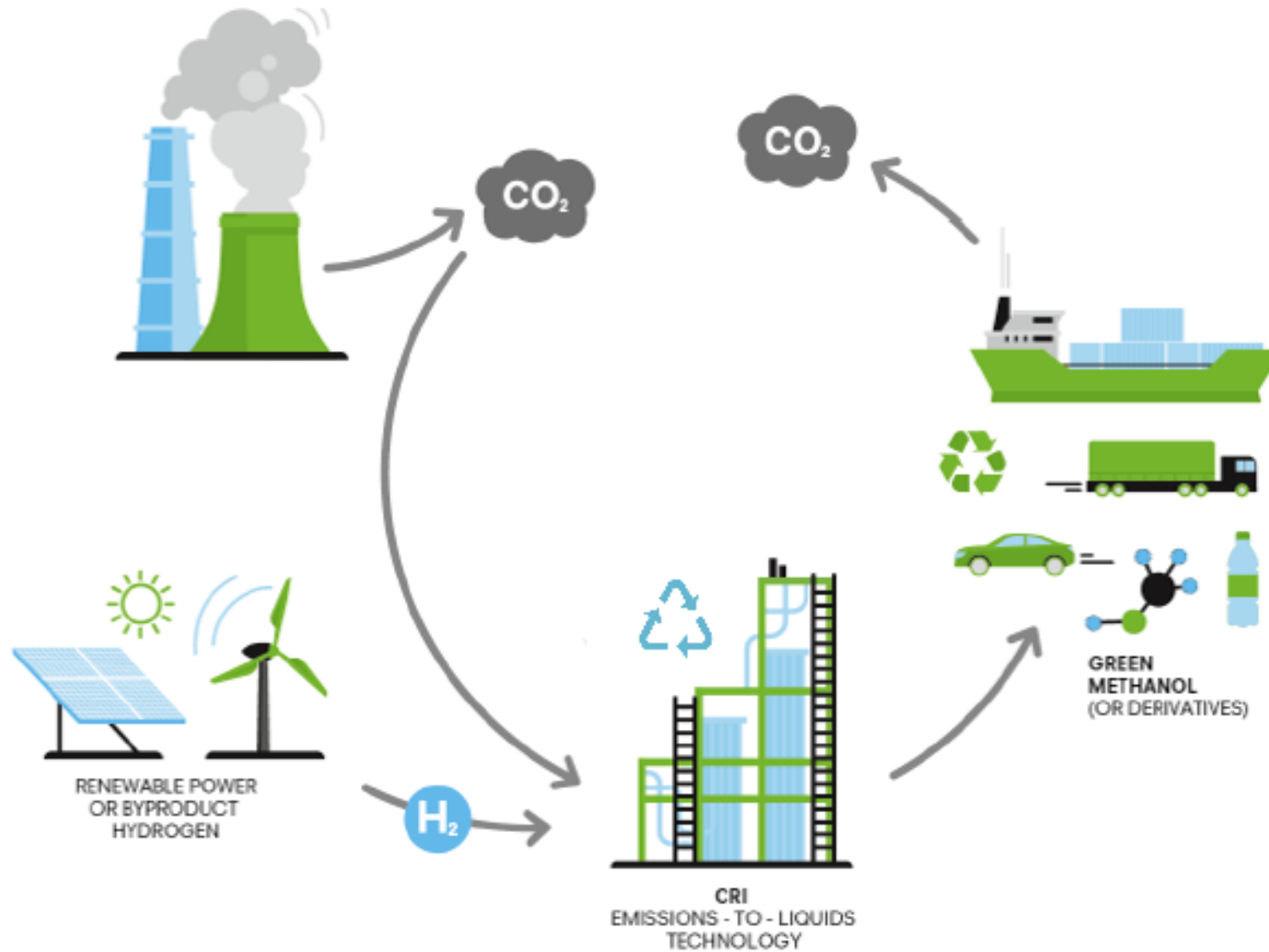
Sportswear  
Fleece fabrics

Safety glass laminate  
Windshield washer fluid  
Solvents  
Upholstery

# RENEWABLE PATHWAYS ARE RAPIDLY DEVELOPING



# RENEWABLE METHANOL CIRCULAR ECONOMIES



Source: Carbon Recycling International

# RENEWABLE/BIO METHANOL PROJECTS



# INTERNATIONAL REGULATORY LANDSCAPE

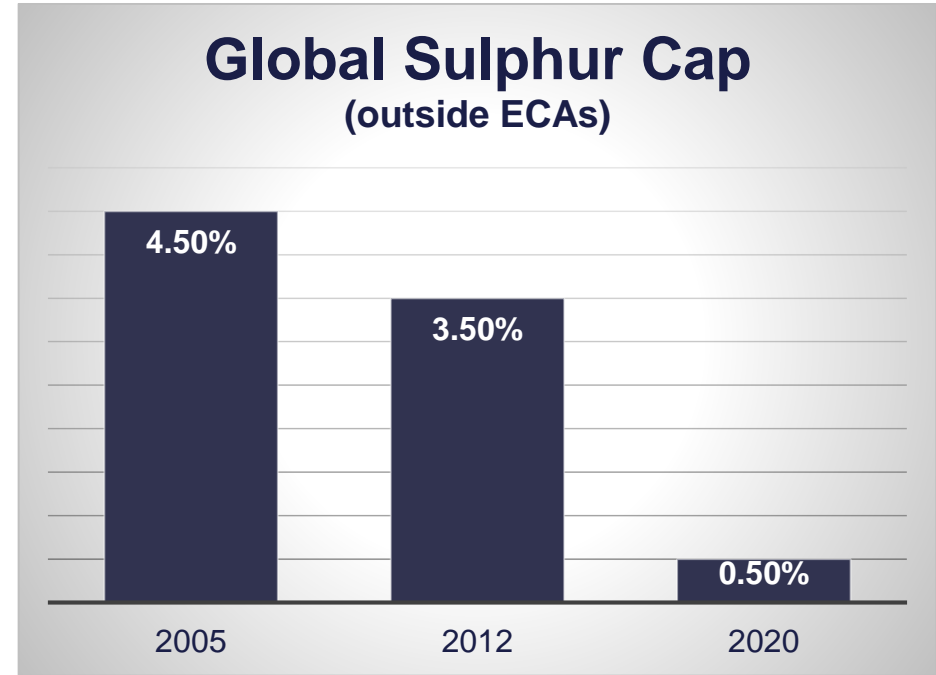
02



# SULPHUR CAP



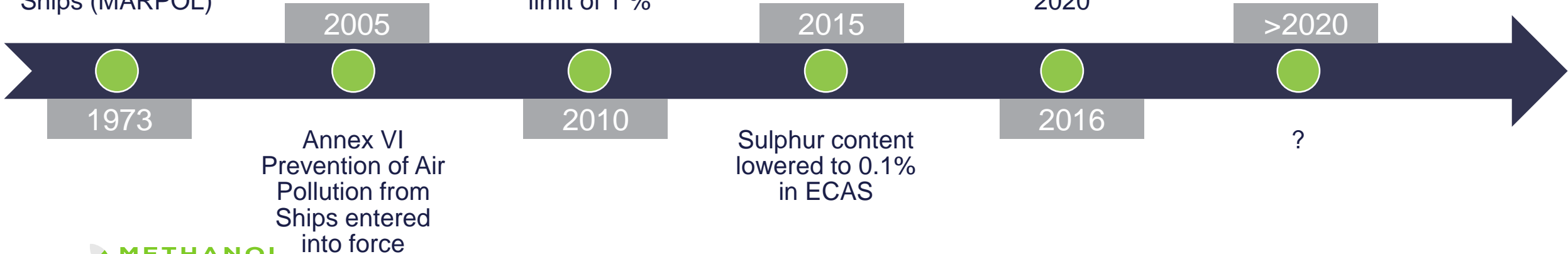
\* Note: China and Hong Kong may go down to 0.1% earlier than 2020.



International Convention for the Prevention of Pollution from Ships (MARPOL)

ECAs first introduced with sulphur content limit of 1 %

Global sulphur limit of 0.5%, effective January 2020



## **ROAD TO 2050**

### **IMO Initial Strategy on the Reduction of GHG Emissions adopted at MEPC 72 (April 2018)**

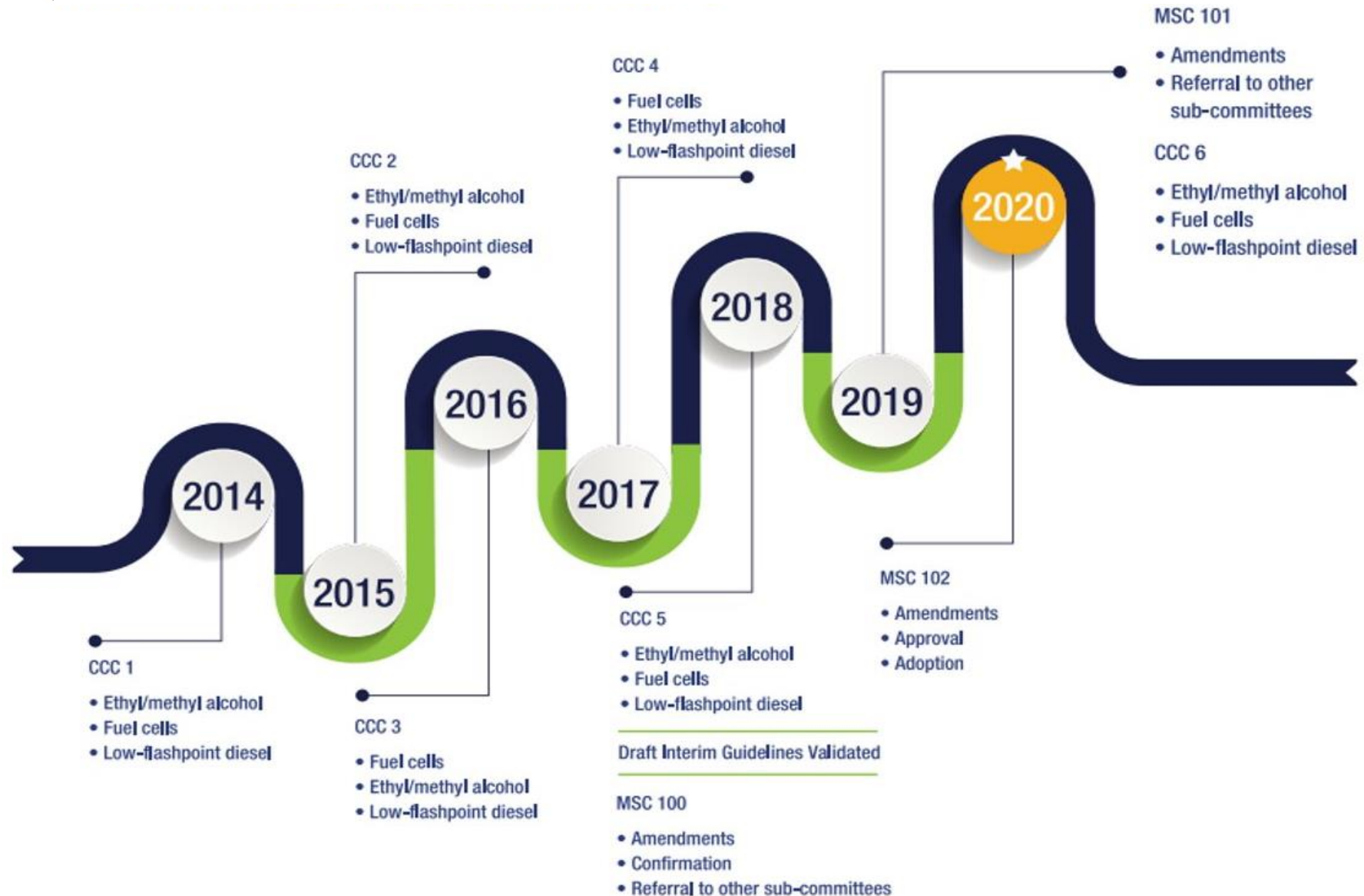
**Level of ambition of Initial Strategy.**

**Carbon intensity of ships to decline through implementation of further phases of energy efficiency design index (EEDI) for new ships.**

**Reduce CO<sub>2</sub> emissions per transport work, as an average across international shipping by at least 40% by 2030, and 70% by 2050, compared to 2008.**

**Peak GHG emissions from international shipping ASAP, and reduce total annual GHG emissions by at least 50% by 2050 compared to 2008**

# PROGRESSION OF GUIDELINES FOR METHANOL



# METHANOL AS A MARINE FUEL

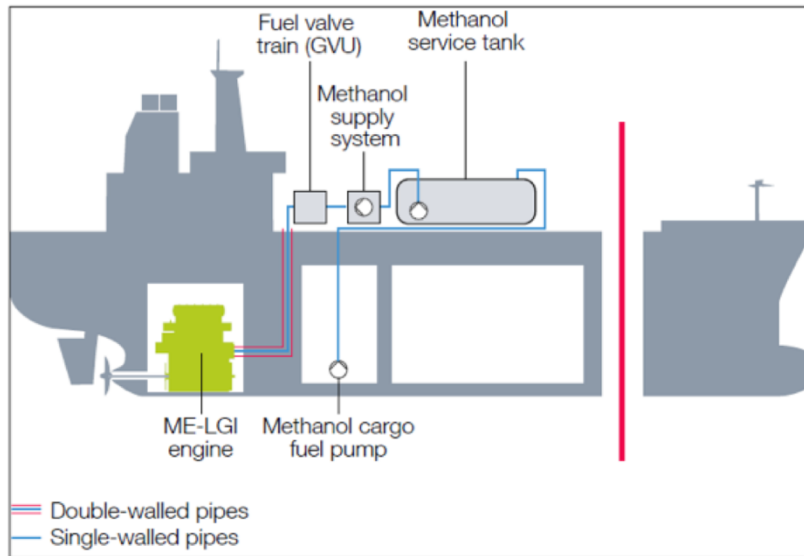
03

## CONVENTIONAL MeOH EMISSIONS SCORECARD



**Methanol (MeOH) achieves low emissions & acts as a bridge in lowering CO<sub>2</sub> in the future (renewable/bio methanol)**

# PRACTICAL SOLUTION

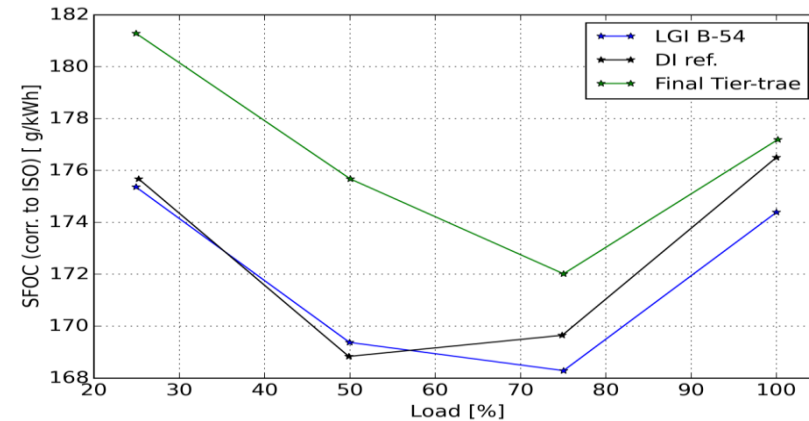
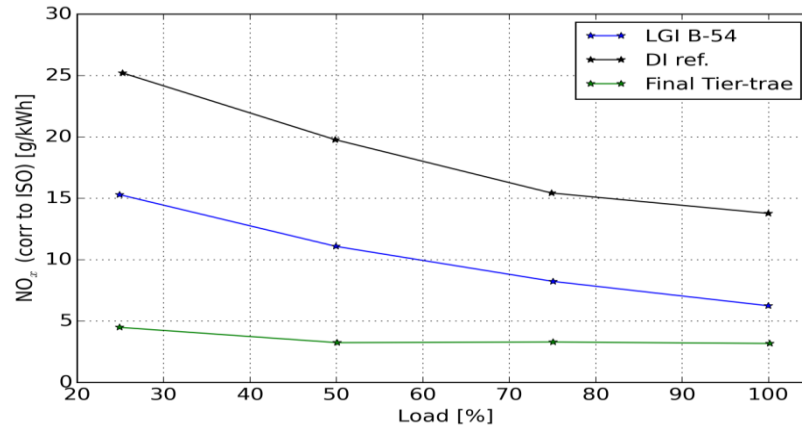


- Multi – fuel engines will be the norm going forward
- Methanol can be readily and safely applied in both new build and conversion

- Methanol can be a practical solution for dual fuel applications, to include other alternative fuels such as LPG and LNG



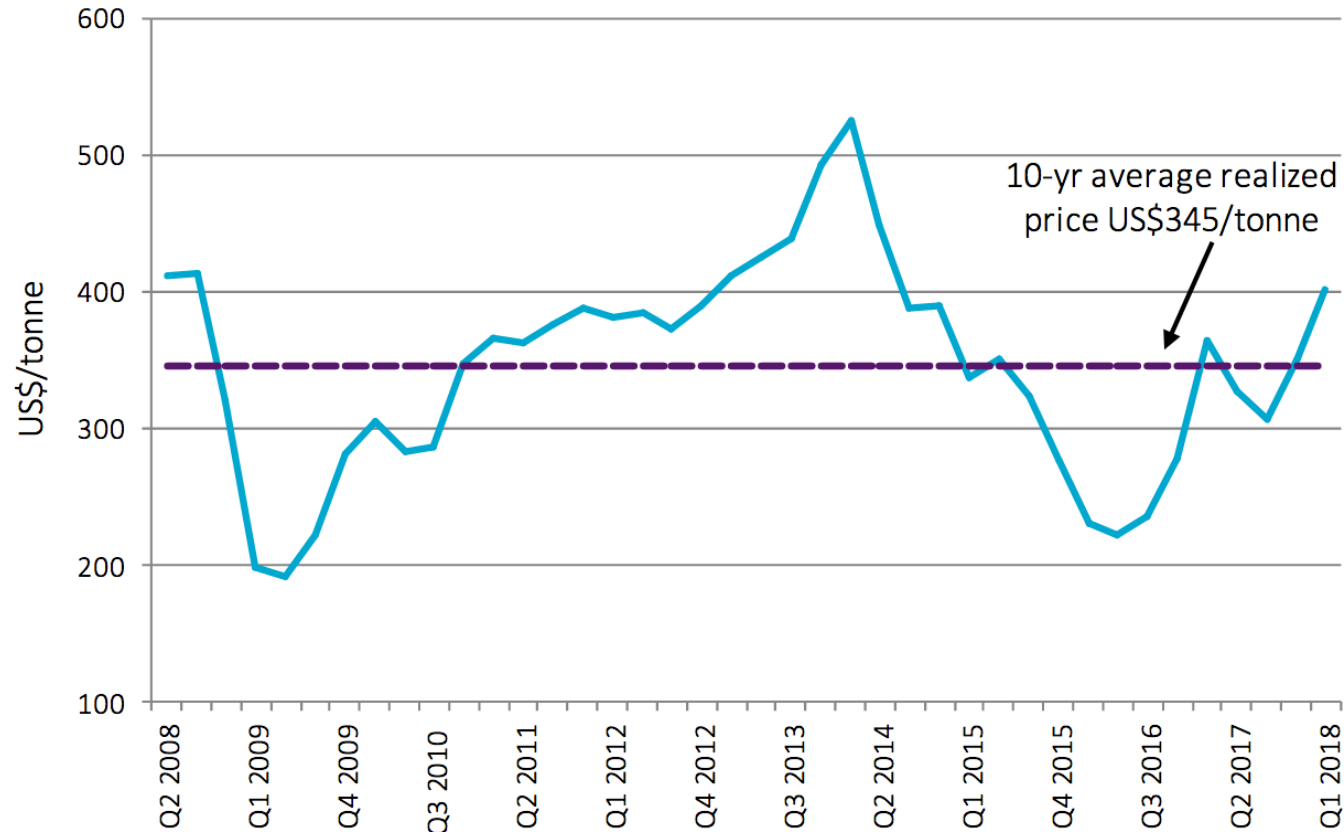
# METHANOL / WATER BLENDING (EMULSIFICATION)



- Approximately 25-40% water is added to the methanol to achieve a new, Tier III solution
- NO<sub>x</sub> decreases almost linearly with water content, to approximately 2 g/kWh at 50% and 75% load
- Similar system is being planned for fuel oil, so the Tier III compliant technology will be available as a dual fuel solution
- R&D testing completed - service test is under preparation

Source: MAN

# METHANEX 10-YR AVG REALIZED PRICE

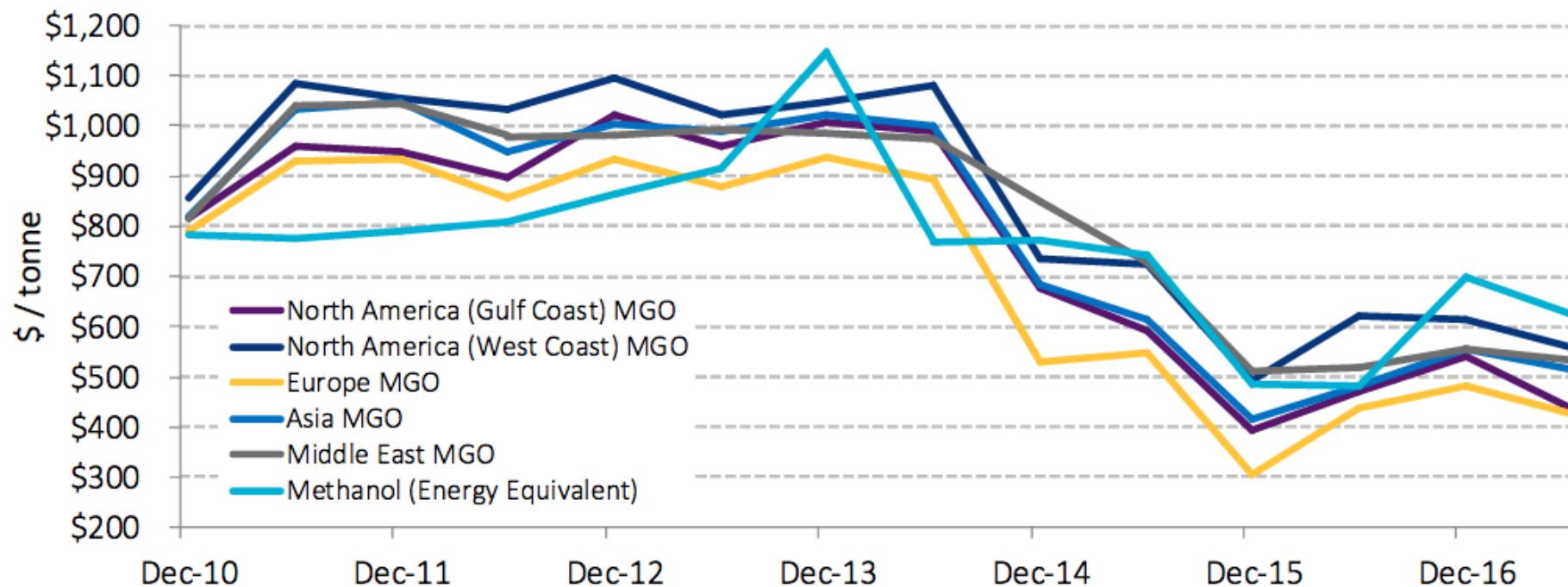


- Methanex posts reference prices monthly in Asia and North America and quarterly in Europe
- Realized pricing is lower than reference prices due to discounts specified in contracts

Source: Methanex Corporation



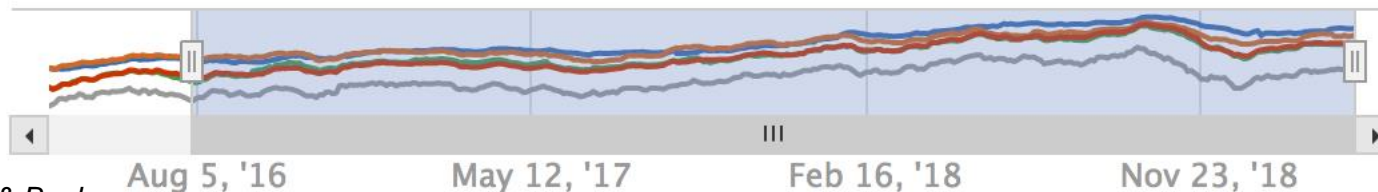
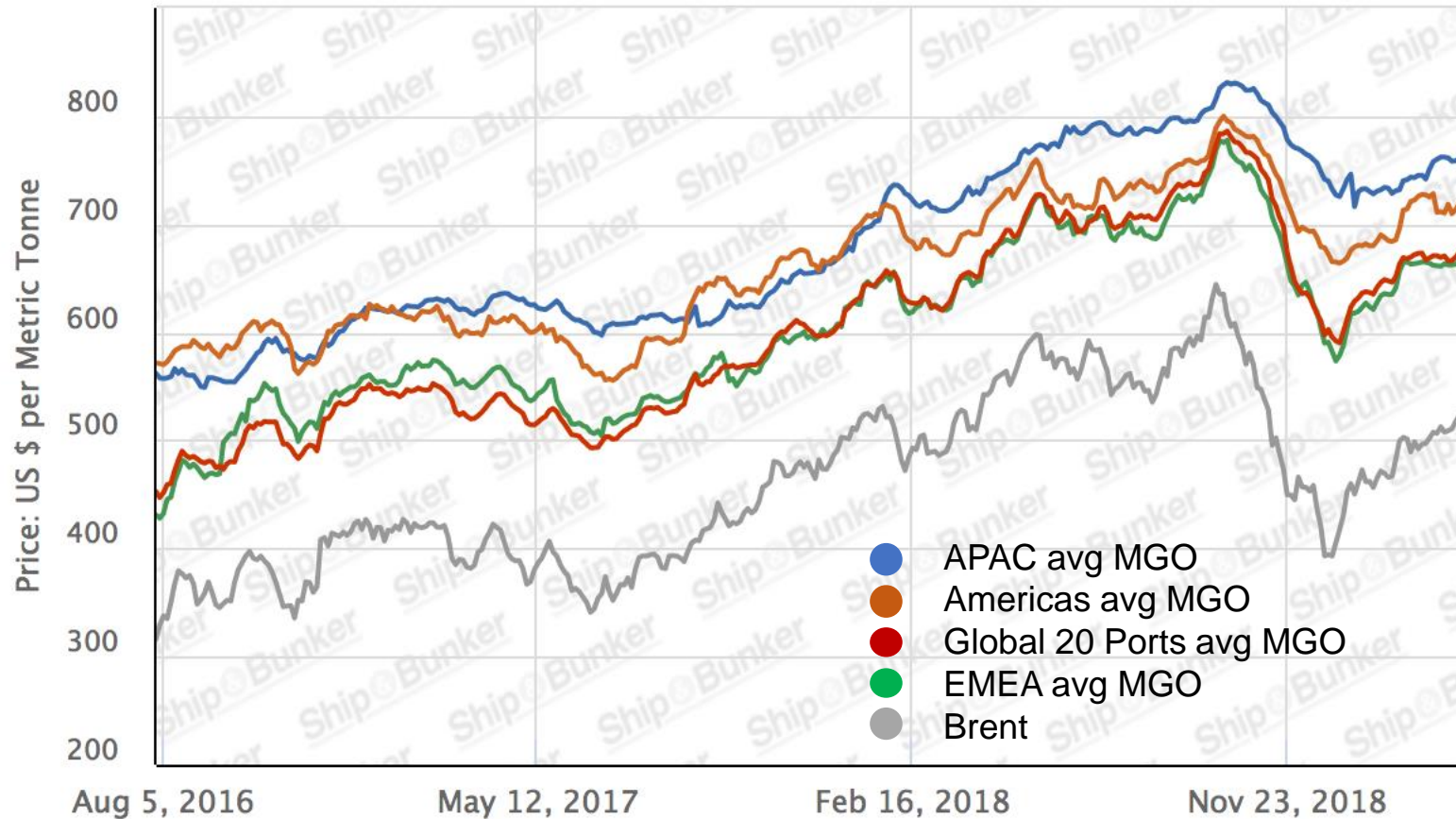
# METHANOL ON AN ENERGY EQUIVALENT BASIS



- MGO NA GC: Avg New orleans, Houston; MGO NA WC: Avg LA, San Francisco, Seattle, Vancouver; MGO Europe: Avg Rotterdam, Antwerp, Hamburg; MGO Asia: Avg Shanghai, Korea; MGO Middles East: Avg Fujairah, Kuwait, Khor Faakan
- Methanol: Avg USGC, China and Europe spot prices; adjusted to energy equivalent of MGO (2.16 factor)

Source: Platts and IHS Chemical

# BUNKER PRICING: 2-YR MGO SNAPSHOT

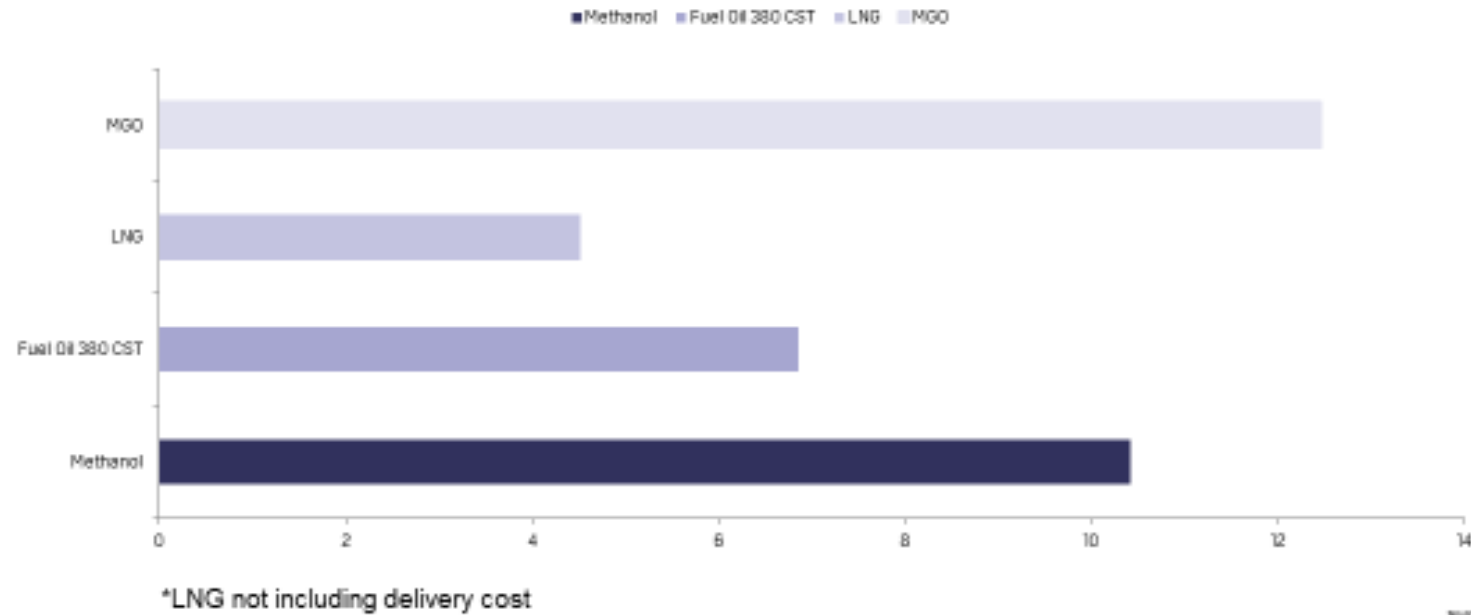


Source: Ship & Bunker

# METHANOL ON AN ENERGY EQUIVALENT BASIS

Cost comparison: Unfavourable density and energy levels, but methanol cheaper than MGO

(Price per unit of energy volumetrically – October 2019)



S&P Global  
Platts

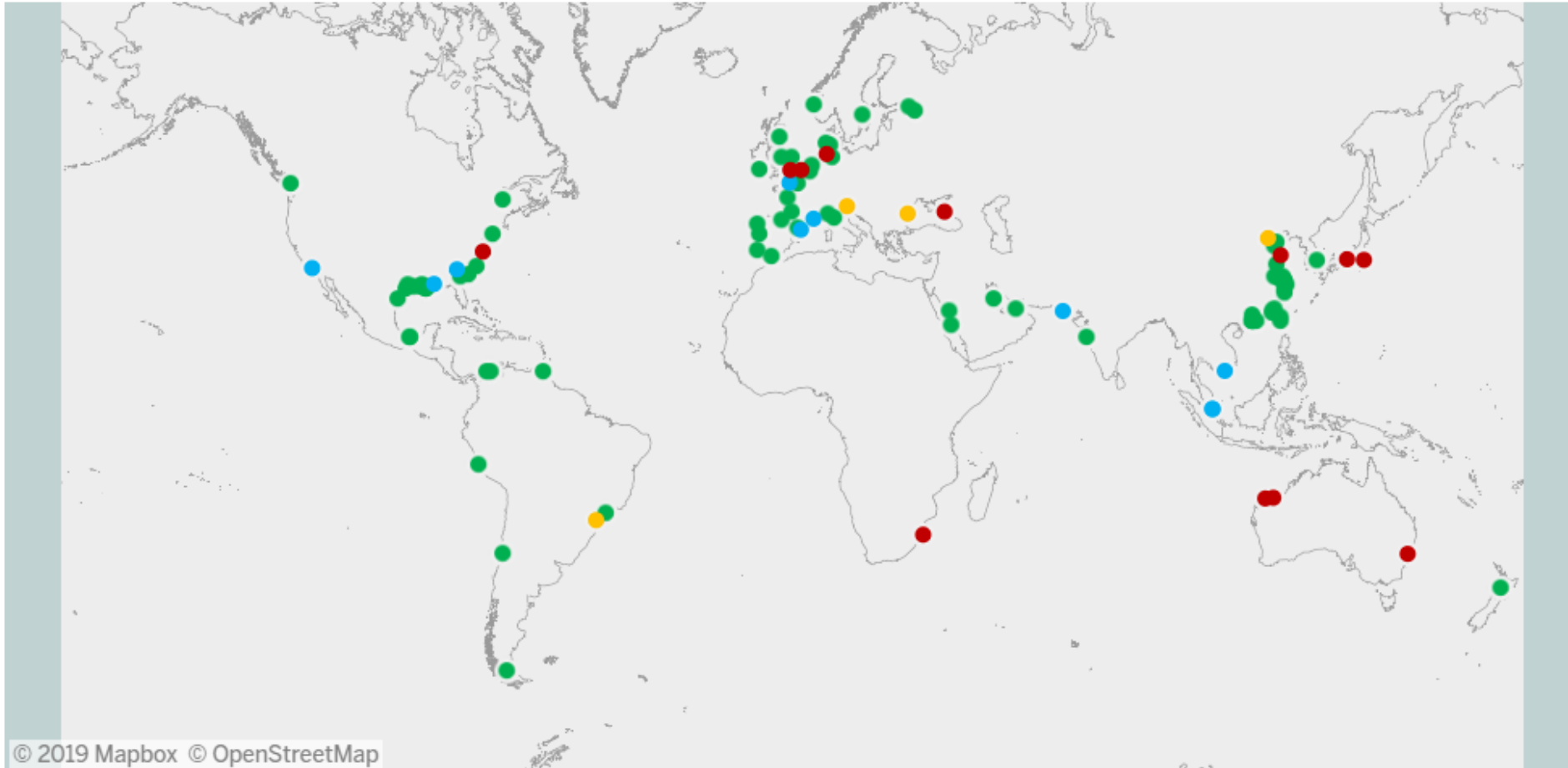
SOURCE: S&P GLOBAL PLATTS

16

Source: Platts

# METHANOL IS WIDELY AVAILABLE AT PORTS

## Methanol Fuel Availability at Ports



© 2019 Mapbox © OpenStreetMap

■ Ports with confirmed methanol capacity (provided by ports directly)

■ Ports with no methanol capacity

■ Ports with private bulk liquid storage

■ Ports with confirmed methanol supply/storage (provided by suppliers operating at the port)

# HAZARD COMPARISON

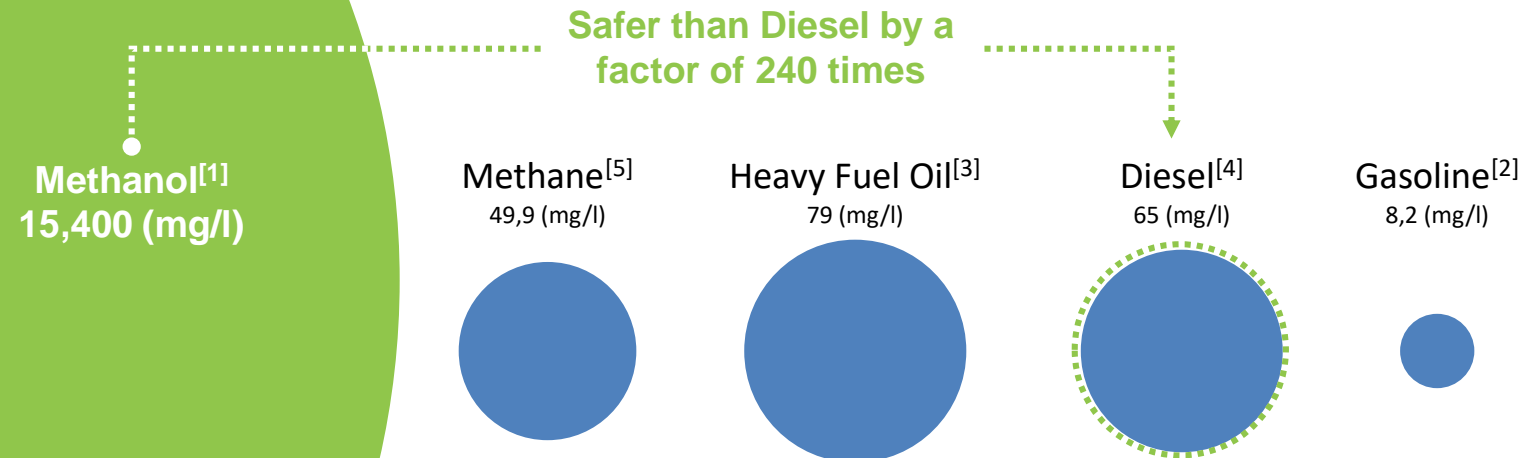
	METHANOL	DIESEL	GASOLINE
Hazard pictograms (CPL)			
Signal word: (CPL)	Danger	Danger	Danger
Hazard statements (CPL)	<p>H220: Highly flammable liquid and vapour.</p> <p>H301: Toxic if swallowed.</p> <p>H311: Toxic in contact with skin.</p> <p>H331: Toxic if inhaled.</p> <p>H370: Causes damage to organs.</p>	<p>H220: Flammable liquid and vapour.</p> <p>H304: May be fatal if swallowed and enters airways.</p> <p>H315: Causes skin irritation.</p> <p>H332: Harmful if inhaled.</p> <p>H351: Suspected of causing cancer.</p> <p>H373: May cause damage to organs through prolonged or repeated exposure.</p> <p>H411: Toxic to aquatic life with long lasting effects.</p>	<p>H220: Extremely flammable liquid and vapour.</p> <p>H304: May be fatal if swallowed and enters airways.</p> <p>H315: Causes skin irritation.</p> <p>H360D: May cause genetic defects.</p> <p>H370: May cause cancer.</p> <p>H373: Suspected of damaging fertility or the unborn child.</p> <p>H400: May cause death of aquatic life.</p> <p>H411: Toxic to aquatic life with long lasting effects.</p>
Precautionary statements (CLP)	<p>P201: Read label carefully. No smoking.</p> <p>P202: Wear protective gloves/protective clothing/eye protection/face protection.</p> <p>P203: Do not eat, drink or smoke when using this product.</p> <p>P204: Wash hands thoroughly after handling.</p> <p>P210: Keep away from heat/sparks/open flames/hot surfaces. No smoking.</p> <p>P211: Use explosion proof electrical/ventilation/lighting equipment.</p> <p>P223: Use only non-sparking tools.</p> <p>P231: Take precautionary measures against static discharge.</p> <p>P232: Do not breathe dust/fume/gas/vapour/spray.</p> <p>P241: Wash hands thoroughly after handling.</p> <p>P271: Do not eat, drink or smoke when using this product.</p> <p>P273: Avoid release to the environment.</p> <p>P280: Wear protective gloves/protective clothing/eye protection/face protection.</p> <p>P301+P312: IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician.</p> <p>P302+P352: IF ON SKIN: Wash with plenty of soap and water.</p> <p>P303+P361+P353: IF ON SKIN (or hair): Remove contaminated clothing and shoes. Wash skin with soap and water.</p> <p>P304+P340: IF INHALED: Remove person to fresh air and keep at rest in a position comfortable for breathing.</p> <p>P305+P351+P338: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.</p> <p>P308+P313: Call a POISON CENTER or doctor/physician if you feel unwell.</p> <p>P310: Do NOT induce vomiting.</p> <p>P312: Call a POISON CENTER or doctor/physician if you feel unwell.</p> <p>P314: Do NOT induce vomiting.</p> <p>P320: Call a POISON CENTER or doctor/physician if you feel unwell.</p> <p>P330: Drink water.</p> <p>P331: Do NOT induce vomiting.</p> <p>P332+P313: IF skin irritation occurs: Get medical advice/attention.</p> <p>P337+P313: In case of eye contact: Rinse with water for several minutes. Get medical advice/attention.</p> <p>P340: Get medical advice/attention.</p> <p>P360+P353: Wear a well-ventilated mask. Avoid breathing dust/fume/gas/vapour/spray.</p> <p>P370+P377: Avoid breathing dust/fume/gas/vapour/spray.</p> <p>P373: Avoid breathing dust/fume/gas/vapour/spray.</p> <p>P380+P313: Do NOT breathe dust/fume/gas/vapour/spray.</p> <p>P390: Contain spillage.</p> <p>P400: Do not remove from container.</p> <p>P403: Store in a cool, dry place.</p> <p>P500: Dispose of contents/container in accordance with local/regional/national/international regulations.</p>	<p>P201: Read label carefully before use.</p> <p>P210: Keep away from heat/sparks/open flames/hot surfaces. 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No smoking.</p> <p>P231: Use explosion proof electrical/ventilation/lighting equipment.</p> <p>P232: Use only non-sparking tools.</p> <p>P233: Take precautionary measures against static discharge.</p> <p>P234: Do not breathe dust/fume/gas/vapour/spray.</p> <p>P241: Wash hands thoroughly after handling.</p> <p>P271: Do not eat, drink or smoke when using this product.</p> <p>P273: Avoid release to the environment.</p> <p>P280: Wear protective gloves/protective clothing/eye protection/face protection.</p> <p>P301+P312: IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician.</p> <p>P302+P352: IF ON SKIN: Wash with plenty of soap and water.</p> <p>P303+P361+P353: IF ON SKIN (or hair): Remove contaminated clothing and shoes. Wash skin with soap and water.</p> <p>P304+P340: IF INHALED: Remove person to fresh air and keep at rest in a position comfortable for breathing.</p> <p>P305+P351+P338: IF IN EYES: Rinse cautiously with water for several minutes. 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Methanol classified as “not more dangerous” than other fuels such as gasoline or diesel – fuels largely familiar to most people

# SAFER FOR THE ENVIRONMENT

## LC50, LC = LETHAL CONCENTRATION FISH

*Concentration in water, at which half the marine population died within the specified test duration*



<sup>[1]</sup> ECHA, European Chemicals Agency, registration dossier Methanol

<sup>[2]</sup> Petrobras/Statoil ASA, Safety Data Sheet, ECHA registration dossier Gasoline







<sup>[3]</sup> GKG/ A/S Dansk Shell, Safety Data Sheet

<sup>[4]</sup> ECHA, European Chemicals Agency, registration dossier Diesel

<sup>[5]</sup> ECHA, European Chemicals Agency, registration dossier Methane

*Additional Source: Meyer-Werft*

# METHANOL FUELLED VESSELS AND PILOTS

	DUAL FUEL		FUEL CELL		PROJECT   R&D	
						
<b>Quantity</b>	9 + 2	1	1	2	1	+4
<b>Vessel Type</b>	Chemical tankers	ROPAX ferry	Pilot boat	Tourist boat	Ferry	Cruise ships, fishing boats, barges, dredges, others
<b>Owner</b>	MOL, W-L, Marininvest, Methanex, Mitsui, OIIO, NYK	Stena Line	MI/SMA ScandiNaos	Innogy HTWG Konstanz	Viking Line	SUMMETH/MARTEC, Lean Ships, Methaship, Billion Miles <sup>1</sup> , FiTech <sup>2</sup> , IWA <sup>3</sup> , PCG Product Vessel <sup>4</sup> , NTU <sup>2</sup> , GMM, Fastwater, Port of Rotterdam Barge, Jupiter, Paxell, Methanex Fishing <sup>5</sup>
<b>Engine Type</b>	2 stroke MAN	4 stroke Wärtsila	high speed Scania, Weichai	Serenergy fuel cell stacks		SI hybrid, dual fuel, etc.
<b>Design</b>	new build	retrofit	retrofit	retrofit	retrofit	new build & retrofit

All projects are based in the EU unless noted otherwise<sup>1</sup>China/SG, <sup>2</sup>EU/China/SG, <sup>3</sup>India, <sup>4</sup>Malaysia, <sup>5</sup>China

## ***BROADLY, METHANOL IS...***

- A cost effective and “future proof” fuel which can be produced from a variety of feedstocks – to include renewables
- One of the top 5 seaborne chemical commodities – safely handled for over 50 years
- A lower cost alternative for converting vessels, boilers and other power sources to methanol – minimal and economically viable without subsidies
- Widely available and alleviates many infrastructure and safety limitations both on land and at sea, trading within a narrower price range than competing fuels
- Not as well understood as a fuel, even though it has similar handling characteristics as distillate fuel





# THANK YOU



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