METHANOL INSTITUTE

Methanol As a Marine Fuel

中国区首席代表 **China Chief Representative**
赵凯 **Kai ZHAO**

HK Green Methanol OGV Workshop

2024/10/22

01 About Methanol Institute
关于全球甲醇行业协会

History 历史

- The Methanol Institute (MI) was established in 1989
  全球甲醇行业协会（MI）成立于 1989 年
- 30 years later, MI recognized as the trade association for the global methanol industry
  经过 30 年的发展，MI 已成为全球甲醇行业的行业协会
- Facilitating methanol's expansion from our Singapore headquarters and regional offices in Washington DC, Brussels, Beijing and New Delhi
  通过新加坡总部以及设在华盛顿、布鲁塞尔、北京和新德里的地区办事处促进甲醇发展
- 2022年2月正式设立北京代表处，国家工信部为行业主管单位 Formal BJ Rep Office from Feb, 2022 under MIIT as Professional Supervision Unit (PSU)

Members 会员

METHANOL INSTITUTE

Tier 1

methanex the power of agility · OCI Global · PROMAN · سابك sabic

Tier 2

Atlantic Methanol · KOCH METHANOL ST. JAMES · MITSUBISHI GAS CHEMICAL · MITSUI & CO., LTD. · Oman Methanol Company L.L.C. · PETRONAS

Tier 3

eni ecofuel · JM Johnson Matthey Inspiring science, enhancing life · Mitsubishi International Corporation · Qatar Fuel Additives Company Limited · Sipchem EXCELLENCE everywhere

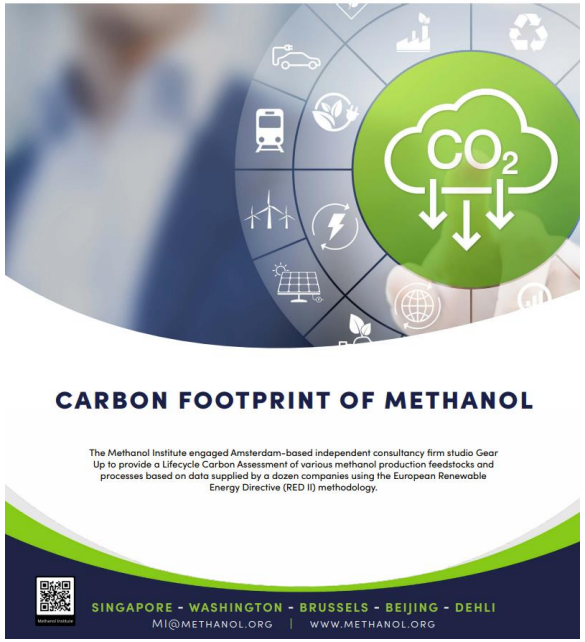
Tier 4

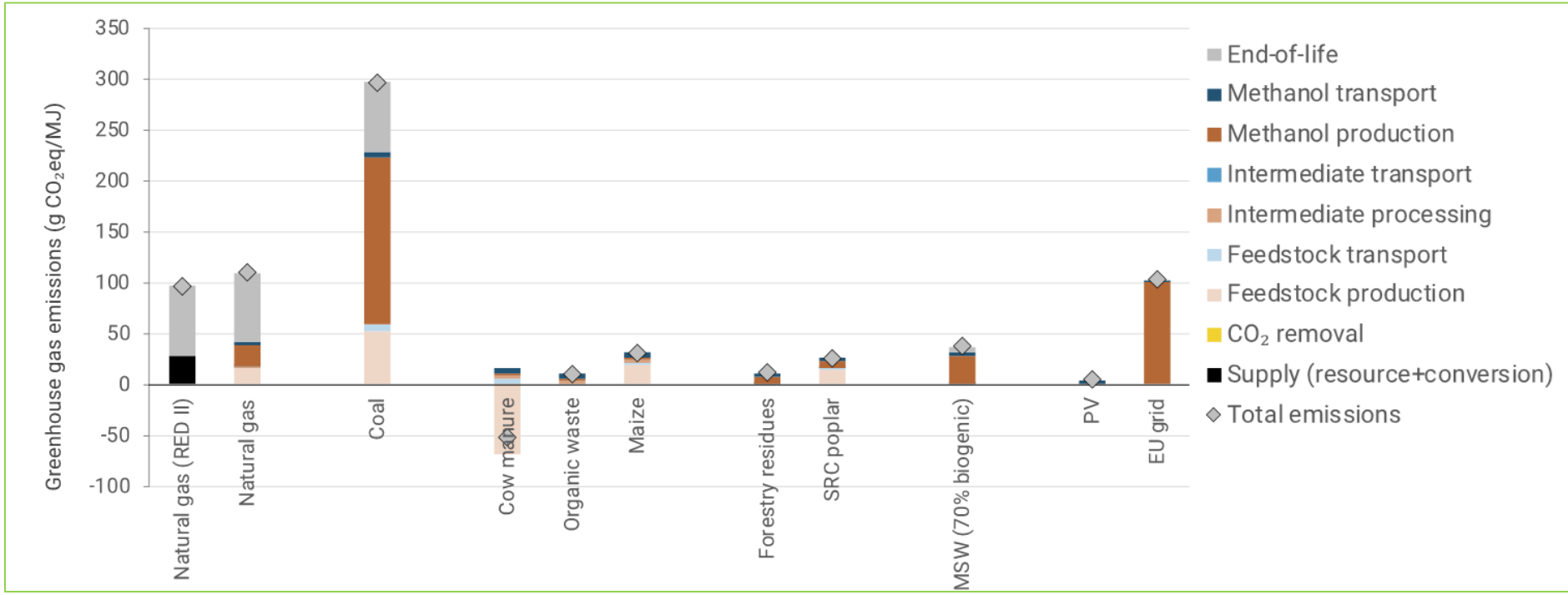
ABEL ENERGY · GEELY · ADVENT · AIR COMPANY · ALFA LAVAL · evero · danans · aramco · Blue World Technologies · Carbon Neutral Consulting · COSCO SHIPPING · CLARIANT · ClearFlame ENGINE TECHNOLOGIES · CMA CGM · CARBON RECYCLING INTERNATIONAL carbonrecycling.is · eFuel alliance · Element 1 · Enerkem · EUROPEAN ENERGY · CONTROLROOMS.AI · MAERSK · oberon FUELS · PYLETECH Group · GIDARA ENERGY · GANE ENERGY · GLOCAL GREEN · GREEN MARINE · GREENFIELD GLOBAL · IMTT · Lake Charles Methanol · Linde · M2X · MADOQUA · BERGEBULK moving mountains · EVOS · PTTEP · MOL Mitsui O.S.K. Lines · msc · Nebraska Public Power District · Goldwind · NCLH NORWEGIAN CRUISE LINE HOLDINGS LTD. · OLDENDORFF · FiTech · PURIFIRE LABS · ARGO · Royal Caribbean Group · element FUELS · NOBLE · Cargill · MSEA · HERO FUTURE ENERGIES planet positive power · BUREAU VERITAS · Elyse · MP · MMSA INDEPENDENT. OBJECTIVE. GLOBAL METHANOL ADVISORS · HYSTOR ENERGY · Ørsted · RioTinto · S&P Global Commodity Insights · solvadis we do chemistry · Stena Bulk INNOVATION & PERFORMANCE · SunGas RENEWABLES · SunHydro 阳氢集团 · TOPSOE · TotalEnergies · uniper · VeryOne · aircela · CAT · Bunker Holding Group · CASALE · mtu A Rolls-Royce solution · ACIES BIO · NACERO · Gena · STRIVE by STX · StormFisher HYDROGEN · CNTY 中国天楹

02

可再生甲醇
Renewable Methanol

Carbon Footprint of Methanol 2022
甲醇碳足迹报告 2022





- Modern facilities producing from natural gas have carbon footprint of 93-110 g CO2eq/MJ, depends on carbon content of natural gas feed and tools like CO2 recycling back to methanol reactor 现代天然气制甲醇的碳足迹 93-110 g CO2eq/MJ,如果仅考虑生产端，为0.5-0.8kg CO2 eq/kg
- Emission of End of Life methanol 甲醇使用端的碳排放为1.375kg CO2 eq /kg
- Renewable Resources can reduce emission in significant way 可再生资源将显著降低碳排放

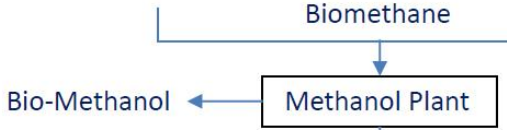
“Mass Balance 质量平衡”生物质甲醇 Bio-Methanol

Anaerobic Digester

Feedstocks include food waste, animal manure, sewage sludge, industrial organic waste

Landfill Gas recovery plant

Feedstocks include municipal organic waste



- 质量平衡允许化石资源和可再生资源混合，实现最大化的成本效益 Fossil and renewable resources co-feeding to achieve the cost efficiency
- 巴斯夫在德国生产生物质平衡的甲醇，实现50%的温室气体减排 BASF produces biomass balanced methanol in Germany with 50% GHG reduction
- OCI, 梅赛尼斯等在美国路易斯安那生产ISCC认证的生物质甲醇 OCI and Methanex now producing ISCC certified bio-methanol in Geismar, LA
- The current “Green Methanol” 目前使用的“绿色甲醇”来源
- UDB???

Sources: OCI, Methanex Corporation, Maersk

基于气化的生物质甲醇 Bio Methanol from Biomass Gasification

图 21. 加拿大艾伯塔省 Enerkem 的 MSW 制生物燃料（甲醇和乙醇）工厂。

来源：Enerkem (2020b)。

基于林业废弃物和纸浆的生物质甲醇 Bio Methanol from Forestry Waste and Pulping

Source：https://news.cision.com/sodra/r/sodra-first-in-the-world-with-fossil-free-biomethanol,c3040025

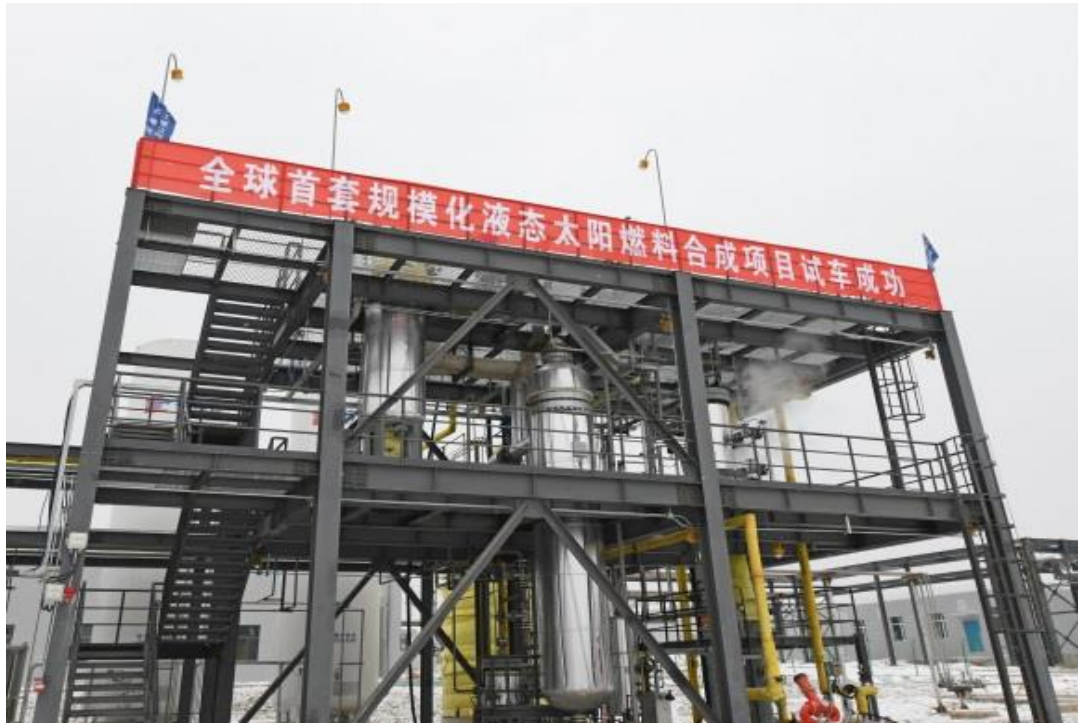
CO2+H2 eMethanol 电制甲醇

RFNBO-Renewable Fuel from Non-biogenic Origin: Electrolzer needed for hydrogen production, need to pay attention to the resources of electricity and CO2

RFNBO-需要电解槽参与制氢，需要注意电和二氧化碳的来源

Vulcanol from Carbon Recycling International: Geothermal water electrolysis and captured CO2

冰岛 CRI，地热制氢捕集CO2

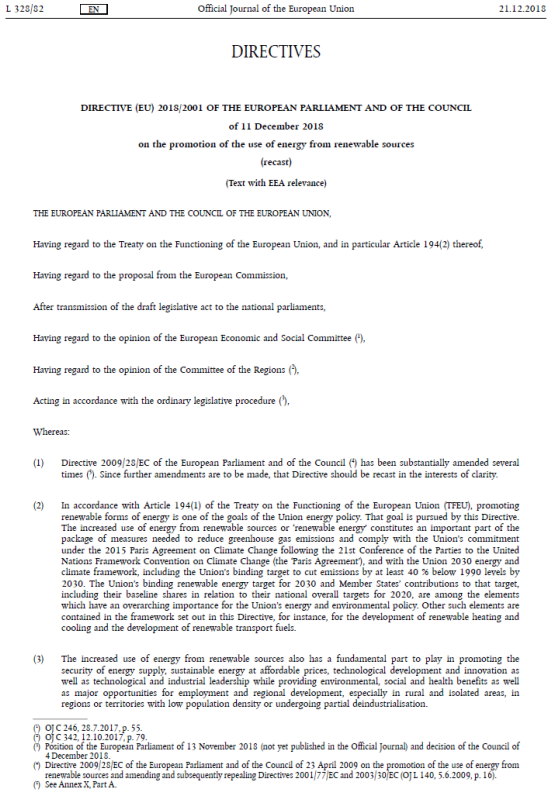


Liquid Sunshine in China: Solar water electrolysis and captured CO2

中国液态阳光：太阳能电解水，捕集CO2

甲醇作为燃料的碳足迹标准和认证 (适用于其他燃料)
Standards and Certifying of Methanol as bio-Fuel

欧盟 可再生燃料指令 EU RED2-3



L 328/82 EN Official Journal of the European Union 21.12.2018

DIRECTIVES

DIRECTIVE (EU) 2018/2001 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL
of 11 December 2018
on the promotion of the use of energy from renewable sources
(recast)
(Text with EEA relevance)

THE EUROPEAN PARLIAMENT AND THE COUNCIL OF THE EUROPEAN UNION,

Having regard to the Treaty on the Functioning of the European Union, and in particular Article 194(2) thereof,

Having regard to the proposal from the European Commission,

After transmission of the draft legislative act to the national parliaments,

Having regard to the opinion of the European Economic and Social Committee (1),

Having regard to the opinion of the Committee of the Regions (2),

Acting in accordance with the ordinary legislative procedure (3),

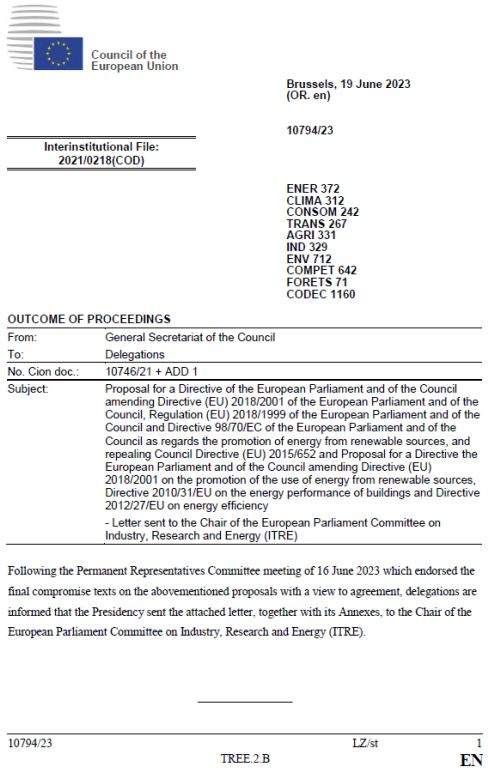
Whereas:

(1) Directive 2009/28/EC of the European Parliament and of the Council (4) has been substantially amended several times (5). Since further amendments are to be made, that Directive should be recast in the interests of clarity.

(2) In accordance with Article 194(1) of the Treaty on the Functioning of the European Union (TFEU), promoting renewable forms of energy is one of the goals of the Union energy policy. That goal is pursued by this Directive. The increased use of energy from renewable sources or 'renewable energy' constitutes an important part of the package of measures needed to reduce greenhouse gas emissions and comply with the Union's commitment under the 2015 Paris Agreement on Climate Change following the 21st Conference of the Parties to the United Nations Framework Convention on Climate Change (the 'Paris Agreement'), and with the Union 2030 energy and climate framework, including the Union's binding target to cut emissions by at least 40 % below 1990 levels by 2030. The Union's binding renewable energy target for 2030 and Member States' contributions to that target, including their baseline shares in relation to their national overall targets for 2020, are among the elements which have an overarching importance for the Union's energy and environmental policy. Other such elements are contained in the framework set out in this Directive, for instance, for the development of renewable heating and cooling and the development of renewable transport fuels.

(3) The increased use of energy from renewable sources also has a fundamental part to play in promoting the security of energy supply, sustainable energy at affordable prices, technological development and innovation as well as technological and industrial leadership while providing environmental, social and health benefits as well as major opportunities for employment and regional development, especially in rural and isolated areas, in regions or territories with low population density or undergoing partial deindustrialisation.

(1) OJ C 246, 28.7.2017, p. 55.
(2) OJ C 342, 12.10.2017, p. 79.
(3) Positions of the European Parliament of 13 November 2018 (not yet published in the Official Journal) and decision of the Council of 4 December 2018.
(4) Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC (OJ L 140, 5.6.2009, p. 16).
(5) See Annex X, Part A.



Council of the European Union

Brussels, 19 June 2023
(OR. en)

10794/23

Interinstitutional File:
2021/0218(COD)

ENER 372
CLIMA 312
CONSOM 242
TRANS 267
AGRI 331
IND 329
ENV 712
COMPET 642
FORETS 71
CODEC 1160

OUTCOME OF PROCEEDINGS

From:	General Secretariat of the Council
To:	Delegations
No. Cion doc.:	10746/21 + ADD 1
Subject:	Proposal for a Directive of the European Parliament and of the Council amending Directive (EU) 2018/2001 of the European Parliament and of the Council, Regulation (EU) 2018/1999 of the European Parliament and of the Council and Directive 98/70/EC of the European Parliament and of the Council as regards the promotion of energy from renewable sources, and repealing Council Directive (EU) 2015/652 and Proposal for a Directive the European Parliament and of the Council amending Directive (EU) 2018/2001 on the promotion of the use of energy from renewable sources, Directive 2010/31/EU on the energy performance of buildings and Directive 2012/27/EU on energy efficiency - Letter sent to the Chair of the European Parliament Committee on Industry, Research and Energy (ITRE)

Following the Permanent Representatives Committee meeting of 16 June 2023 which endorsed the final compromise texts on the abovementioned proposals with a view to agreement, delegations are informed that the Presidency sent the attached letter, together with its Annexes, to the Chair of the European Parliament Committee on Industry, Research and Energy (ITRE).

10794/23 LZ/st 1
TREE.2.B EN

来源：https://www.imo.org/en/OurWork/Environment/Pages/Lifecycle-GHG---carbon-intensity-guidelines.aspx

生物质甲醇 -生物燃料的法规和认证 欧洲 RED （ISCC 和 RSB）

LCA GHG <33g/MJ

Certification Scheme: ISCC EU

ISCC EU has been fully recognised by the European Commisson since 2011 With ISCC EU certification the compliance with the legal requirements for the sustainability and greenhouse gas (GHG) emission savings criteria for sustainable fuels and the production of electricity, heating and cooling from biomass set out in the renewed Renewable Energy Directive (REDII) for all Member States of the European Union can be verified. ISCC EU certification covers the raw materials and fuels as stated in the RED II:

- Agricultural and forest biomass, waste and residues (including agricultural, aquaculture, fisheries an forestry residues), lignocellulosic and non-food cellulosic materials for the production of biofuels, bioliquids and biomass fuels, including advanced biofuels and biogas for transport (i.e. biofuels and biogas produced from feedstocks listed in Part A of Annex IX of the RED II) and biofuels, bioliquids and biomass fuels with a low risk or a high risk of indirect land-use change (iLUC).
- Liquid and solid waste streams of non-renewable origin or waste processing and exhaust gas of nor renewable origin for the production of recycled carbon fuels.
- Energy derived from renewable sources other than biomass for the production of renewable liquid and gaseous transport fuels of nonbiological origin.

ISCC certification goes beyond the legal requirements of the RED II as it covers additional ecological and social requirements.

来源：https://www.iscc-system.org/certification/iscc-certification-schemes/iscc-eu/

甲醇作为燃料的碳足迹标准和认证 (适用于其他燃料)
Standards and Certifying of Methanol as Fuel

RFNBO E methanol 电制甲醇 –同时满足ISCC EU 和欧盟最新关于RFNBO的RED 修正案

EUROPEAN COMMISSION

Brussels, 10.2.2023
C(2023) 1086 final

COMMISSION DELEGATED REGULATION (EU) …/...

of 10.2.2023

supplementing Directive (EU) 2018/2001 of the European Parliament and of the Council by establishing a minimum threshold for greenhouse gas emissions savings of recycled carbon fuels and by specifying a methodology for assessing greenhouse gas emissions savings from renewable liquid and gaseous transport fuels of non-biological origin and from recycled carbon fuels

EUROPEAN COMMISSION

Brussels, 10.2.2023
C(2023) 1087 final

COMMISSION DELEGATED REGULATION (EU) …/...

of 10.2.2023

supplementing Directive (EU) 2018/2001 of the European Parliament and of the Council by establishing a Union methodology setting out detailed rules for the production of renewable liquid and gaseous transport fuels of non-biological origin

10. Emissions from existing use or fate include all emissions in the existing use or fate of the input that are avoided when the input is used for fuel production. These emissions shall include the CO_2 equivalent of the carbon incorporated in the chemical composition of the fuel that would have otherwise been emitted as CO2 into the atmosphere. This includes CO_2 that was captured and incorporated into the fuel provided that at least one of the following conditions is fulfilled:

(a) The CO_2 has been captured from an activity listed under Annex I of Directive 2003/87/EC and has been taken into account upstream in an effective carbon pricing system and is incorporated in the chemical composition of the fuel before 2036. This date shall be extended to 2041 in other cases than CO_2 stemming from the combustion of fuels for electricity generation; or

(b) The CO_2 has been captured from the air; or

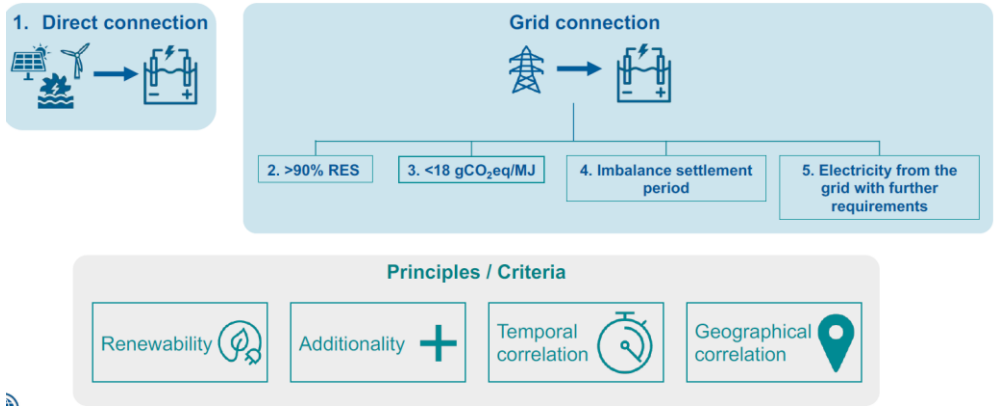
(c) The captured CO_2 stems from the production or the combustion of biofuels, bioliquids or biomass fuels complying with the sustainability and greenhouse gas saving criteria and the CO_2 capture did not receive credits for emission savings from CO_2 capture and replacement, set out in Annex V and VI of Directive (EU) 2018/2001; or

(d) The captured CO2 stems from the combustion of renewable liquid and gaseous transport fuels of non-biological origin or recycled carbon fuels complying with the greenhouse gas saving criteria, set out in Article 25(2) and Article 28(5) of Directive (EU) 2018/2001 and this Regulation; or

(e) The captured CO_2 stems from a geological source of CO_2 and the CO_2 was previously released naturally.

Captured CO2 stemming from a fuel that is deliberately combusted for the specific purpose of producing the CO2 and CO2, the capture of which has received an emissions credit under other provisions of the law shall not be included

Depending on the connection, five possible scenarios can be envisioned

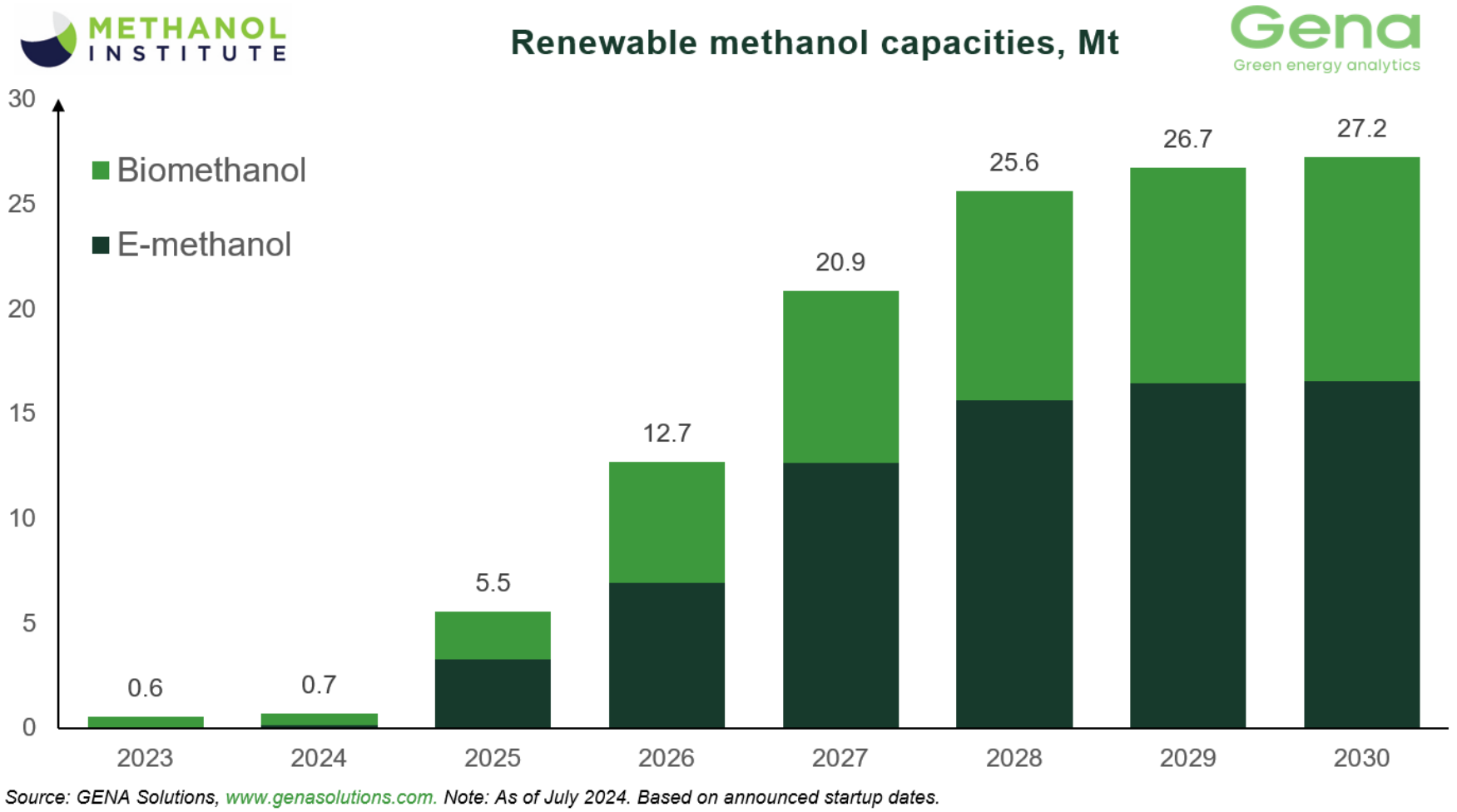


RFNBO-Renewable Fuel from Non-biogenic Origin: Electrolzer needed for hydrogen production, need to pay attention to the resources of electricity and CO2 and related definitions from the latest EU delegated acts

RFNBO-需要电解槽参与制氢，需要注意电和二氧化碳的来源，同时LCA GHG <28.2g/MJ

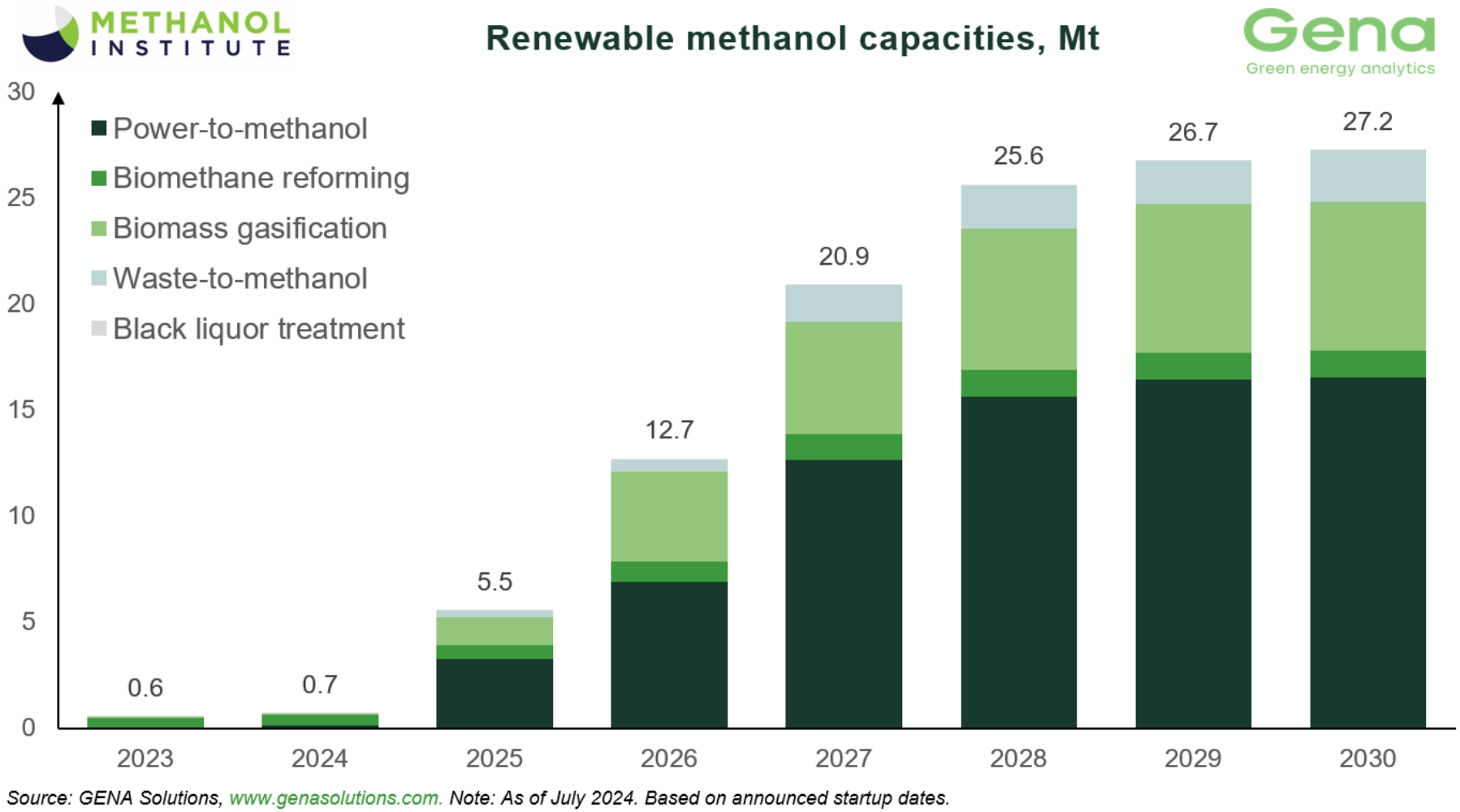
来源：https://ec.europa.eu/commission/presscorner/detail/en/ip_23_594

Renewable Methanol Projects 全球可再生甲醇产能



www.methanol.org/renewable/

Renewable Methanol Projects 全球可再生甲醇产能

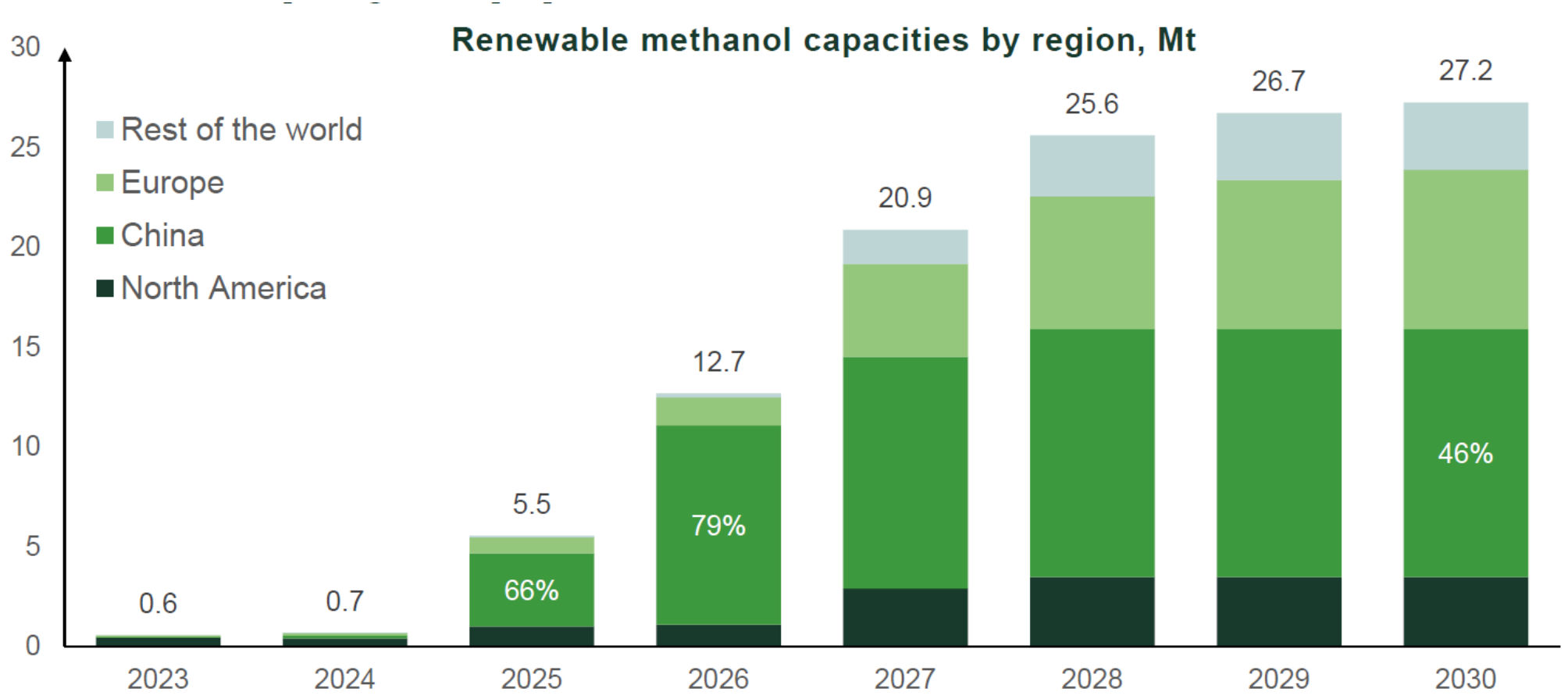


Source: GENA Solutions, www.genasolutions.com. Note: As of July 2024. Based on announced startup dates.

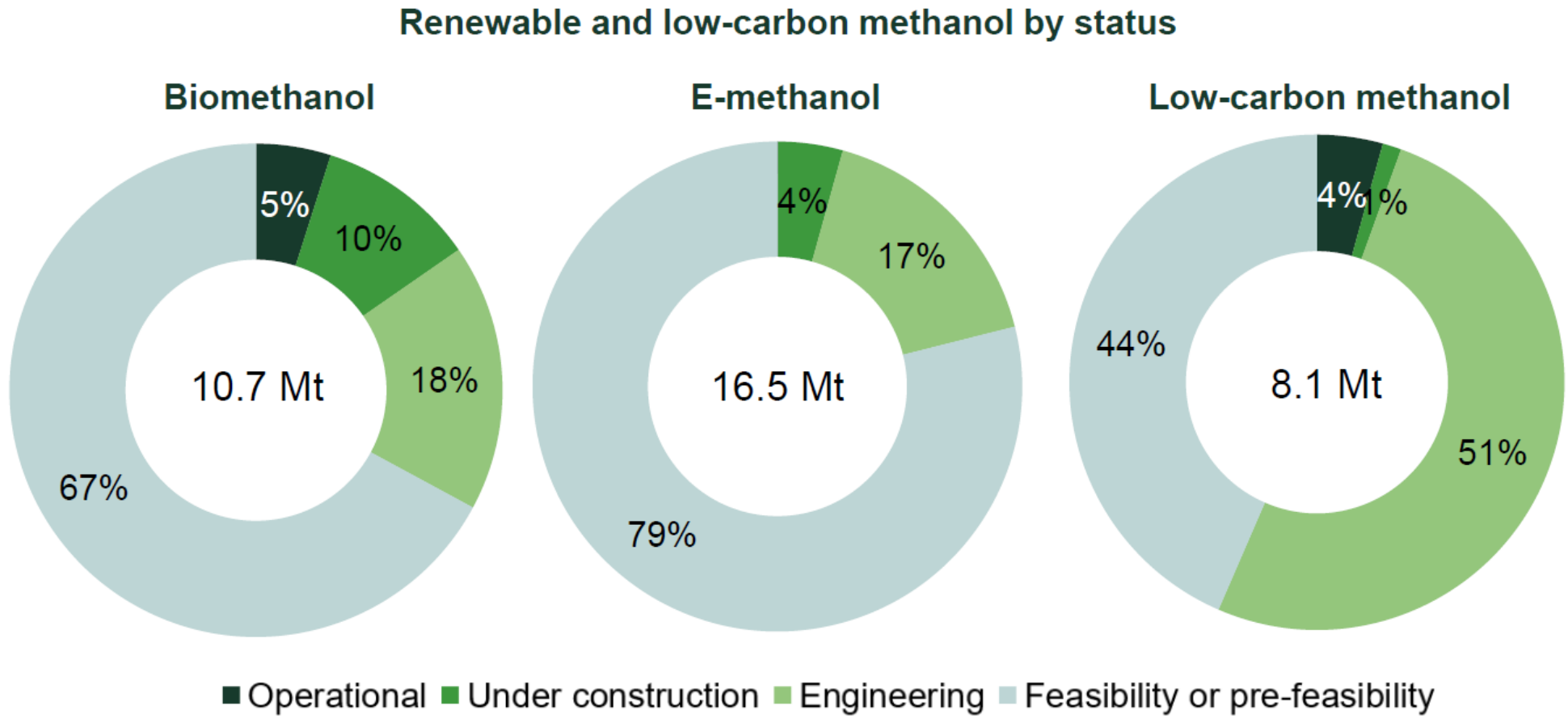
www.methanol.org/renewable/

Production Lead 产能领先者

China takes lead in the renewable methanol development in the min-term perspective
中国在可再生甲醇开发上在中期领先

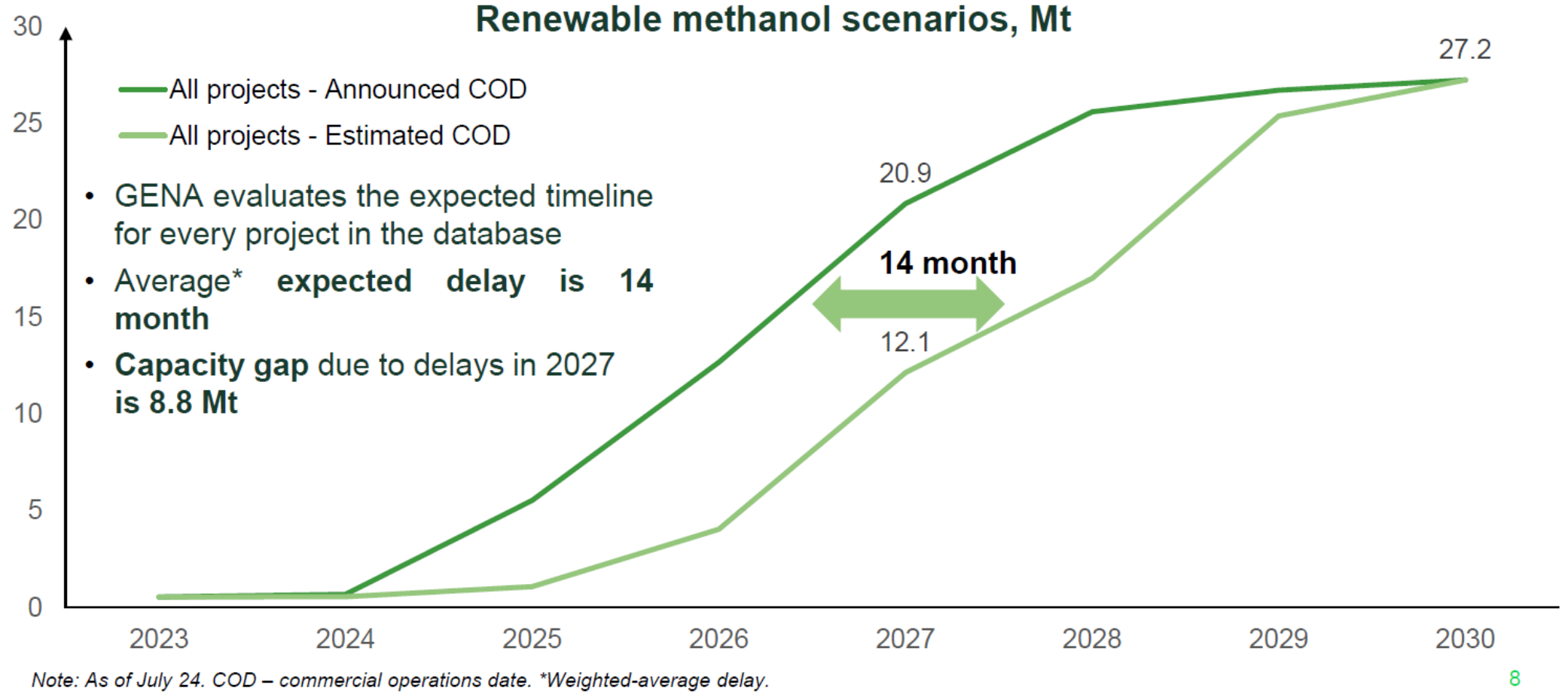


Production in different stages 不同开发阶段



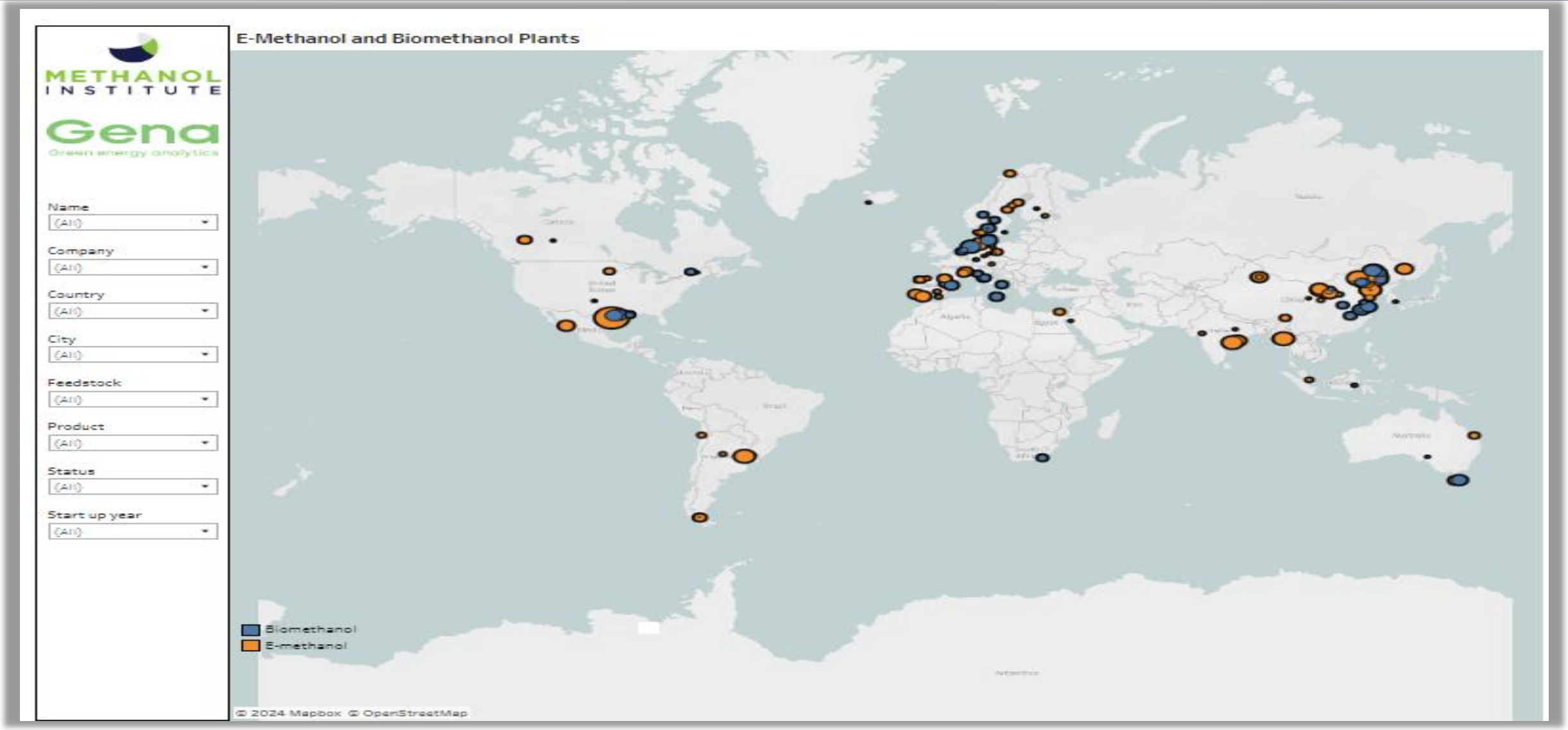
Note: As of July 2024. RM – Renewable methanol. LCM – Low-carbon methanol.

化工项目开发面临延期 Potential delay of projects



*Note: As of July 24. COD – commercial operations date. *Weighted-average delay.*

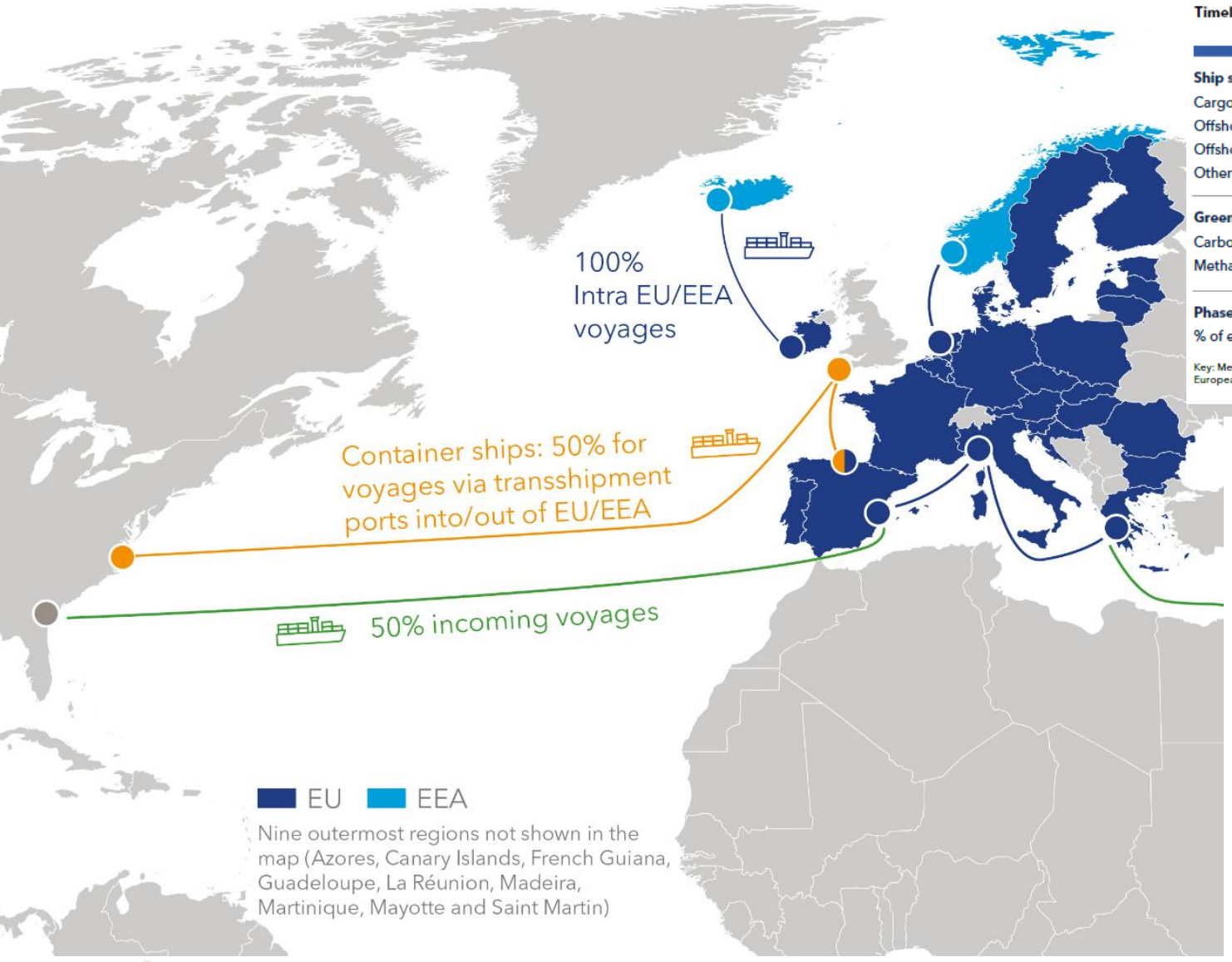
Renewable Methanol Projects

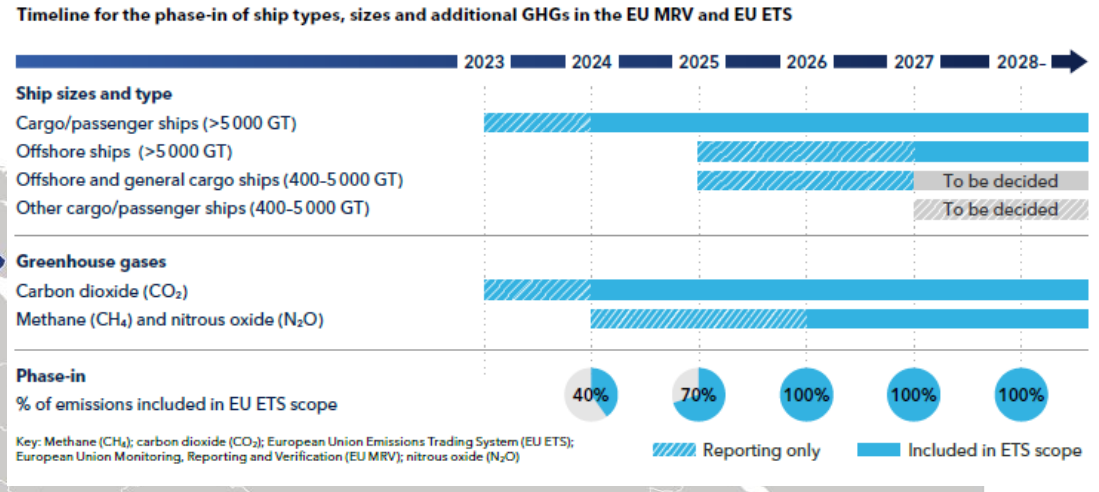


www.methanol.org/renewable/

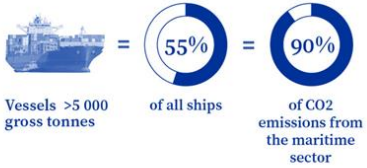
03 Methanol Marine Fuel
甲醇船舶燃料

Policy impact EU ETS and FuelEU Maritime



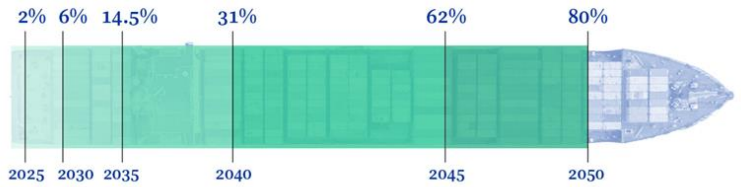


The FuelEU maritime regulation will oblige vessels above 5 000 gross tonnes calling at European ports (with exceptions such as fishing ships):



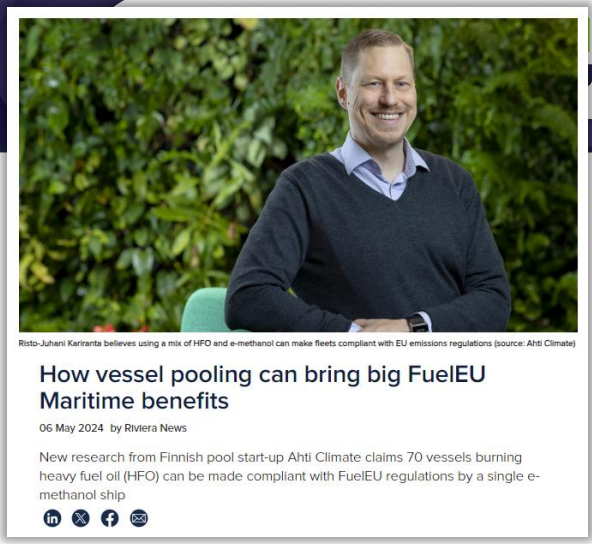
→ to **reduce** the **greenhouse gas intensity** of the energy used on board as follows

Annual average carbon intensity reduction compared to the average in 2020



→ to connect to **onshore power supply** for their electrical power needs while moored at the quayside, unless they use another zero-emission technology

欧盟 FuelEU Maritime – Pooling机制



- 基于欧盟海事燃料法规的Pooling 机制，Ahti Climate 认为一艘在欧洲使用电制甲醇的船舶可以使70艘使用重质燃料油的船舶合规 With FuelEU Maritime pooling compliance mechanism, Ahti Climate believes one e-methanol vessel on voyages within EU waters could make 70 vessels using HFO compliant

- 与此对比，使用LNG低速发动机的船舶只能使5艘使用重质燃料油的船舶合规 By comparison, an LNG vessel with a low-speed engine could make five HFO-fuelled ships compliant

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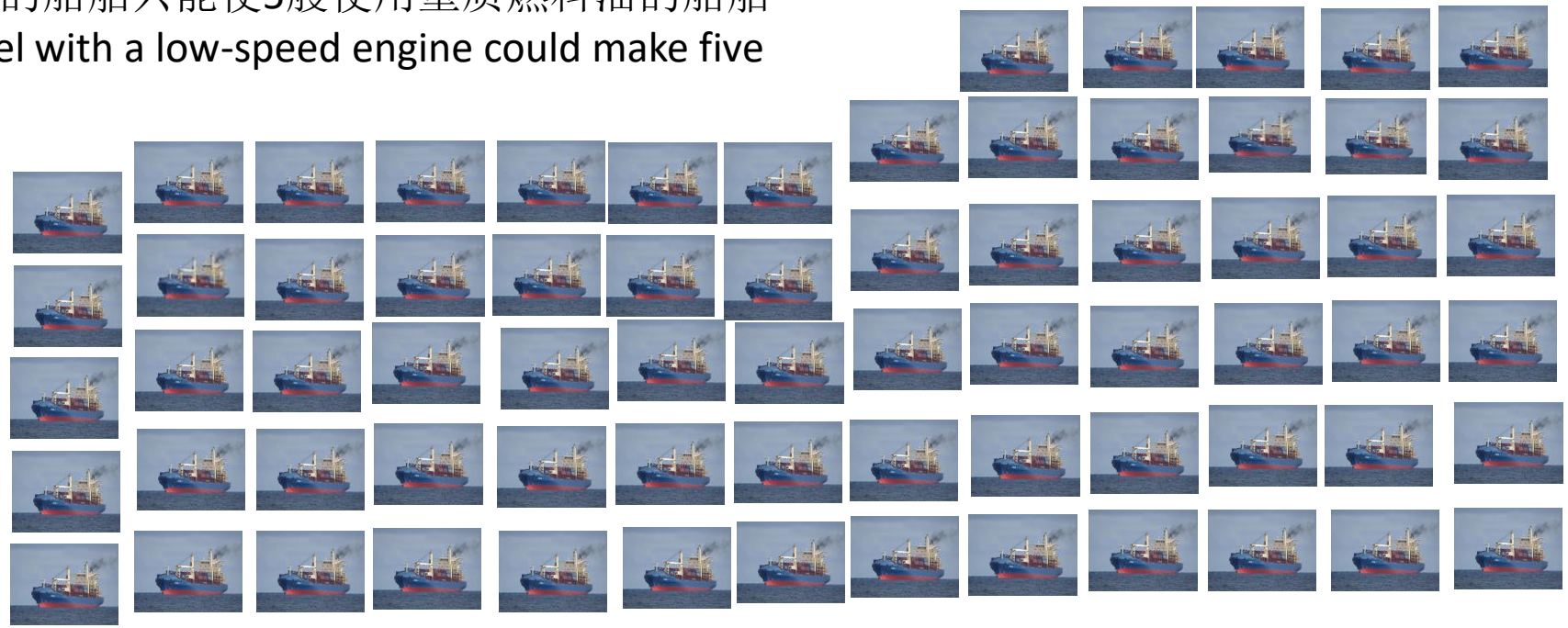
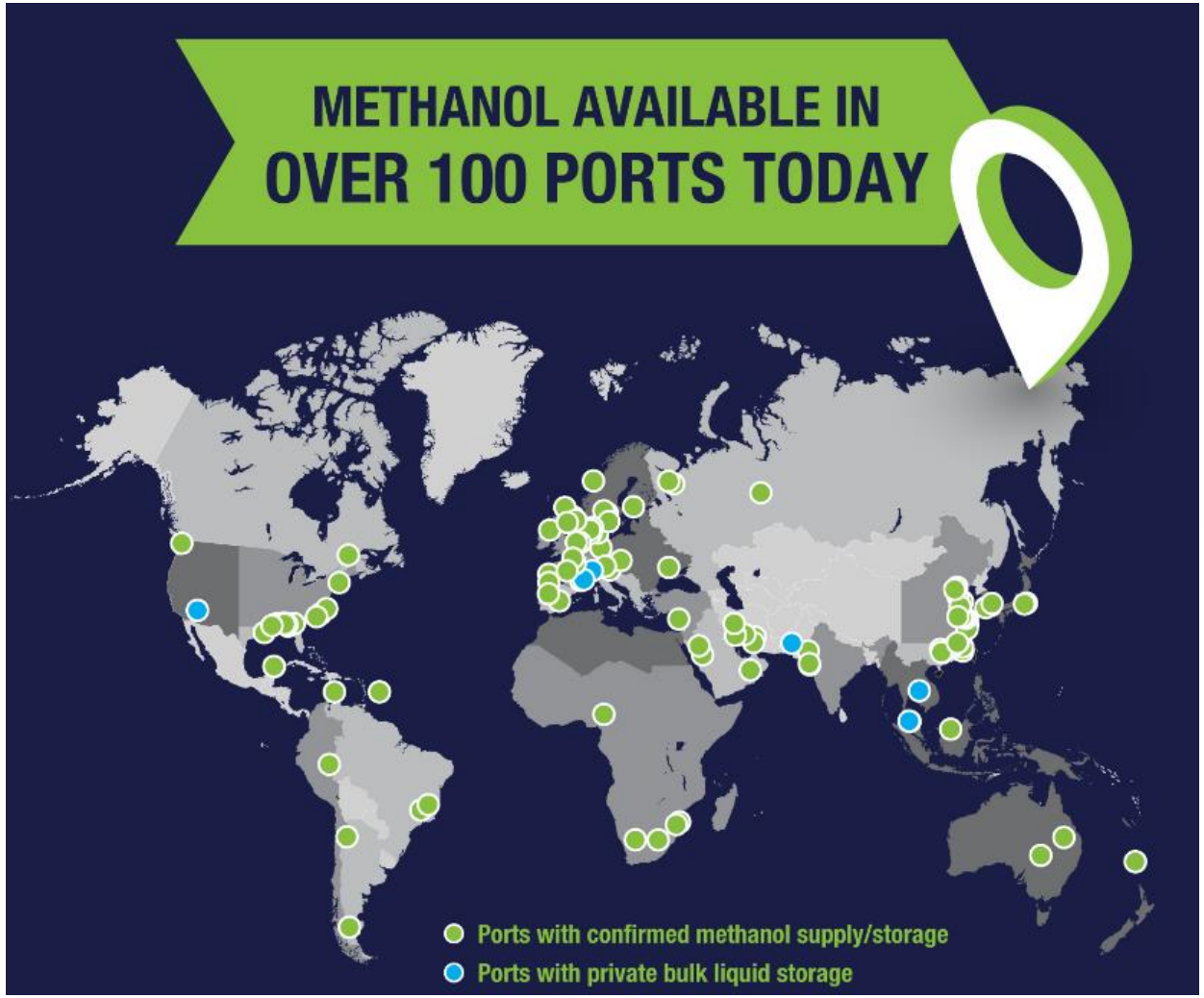
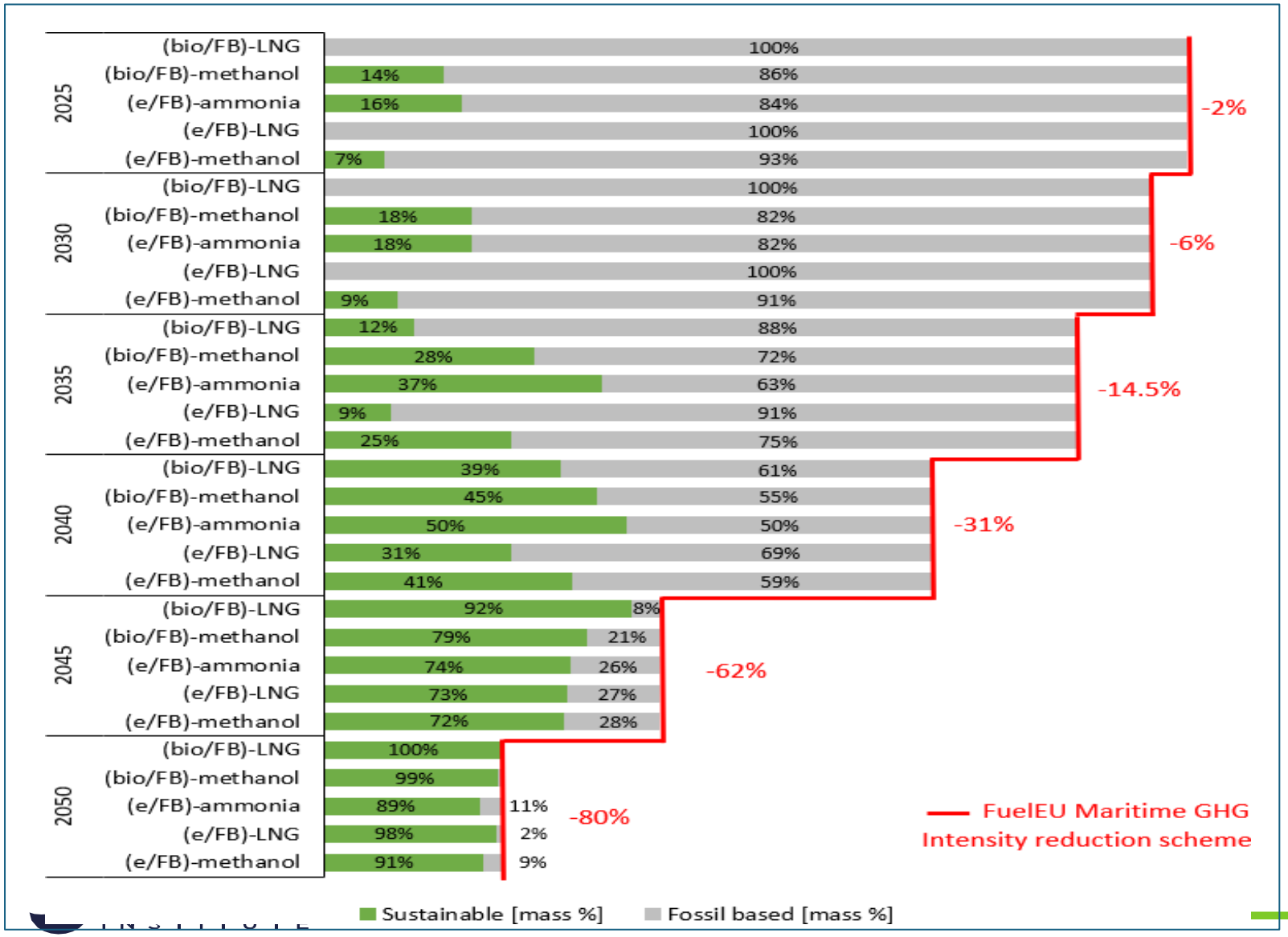


Available and Easily Bunkered 加注简易且全球可供



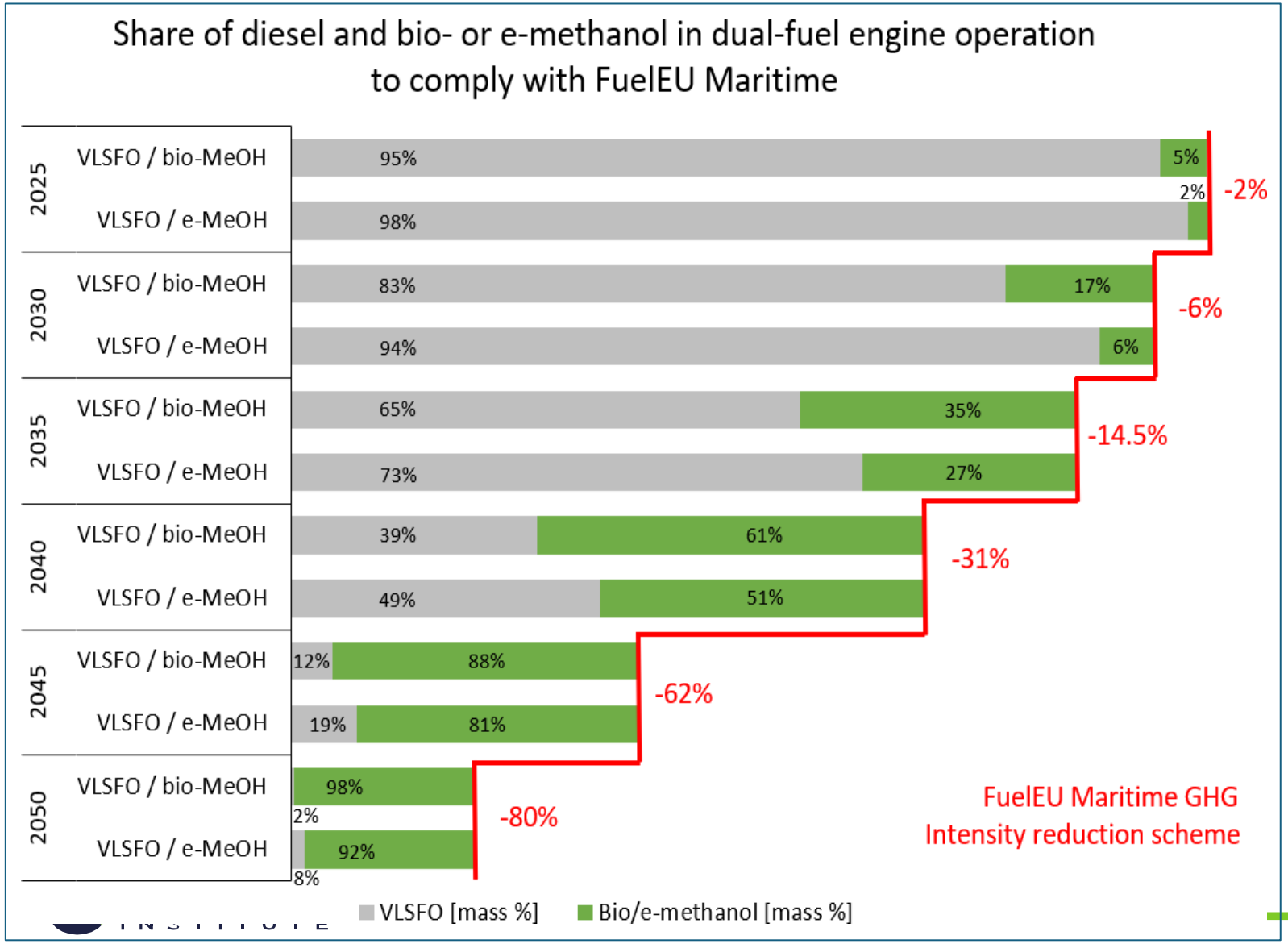
https://public.tableau.com/app/profile/quantzig/viz/MethanolAvailabilityDataTopGlobalMaritimePorts/MethanolFuelAvailabilityatPorts

How to meet FuelEU Maritme?-Single Fuel 合规履约的方式和预测-单一燃料



- Renewable and traditional fuel can be blended to meet any targets from 2025-2050可再生燃料和化石燃料可以混合，在同一品种下，完成合规，左图介绍了可再生燃料合规所需要的份额 2025-2050
- 2045年以后，仅靠生物质燃料可能无法满足欧盟Fuel EU Maritime 的要求 In 2045, the GHG Intensity reduction cannot be reached with bio-methanol or bio-LNG
- 2050年，仅有电制合成燃料能够满足响应和要求 In 2050, only e-methanol and e-ammonia can reach the required reductions

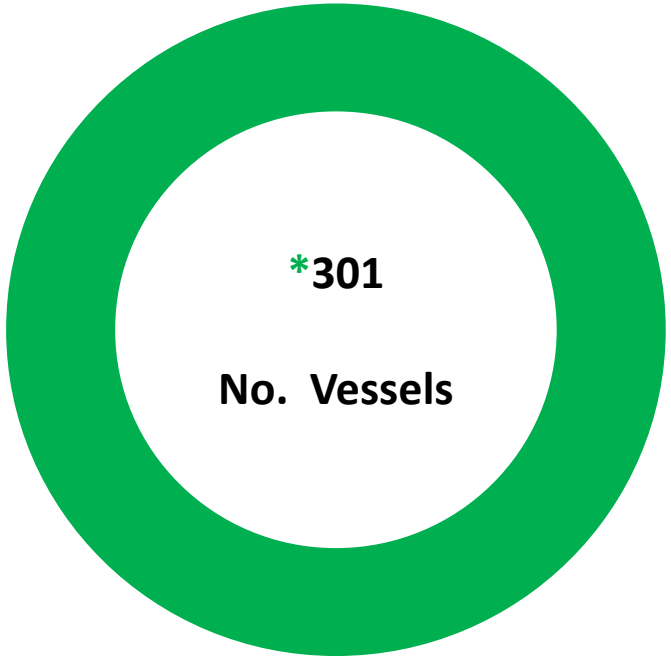
How to meet FuelEU Maritme?-Dual Fuel 合规履约的方式和预测-双燃料情况



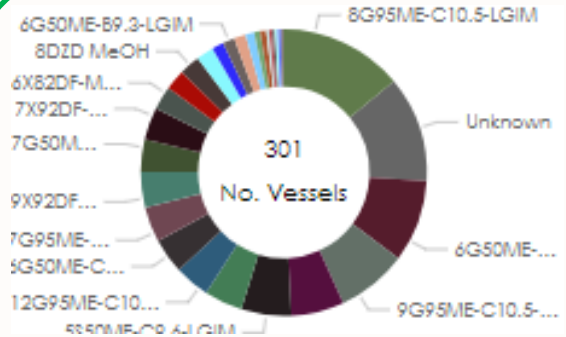
- 由于船舶的双燃料发动机属性，可以维持柴油使用，采用生物或者电制甲醇 A vessel equipped with a dual-fuel engine can play with the amount of diesel that is replaced by bio- or e-methanol
- Fuel EU 法规驱动柴油替代至2050 The required diesel replacement to comply with FuelEU Maritime increases over time in the period 2025-2050 (*)
- 2025仅需少量可再生燃料，如5%的生物甲醇或者2%的电制甲醇，2040需求量迅速增加 In 2025, a vessel can comply using 5% of bio-methanol and 2% of e-methanol, while in 2040 the shares should be respectively 61% and 51%

New Vessel | Order Book

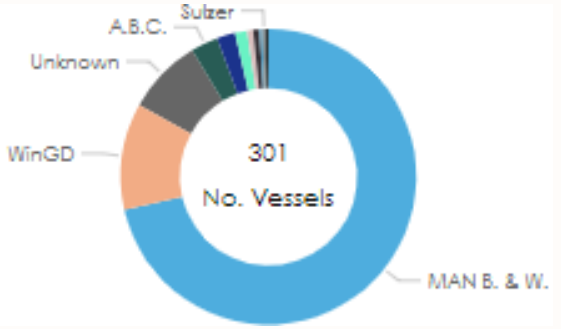
Alt Fuel Uptake by Number of Vessels				
Alt Fuel	Fleet	% Fleet	Order Book	% Order Book
Methanol	39.0	0.0%	262.0	4.1%



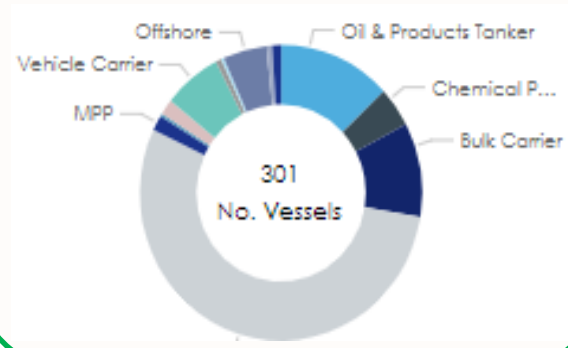
Engine Model



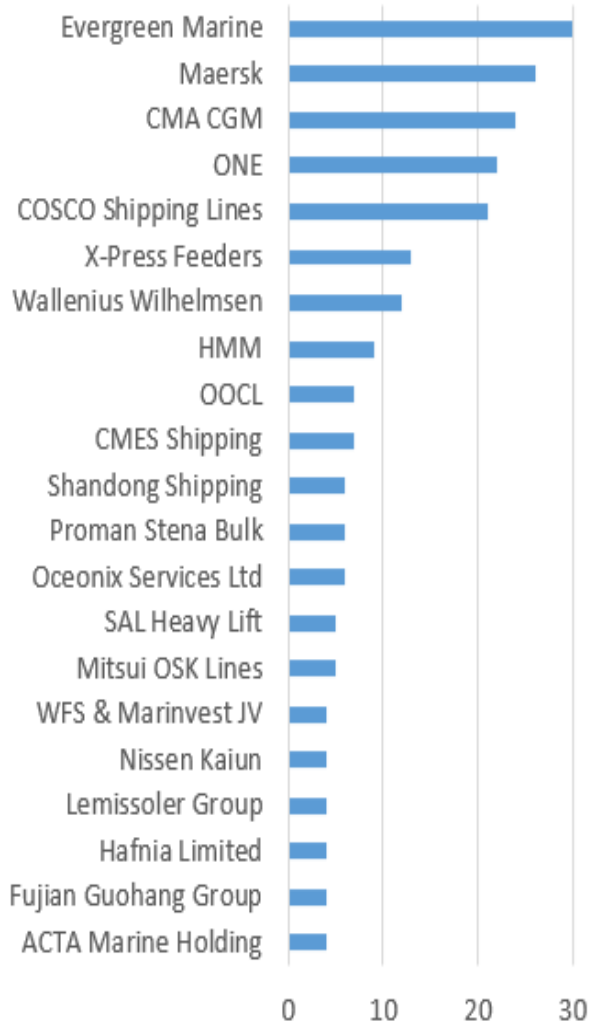
Engine Designers



Vessel Type



Top Owner

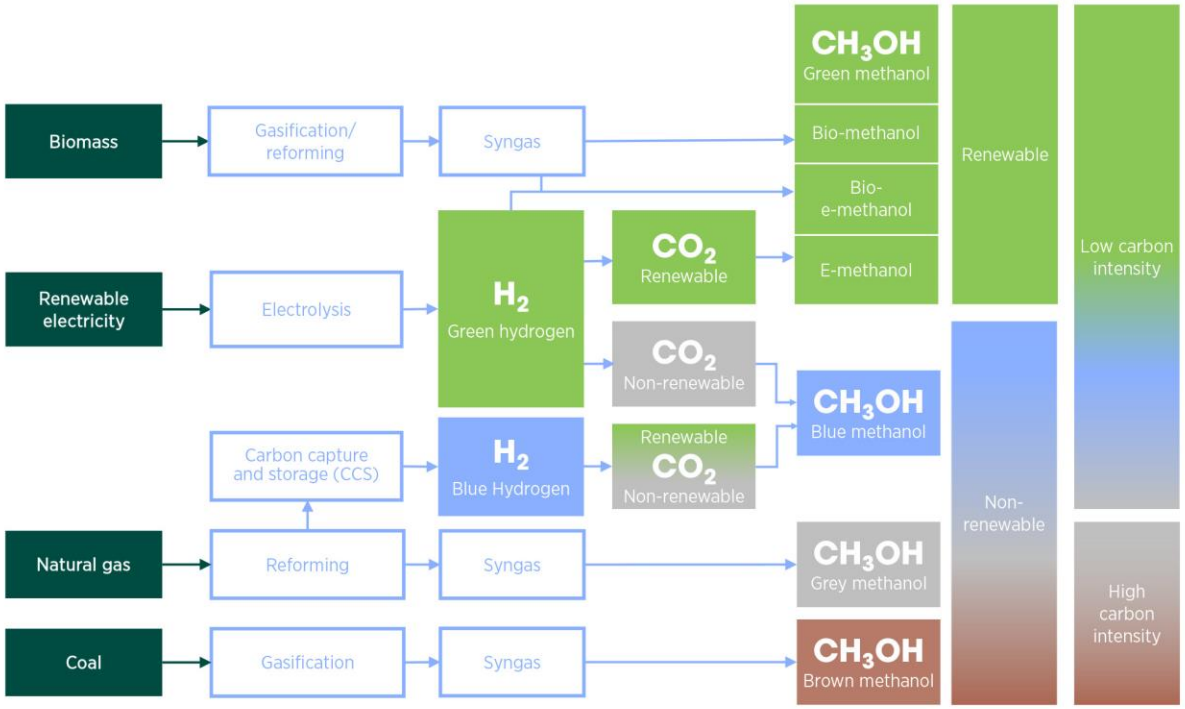


Source: Clarksons

*Doesn't include DF BVs

2050: 需求增长5倍 5-Fold Demand Increase

Figure 2. Principal methanol production routes

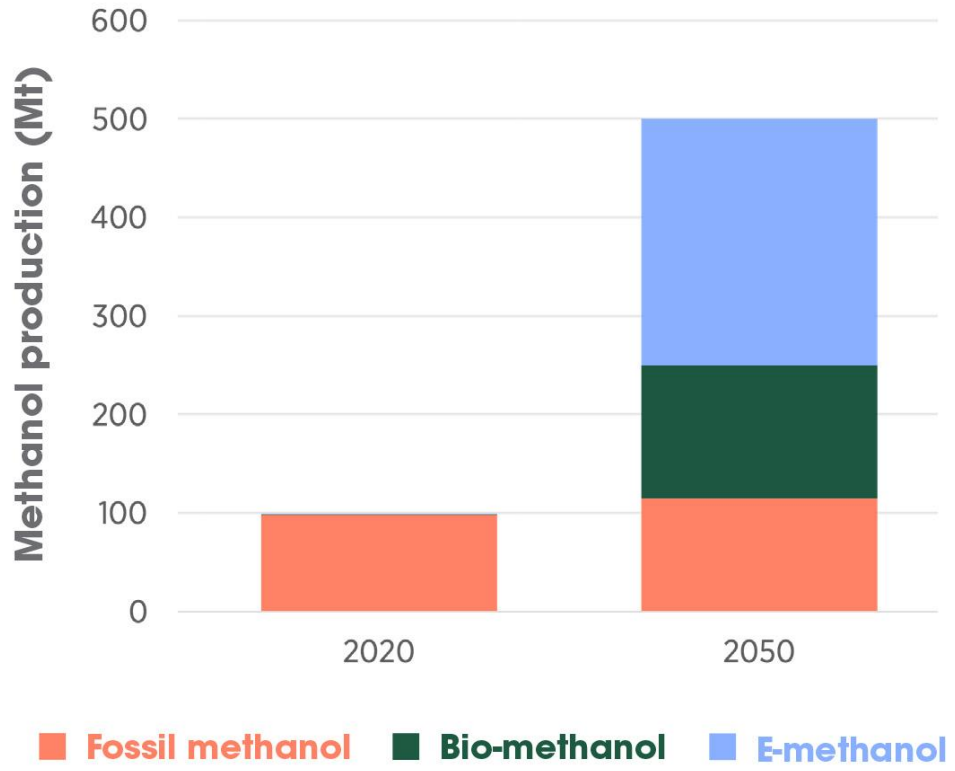


Renewable CO_2: *from bio-origin and through direct air capture (DAC)*

Non-renewable CO_2: *from fossil origin, industry*

While there is not a standard colour code for the different types of methanol production processes; this illustration of various types of methanol according to feedstock and energy sources is an initial proposition that is meant to be a basis for further discussion with stakeholders

Figure 47. Current and future methanol production by source



Source: MI and IRENA: Renewable Methanol: Innovation Outlook: https://irena.org/events/2021/Jan/IRENA-and-the-Methanol-Institute

THANK YOU

谢谢