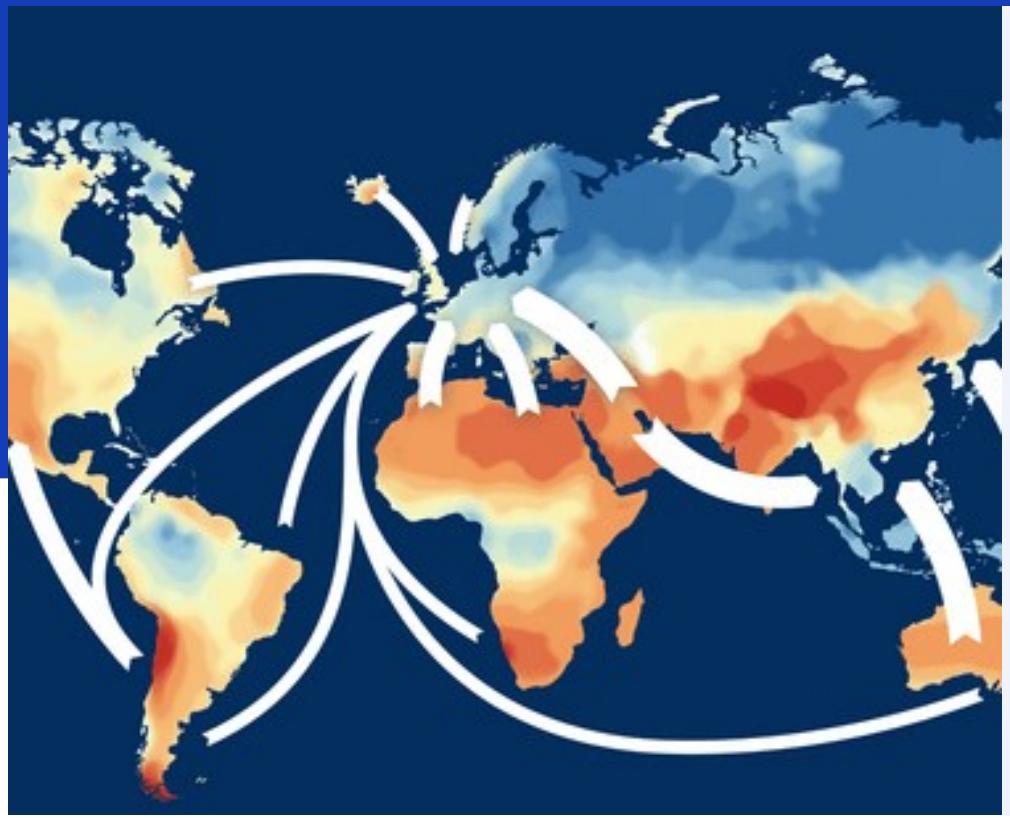
SHIP>NL sessie VI 2024

Drs. M.C.M. Rijkers

Start presentation

TNO innovation for life

Agenda SHIP>NL sessie 19 juni 2024



1. Welkom
2. Deep dive: Deep Dive: Methanol in shipping
   Martijn Kom | Boskalis
3. Reflectie: Renewable Methanol – current state of play & future opportunities
   Karlijn Arts | OCI
4. Afsluiting

Huisregels

- Camera aan, microfoon op ‘mute’
- Vragen?
  - Plaats verduidelijkingsvragen in de meeting chat; of
  - Steek je hand op!
- De moderator zorgt ervoor dat je vraag beantwoord wordt (eventueel achteraf).
- Niet alle slides worden na de sessie gedeeld. Slides van de andere sessies zijn te vinden op SHIPNL: Sustainable Hydrogen Import Program Netherlands | Nationaal Waterstof Programma

- We bespreken uiteraard geen marktgevoelige zaken.

- Chatham house rules: De besproken informatie mag gedeeld worden, maar zonder de spreker te onthullen.

Meerjarig kennisprogramma met 5 lijnen

- **In deze sessie:**

1 Technisch economisch	2 Beleid	3 Markt	4 Internationaal	5 Omgeving
▪ Inzicht in importketens productie-conversie-transport-opslag-reconversie-gebruik ▪ Vraagontwikkeling, scenario's ▪ Infrastructuur & systeemintegratie: corridors, benutten bestaande infra. ▪ Technology assessments, R&D	▪ Impact van 'Fit for 55', REDII, Delegated acts, ETS/CBAM, etc. ▪ Impact van certificering en CO2 allocatie: emissiefactoren, LCA ketenanalyse, etc. ▪ Financiering en stimulering (EU & NL): IPCEI, PCI, TEN-E, JTF, EIB, Horizon Europe, MOOI, DEI, MIEK, SDE++, etc	▪ Marktmodellen: bilaterale contracten, vrije handel, waterstofbeurs ▪ Internationale handelsstromen: verwachte vraag- en aanbodvolumes en transportstromen ▪ Importtarieven, trade agreements en handelsbeperkingen, WTO, etc.	▪ Samenwerking met omringende EU/niet-EU importlanden om corridors te ontwikkelen ▪ Concurrentie met omringende EU/niet-EU importlanden ▪ Geopolitieke aspecten: strategische voorraden, afhankelijkheid, politieke stabiliteit van exportlanden	▪ Ruimtegebruik van ketenelementen ▪ Veiligheid: brandbaarheid, zorgwekkende stoffen, risicocontouren, etc ▪ Milieu: stikstof, lekkage ▪ Maatschappelijke acceptatie ▪ MVO / samenhang met SDG's in exportlanden

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Deep dive: Methanol in shipping

- Martijn Kom | Boskalis

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Reflectie:
Renewable Methanol – current state of play & future opportunities

- Karlijn Arts| OCI

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OCI Global

Renewable methanol

Current state of play and future opportunities

Overview of OCI Methanol Group

	OCI Beaumont (Bio-Methanol)	Natgasoline LLC	OCI Delfzijl (BioMCN) (Bio-Methanol)
Location	Texas, USA	Texas, USA	Delfzijl, Netherlands
Ownership	100%	50% JV with Proman	100%
Commissioning	2012	2018	1974
Capacity (100% Basis)	Methanol: 1,033 ktpa Ammonia: 365 ktpa	Methanol: 1,807 ktpa	Methanol M1: 496 ktpa Methanol M2: 496 ktpa

Methanol Production Assets

- **#2** in US
- **#1** in Europe
- **#5** Globally[2]
- **#1** Leader in Clean Methanol

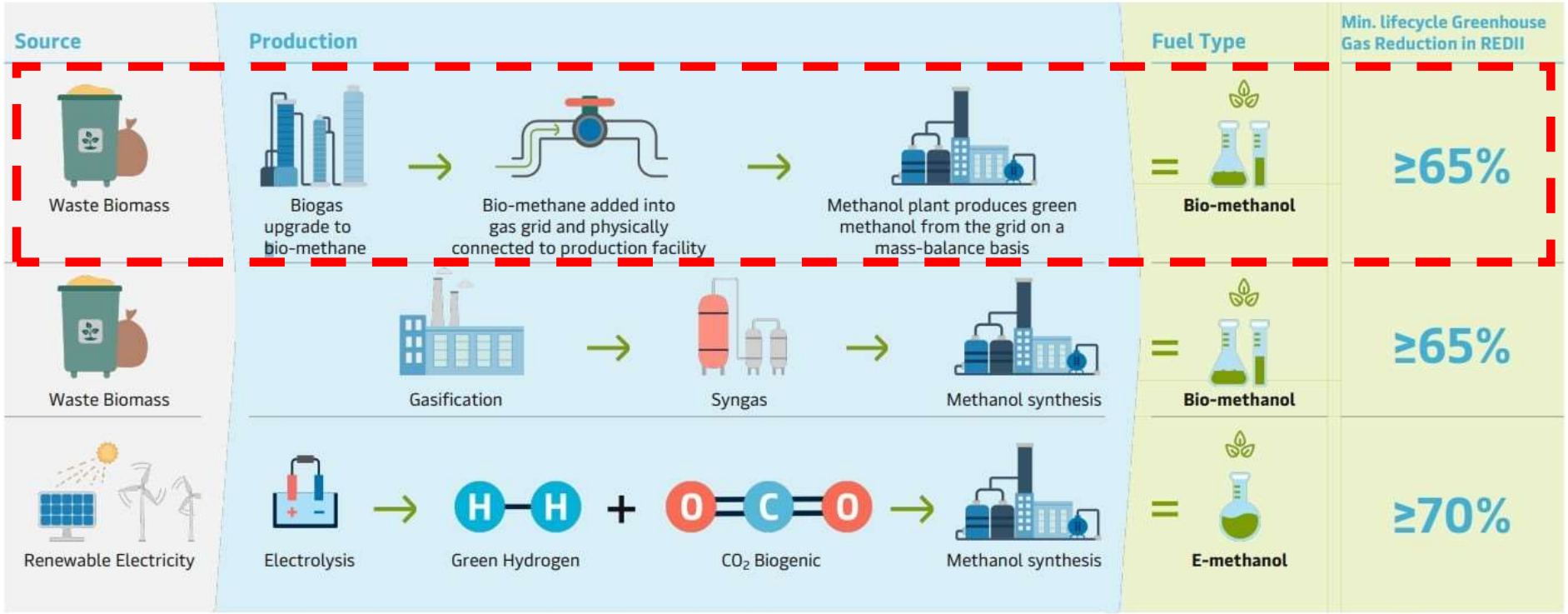
Distribution Assets

- **Global reach with import / export infra network to reach EU, US**
- **Marketing offices in Houston, Rotterdam and Amsterdam**
- **Ample storage capacities: c.240kt** in Texas, Antwerp, Rotterdam and Delfzijl with strategic alliances in Asia
- Flexible logistical capabilities: pipeline, truck / rail, barge and vessel

Notes: (1) Includes 50% of Natgasoline capacity and 365ktpa of ammonia capacity at OCIB. (2) Based on nameplate capacity. #3 globally if Iranian capacity and Trinidad capacity are excluded, which both suffer from significant gas curtailments. (3) Cash cost curve is on an FOB basis. Henry Hub assumed at $2.3 per mmbtu

Production Pathways for Renewable Methanol

Bio-methanol from waste-based biomethane is available at scale today.



Source: Maersk

- Under the ISCC EU scheme, the biomethane to methanol pathway can be tracked and verified **using the mass balance approach**
- The ISCC certification process requires documentation and verification at **each step of the supply chain**, from production to final use, ensuring the sustainability criteria are met.
- The first production pathway, surrounded by a red dotted line, is the only pathway producers can currently use to produce renewable methanol. The technologies of the other two pathways still need to be further developed to reach commercial readiness.

Current pathway- Waste biomass via SMR to biomethanol

As explained in the previous slide, the only available production pathway to produce biomethane based fuels such as bioLNG and biomethanol is via the SMR pathway which is described below

Bio-Methane Sourcing

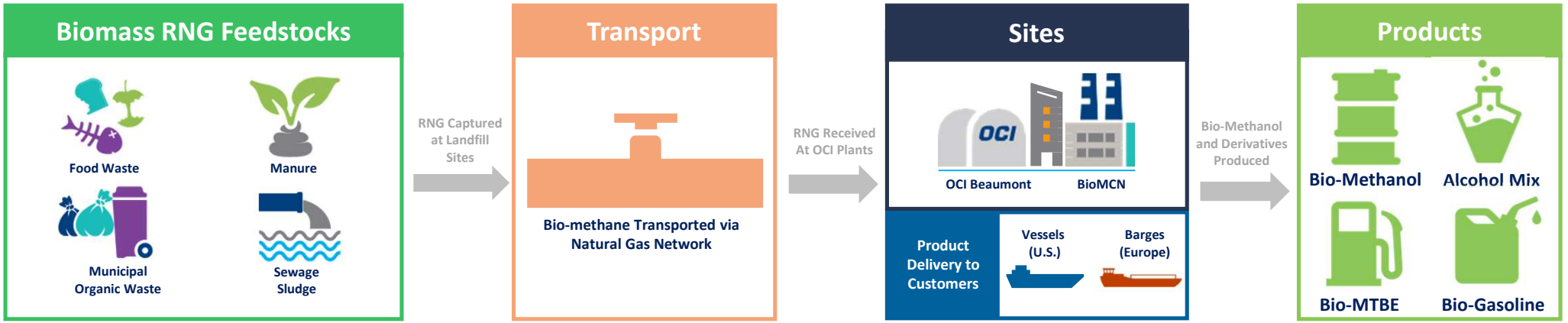
- OCI sources bio-methane (also known as “Renewable Natural Gas” or “Biogas”) from a variety of producers in the EU and USA
- Bio-methane is a renewable energy source produced from the decomposition of organic matter either in a landfill, wastewater treatment plant or comparable sources
- Bio-methane is a direct substitute for fossil natural gas and can be transported through the efficient natural gas grid. This saves transport emissions
- OCI HyFuels is one of the largest buyers of bio-methane globally

Bio-Methanol Production

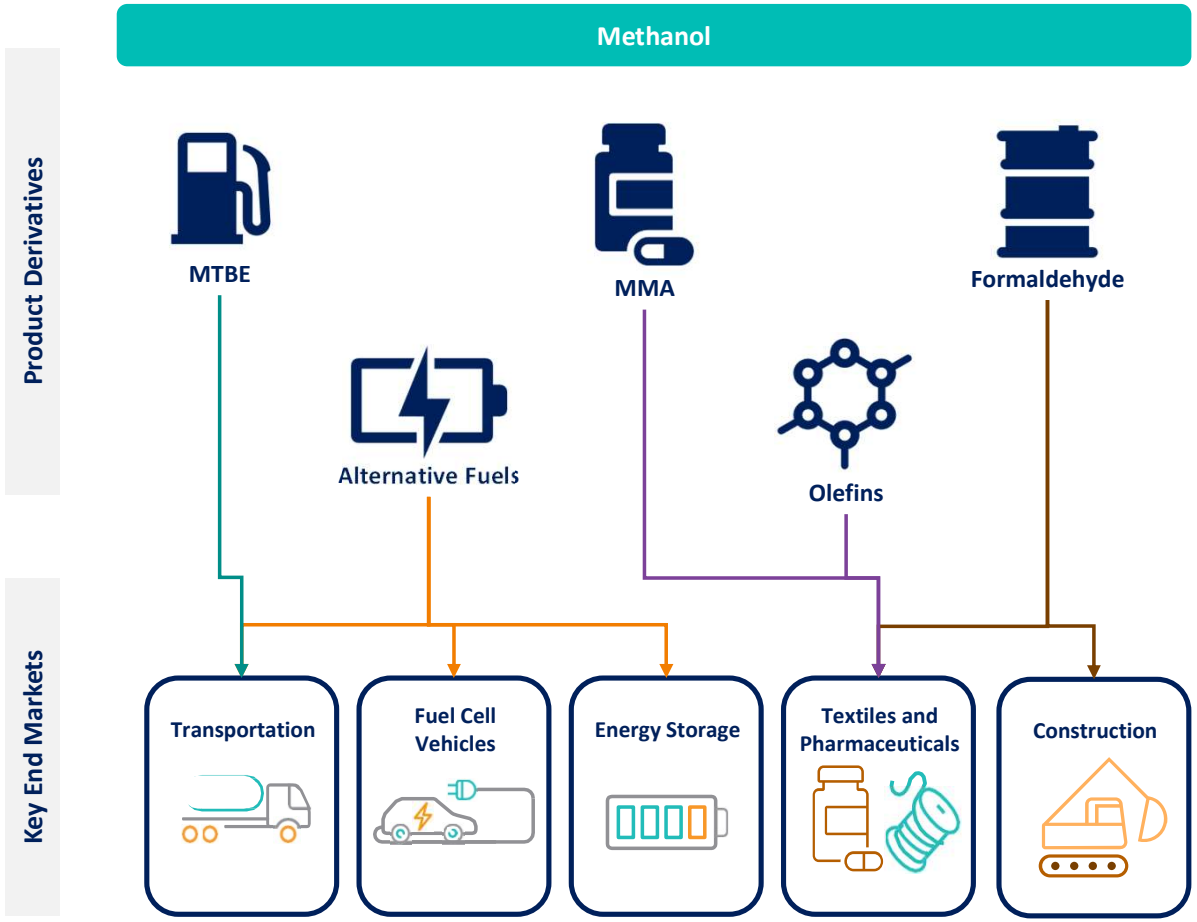
- Methanol is produced by the catalytic reforming of natural gas and steam
- Bio-methanol is produced by substituting fossil natural gas with biomethane in the production process at BioMCN (EU) and OCI Beaumont (USA)
- Chemically, bio-methanol produced from bio-methane is identical to traditional methanol produced from fossil natural gas
- OCI transports bio-methanol via vessel and barge for final sale into various markets

End Products

- OCI currently uses bio-methanol to make Bio-MTBE and an alcohol fuel mix (bio-methanol and ethanol) for road sector
- Maritime is expected to become a big market for our renewable methanol



Promising markets for (renewable) methanol



Robust Demand for Renewable Methanol

Significant potential demand growth for renewable methanol to support decarbonization in multiple verticals

1. Multiple ways of producing Clean Methanol (i.e., green/blue); ability depends on the nearby supply and cost of the feedstock

2. Clean hydrogen feedstock is injected into existing production process (replacing grey hydrogen), and can be combined with grey feedstock, with an appropriate certification system in place

3. Given Methanol's existing versatile applications and evolving new applications, it is one of the best building blocks to decarbonize many industries

Green *(Bio- and E-Methanol)*

- Hydrogen generated by an **electrolyzer** powered by **renewable energy** → Carbon source + H_2
- Hydrogen/syngas derived from the **gasification of Wood Biomass or Municipal Solid Waste Gasifier, i.e. Waste to Energy** → CO + H_2
- **Renewable Natural Gas** supplied to the grid by landfills/digestors → CO + H_2

Blue

- Natural Gas but with **Carbon Capture and Sequestration** → CO + H_2

Gray

- **Natural Gas from fossil fuel** → CO + H_2

Converted into Methanol (CH_3OH) in a synthesis reactor

Methanol as a Vehicle Fuel

- Methanol reduces emissions when blended with gasoline
- EU allows up to 3% blending, with China up to 100% and India up to 15% blending

Methanol as a Marine Fuel

- Global regulations driving demand for cleaner-burning fuels vs. fossil fuels
- Methanol is a clean-burning, cost-competitive fuel that complies with regulation

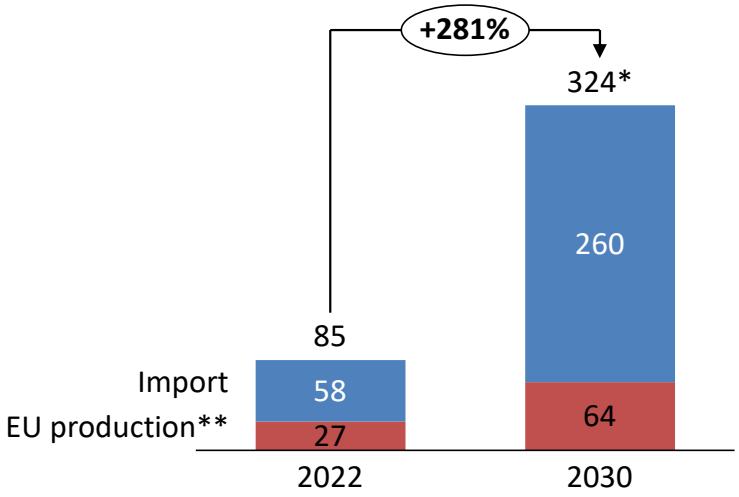
Methanol as a Industrial Chemical

- Over 30% of current demand for methanol goes into olefin production
- Opportunity to decarbonize plastics and other downstream industrial demand

(Imported) renewable methanol is crucial in meeting REDII(I) targets and support FuelEU Maritime and EU ETS maritime targets in particular

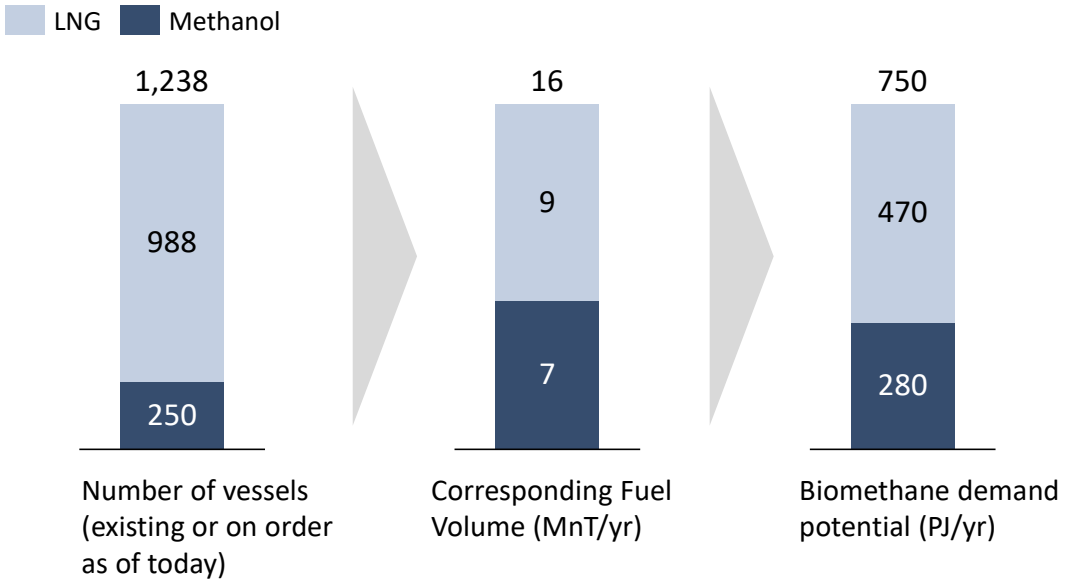
Significant demand for advanced biofuels to meet EU targets set forth by REDIII, FuelEU Maritime and EU ETS Maritime

Advanced biofuel demand in transport, PJ/year based on REDIII target



* There is sub-targets for annex 9A feedstock of 5.5% (incl. 1% of RFNBO), which works out to be about 324 PJ per year by 2030.
** Current EU-based production of advanced biofuels from defined Annex IX A feedstocks is around 27 PJ/yr (Source: E4Tech/ERM).

EU ETS and FuelEUMaritime are driving increased in LNG and methanol fueled vessels



- If all the LNG and methanol vessels in service or on order would use bio-LNG and bio-methanol, the demand for biomethane would be ~750 PJ/yr, far exceeding the current production of EU biomethane today (total of 120 PJ/yr, of which about 38 PJ is from annex 9A eligible feedstocks).

Note: number of vessels are growing, not including retrofit and barges.

Main challenges and opportunities

Opportunities

- Renewable methanol can already contribute to fossil carbonizing our energy systems and fuel pool.
- The production of renewable methanol produced from biomethane can be ramped up relatively fast as there are a lot of biomethane sources which are currently not being used.
- The only thing we can do with biomethane is use this as an energy source, it cannot be used for any ‘higher purposes’ such as food or feed.
- Biomethane diversifies the feedstock pool: we do not ‘fight’ for the solid biomass feedstocks such as UCO, animal fat etc.
- Bio-methane is a direct substitute for fossil natural gas and can be transported through the natural gas grid, which is way more efficient than trucking or shipping solid biomass around.

Challenges

- People are not aware of biomethane-to-biofuel supply chain. Policy makers for example only consider solid biomass supply chains when drafting legislation, through which challenges emerge for biomethane-based fuels.
- In the Netherlands an unequal approach is taken: following the RED, every EU MS should allow the Mass Balance approach to be used on an interconnected gas grid. The Netherlands does allow bioLNG to apply mass balance to the gas grid, but for unexplainable reasons doesn’t allow somewhat identical biomethanol to take the same chain of custody approach.
- The Union Database has been created to monitor and trace renewable fuels within the EU. The Union Database even ensures that the entire European gas grid can be seen as one single interconnected grid on which mass balance can be performed. But, as the Commission is already too busy with developing this system, it is yet uncertain how imported, non-EU hydrogen and biomethane-based fuels can be registered under the UDB. For now, it looks like these imports will not be allowed under the UDB, which will have major consequences for the Netherlands in meeting its RED targets.

Thank you

Volgende kennissessies

- Volgende sessie woensdag 10 juli a.s.:
  - 14.30-15.00 Ontvangst
  - 15.00-15.30 Tour de table
  - 15.30-16.00 Deep Dive: Cryoworld LH_2 | Cryoworld
  - 16.00-17.00 Deep Dive: Traject Visievorming Waterstofdragers | Min.EZK & Min. I&W
  - 17.00-18.00 Borrel

Datum	
Woe 18 september	F2F
Woe 16 oktober	Online
Woe 20 November	F2F
Woe 18 december	Online

SHIP>NL Sessie VI 19 juni 2024

Hartelijk dank voor uw aandacht

Vragen? Neem gerust contact met mij op:

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De slides van alle sessies zijn te vinden op:
SHIPNL: Sustainable Hydrogen Import Program Netherlands | Nationaal Waterstof Programma