

Sustainable Marine Fuels – Putting a global shipping and logistics company on the path to net zero

15 February 2023 – Giovanna Croxatto Vega – Senior Sustainability & LCA Specialist



Getting to zero – a big task

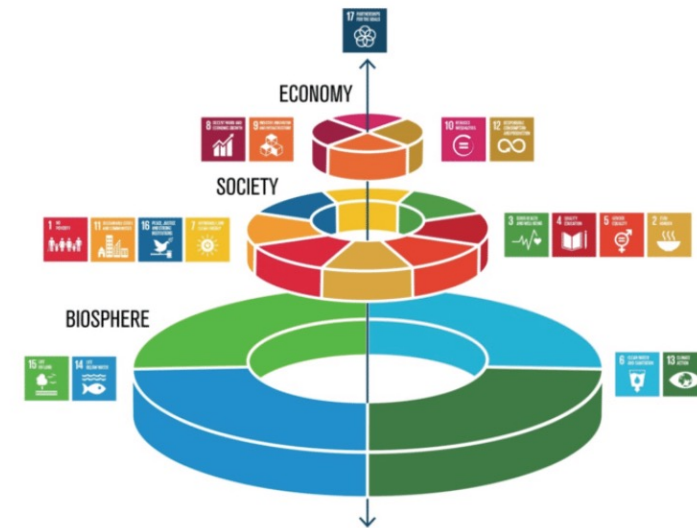
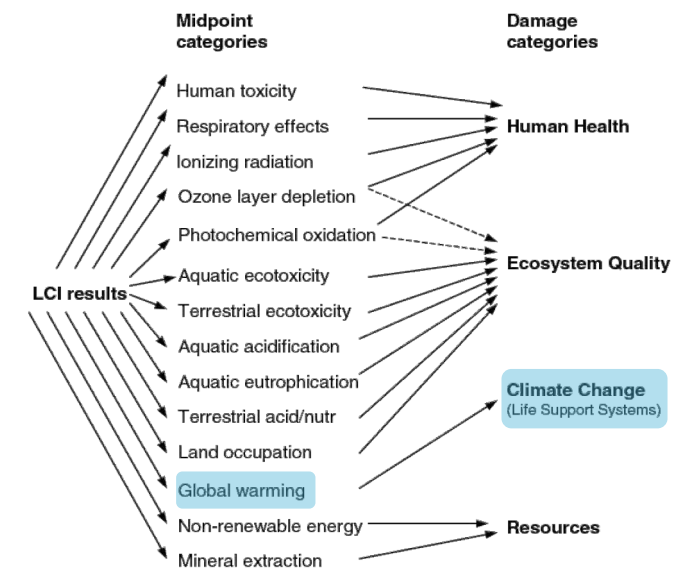
- Scope 1 – 44% of total
 - 95% of our scope one emissions are due to fuel use
- Scope 3 – 56% of total
 - ~70% of Scope 3 emissions also fuel related



Sustainability definitions

- The UN World Commission on Environment and Development: "Sustainable development is development that **meets the needs of the present without compromising** the ability of **future generations** to meet their own needs."
- When we evaluate new fuels at Maersk we use **holistic science-based** methods like Life Cycle Assessment (LCA)
- It's necessary to look beyond GHGs to avoid burden shifting

A complex problem



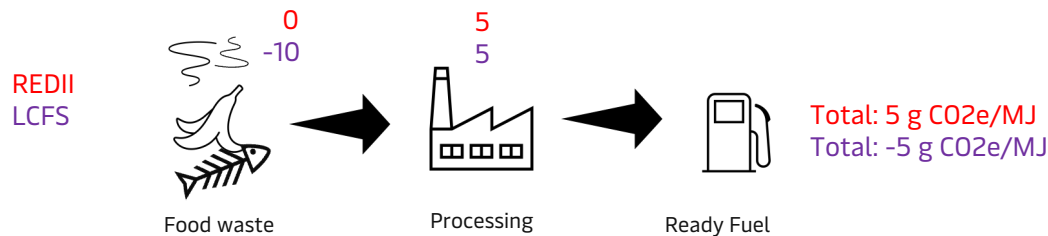
the goals, they are the foundation of society, and society is the
 Folke, C., R. Biggs, A. V. Norström, B. Reyers, and J. Rockström.

Practical challenges for global certification of fuels

- To increase the uptake of sustainable marine fuels we need:

1. Consistent greenhouse accounting and sustainability criteria

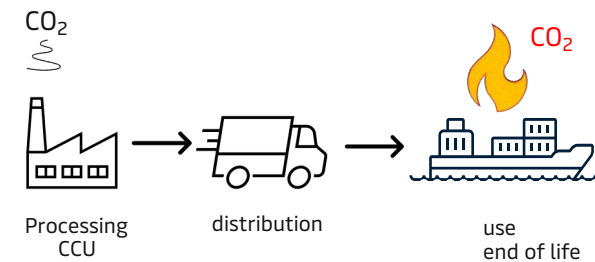
- A biofuel certified to e.g. the LCFS Standard is likely to have a very different GHG footprint than the same fuel certified to the REDII.



Follow existing ISO LCA standards – but set modelling choices in stone

2. Alignment with the GHG Protocol for corporate reporting

- Captured CO₂ from industry is reported in the use sector
 - CO₂ emissions from combustion are reported
 - Only biogenic CO₂ is reported as out of Scope
 - Fossil CO₂ emissions add CO₂ to the atmosphere, but could get a separate claim as circular CO₂ (recycling benefit, but still not carbon neutral)
 - Robust systems to prevent the claiming of savings more than once



Practical challenges for global certification of fuels

- To increase the uptake of sustainable marine fuels we need:

3. PtX needs huge quantities of renewable electricity

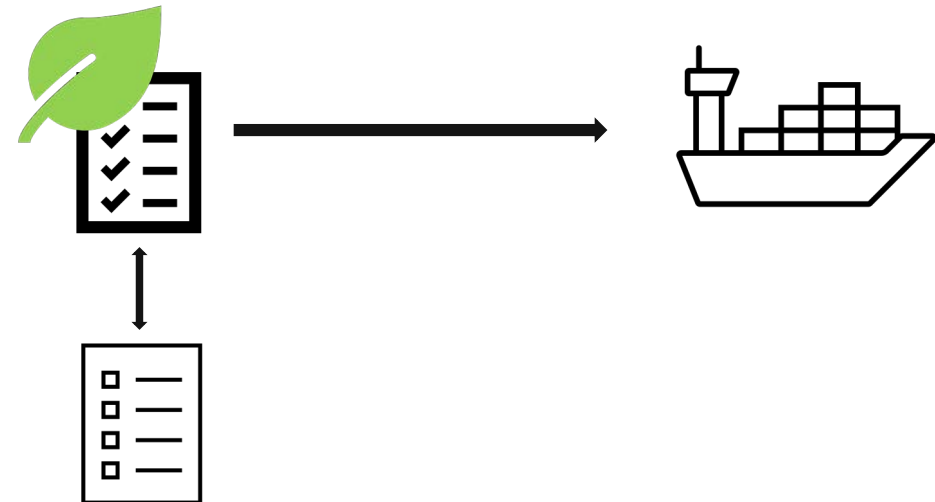
- Additional renewable electricity is needed
- Temporal and geographical correlation
- Long term marginals

Global certification systems to ensure international harmonization of additionality rules (reduce the differences)



4. Small scattered volumes away from shipping routes

- Robust book and claim systems (credit transfer) with reliable registries
 - Fuel production is often far from ports
 - Environmental attributes beyond CO₂



Challenges of Scale

- *The tropics lost **11.1 million hectares** of tree cover in 2021 (source: University of Maryland)*
- **2.5 Gt of carbon dioxide emissions**, equivalent to the yearly emissions of **India**
- *New deforestation frontiers in the Amazons (image)* →

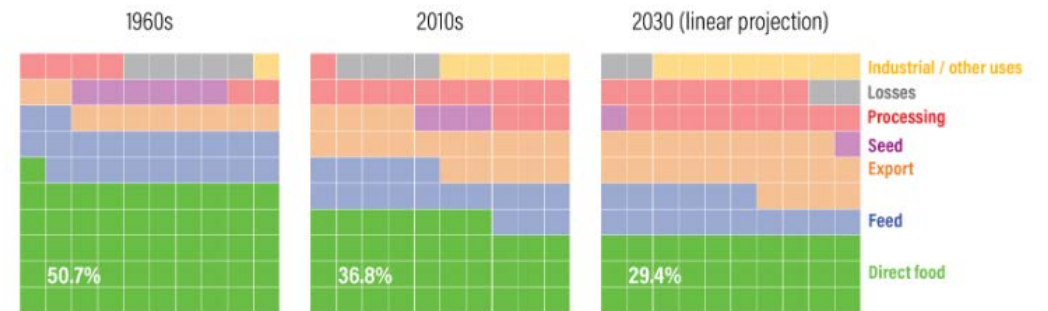


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Current trends mean that by 2030:

- 70% of all harvested hectares – non-(direct)food uses
- Driven by increase in demand for meat, dairy, and other processed foods, as well as, policies that incentivize biofuels
 - Global shortfall of about 994 trillion kcal per year by 2030 (30% less than needed)

The share of global harvested cropland area that goes to direct food



Source: Ray, D. K., Sloat, L. L., Garcia, A. S., Davis, K. F., Ali, T., & Xie, W. (2022). Crop harvests for direct food use insufficient to meet the UN's food security goal. *Nature Food*, 3(5), 367-374.

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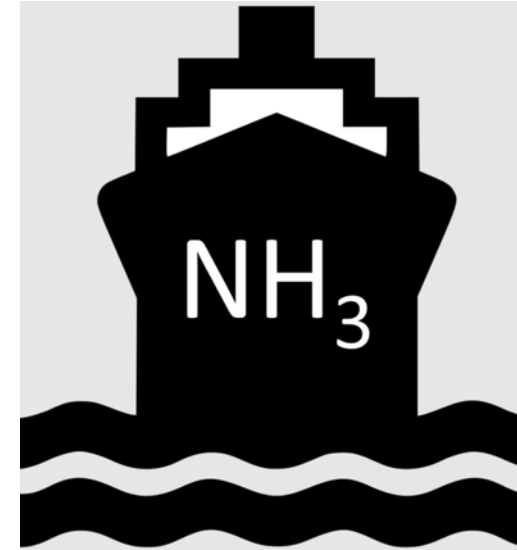
Challenges of Scale

New article in Nature Energy:

*“Further, some of the released nitrogen would **ultimately resolve to N₂O**, which would offset at least some of the climatic benefits afforded by switching maritime shipping fuels”*

<https://doi.org/10.1038/s41560-022-01124-4>

“If 0.4% of the nitrogen in ammonia fuel were to become N₂O, whether directly or indirectly, these emissions would completely offset the GHG emissions benefits of switching fuels in the first place”



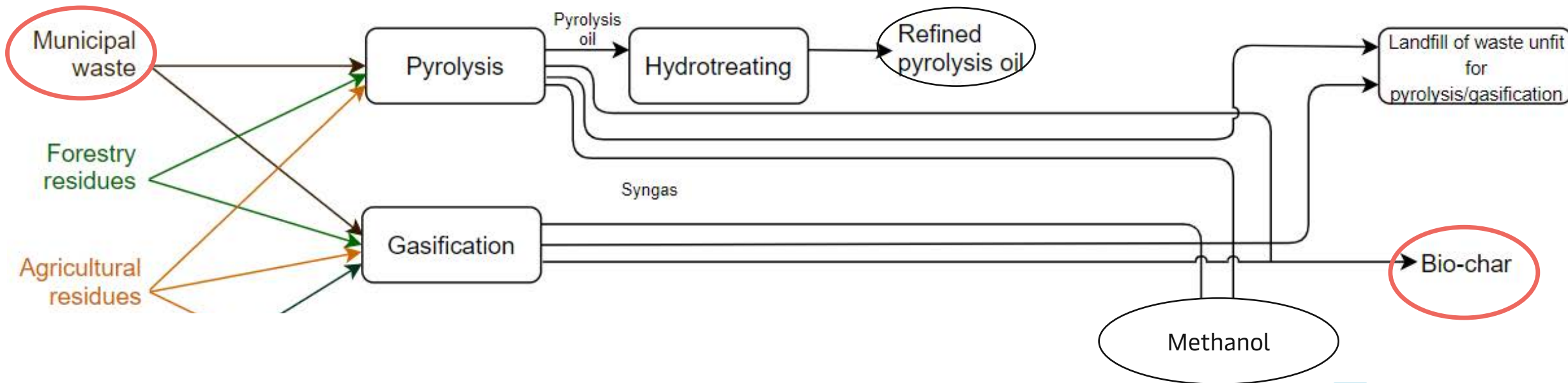
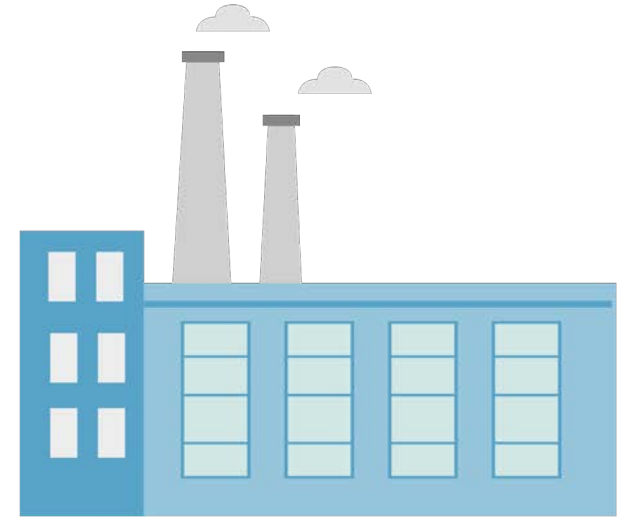
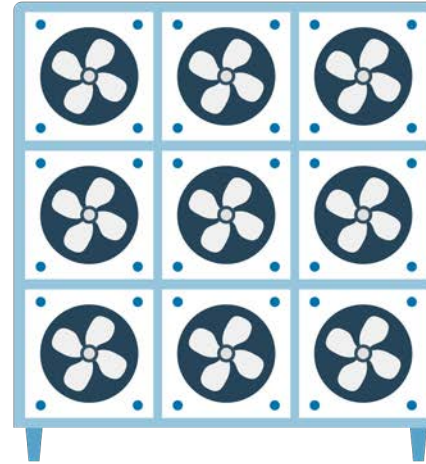
Using ammonia as a shipping fuel could disturb the nitrogen cycle

Ammonia has been proposed as a shipping fuel, yet potential adverse side-effects are poorly understood. We argue that if nitrogen releases from ammonia are not tightly controlled, the scale of the demands of maritime transport are such that the global nitrogen cycle could be substantially altered.

Paul Wolfram, Page Kyle, Xin Zhang, Savvas Gkantonas and Steven Smith

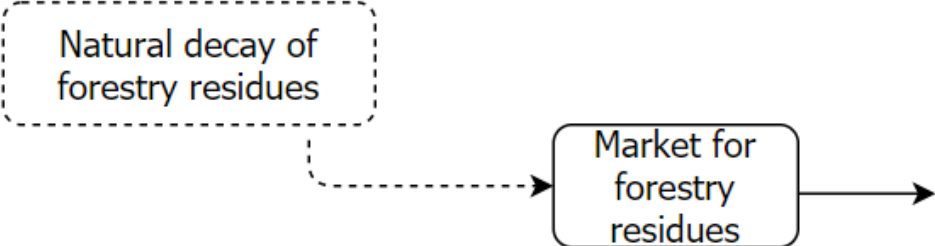
How to get to zero

- Focus on promising fuel pathways that offer co-benefits
- Land constraints and low energy productivity of plants
 - Direct air capture necessary
- Likely, we'll need GHG negative fuels to get to zero
- What are those?

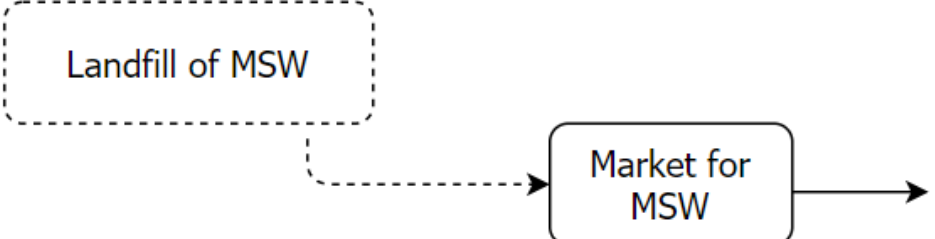


Modelling of feedstocks

Forestry residues



MSW

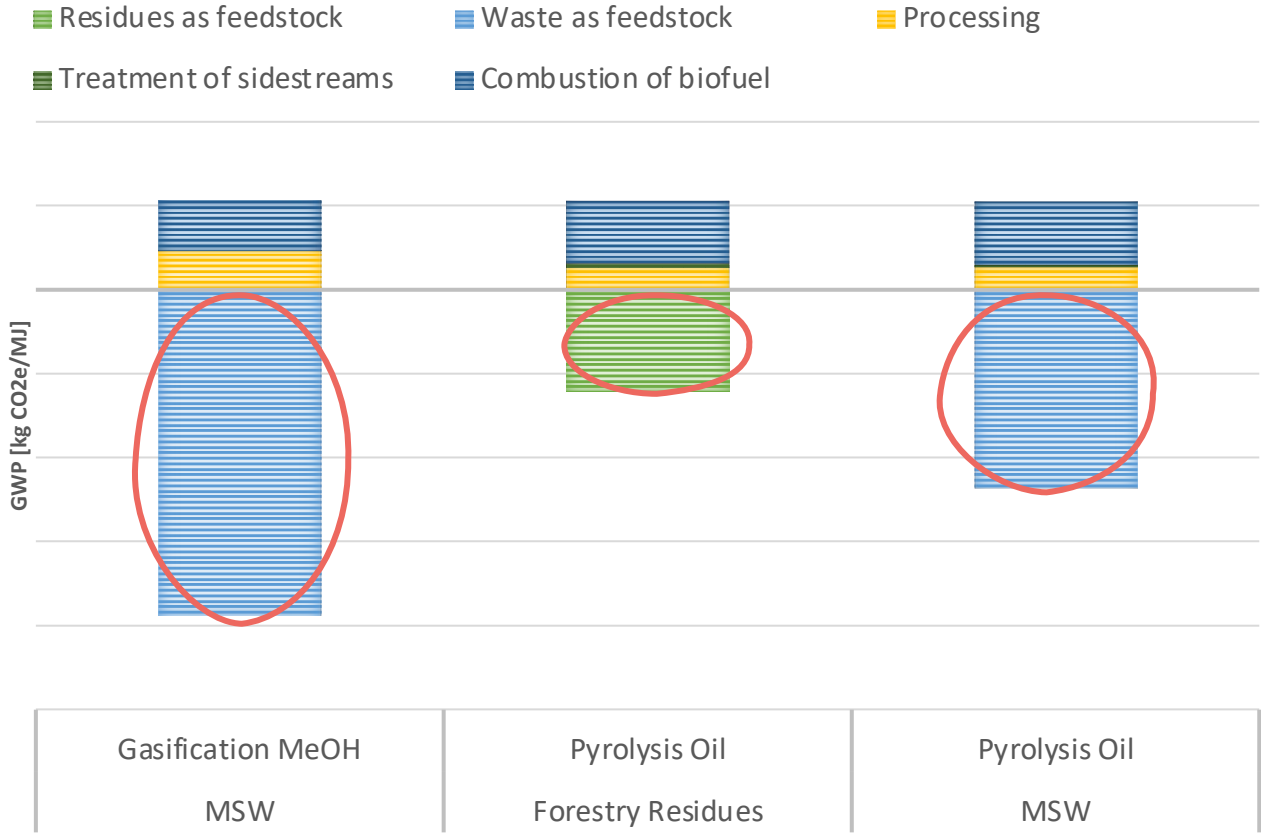


Needs to consider the baselines

Modelling of feedstocks

Forestry residues

MSW



- Avoided decay of the organic fraction of municipal solid waste
- Biochar and avoided decay of forestry residues
- We will need fuels that achieve GHG removals
 - Carbon captured in Biochar
 - Technical removals from the atmosphere (CCS)

The key

- Consistent GHG accounting globally
- Looking beyond GHG and avoiding burden shifting
 - Loss of biodiversity
 - Loss of forests
- Even playing field for renewable electricity for e-fuels production
- Bet on technologies that can deliver the intended results

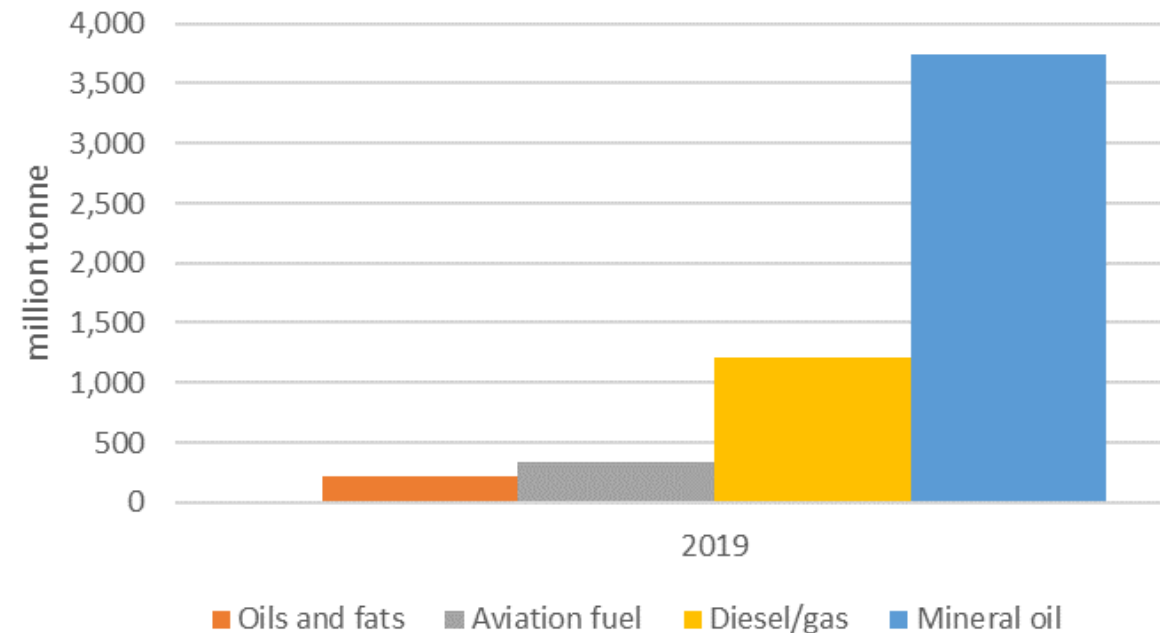


Thank you

Our Responsibility – how we chose methanol?

- Safeguard the journey towards full decarbonization of our operations and customer's supply chains by using science-based methods that ensure sustainability throughout the full life cycle of the fuels, energy, and solutions we deploy at A.P Moller Maersk
- Fuels are analyzed for these parameters
 - Sustainability
 - **Biodiversity impacts project**
 - Scalability
 - **Biomass availability study**
 - Safety
 - **More work needed on ammonia (both on GHGs and ecosystem impacts)**
 - **Project on ammonia**
 - Price

Oils and fats vs kerosene, diesel and mineral oil



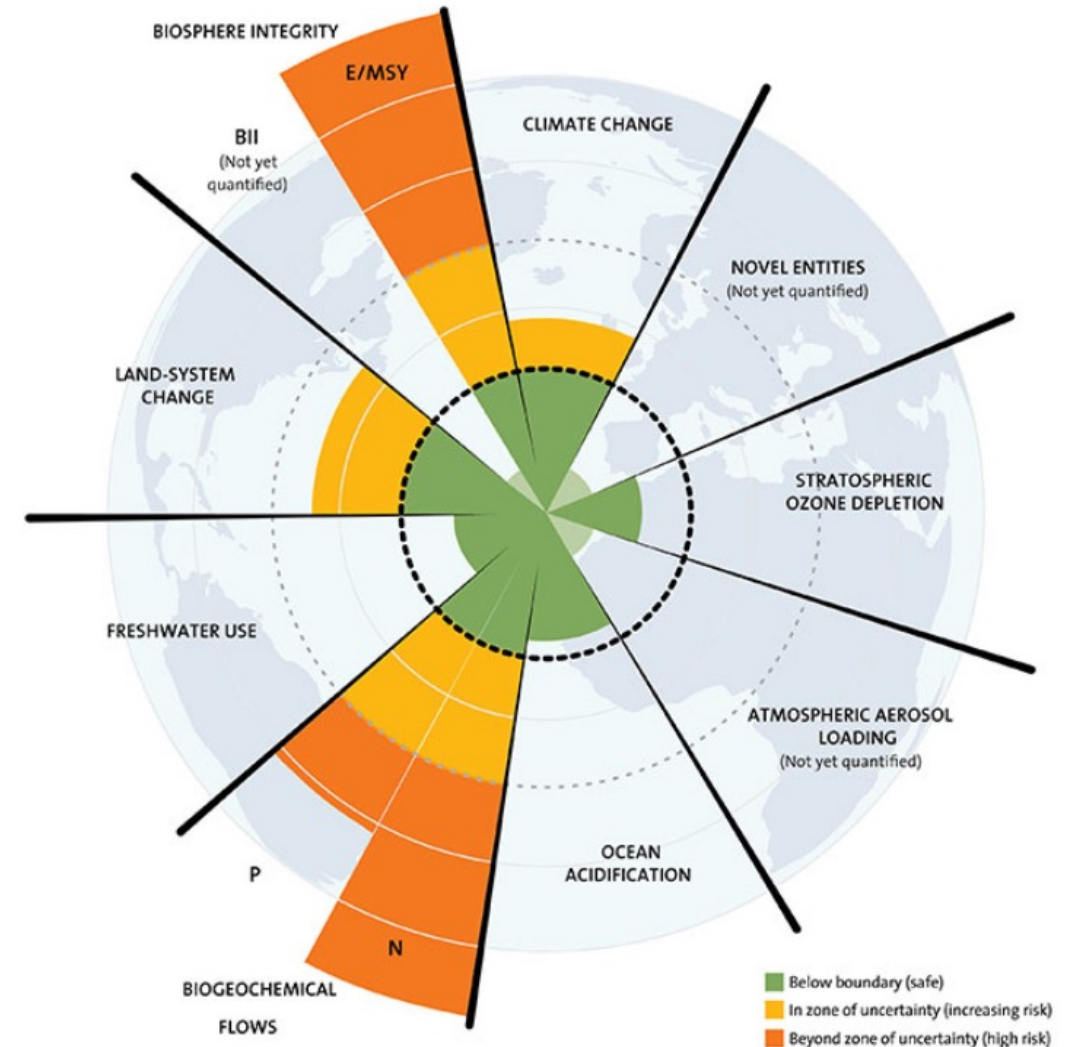
- 'Oils and fats' have little potential to replace fossil fuels
- Biodiversity: Vegetable oils cause major impact

References:

- Schmidt (2015). Life cycle assessment of five vegetable oils. Journal of Cleaner Production 87:130-138.
- International Energy Agency (2022)

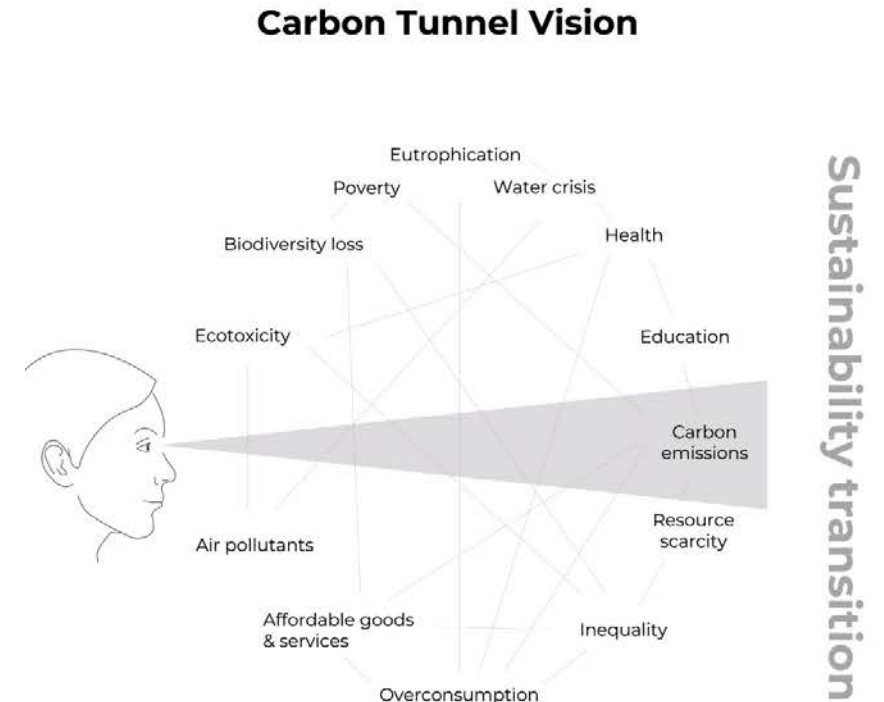
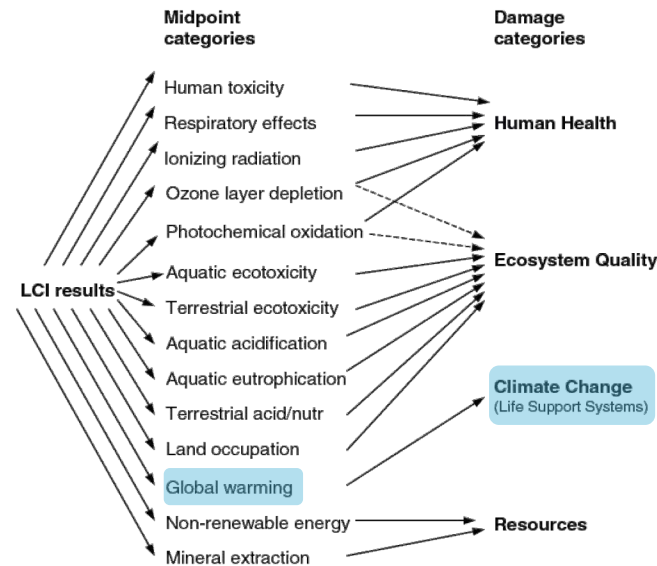
Advances in quantification of sustainability and new global goals

- Definition of **the safe operating space** by Stockholm Resilience Center
- What we do today is relative sustainability.
 - Is fuel A better than fuel B, rather than is fuel A (or B) sustainable (staying within the safe operating space)
- **New goals from COP15**
 - Effective conservation and management of at least 30 per cent of the world's land, coastal areas and oceans
 - Restoration of 30% of terrestrial and marine ecosystems
 - Halting human-induced extinction of threatened species and reducing the rate of extinction of all species tenfold by 2050



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How to get the transition to green fuels going

Our needs for a global certificate:

- ✓ Robust sustainability criteria
 - ✓ Including indirect effects (land use changes)
 - ✓ Focus on prospective, not historical changes
 - ✓ Include the baseline
- ✓ Consistent GHG accounting globally
- Inclusion in incentive schemes

