METHANOL INSTITUTE

LIFE-CYCLE ANALYSIS

COMPONENTS IN MEASURING GHG INTENSITY OF MARINE FUELS

LIFECYCLE ANALYSIS APPROACH POSITION PAPER

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Methanol Institute

INTRODUCTION

Last July, the 80th session of the International Maritime Organization's (IMO) Marine Environment Protection Committee (MEPC) produced important results for the energy transition of maritime mobility. The large-scale integration of low carbon and net carbon neutral fuels at an accelerated rate will be fundamental to attaining the targets laid out in the Greenhouse Gas (GHG) strategy approved by delegates. Lifecycle Analysis (LCA), a methodology to assess environmental impacts of energy carriers, is an important tool to ensure actual GHG reductions resulting from the strategy and to provide the fuels supply chain with the clarity necessary to stimulate the uptake of fuels that will drive the maritime industry's energy transition. This brief aims to identify LCA components that may simultaneously ensure the effectiveness of the IMO's measures, inform regulation supporting the integration of low carbon and net-carbon neutral fuels into the global marine fuel pool and establish safeguards to minimize the potential for unintended consequences. It also suggests additional components complimentary to LCA.

The files covered in this document are:

- Scope
- Primary Features
- Additional Components complimentary to LCA

SCOPE

Obligated Parties

To deliver the energy transition of different shipping segments and ensure consistency with the regulation on carbon intensity of international shipping outlined in *chapter 4 of MARPOL annex VI*, we recommend that the LCA cover all vessels of 400 gross tonnage and above. To the same end, the LCA scope should be expanded beyond the currently defined CII scope of cargo, RoPax and cruise ships of 5000 GT only.

Functional Unit

Considering that the stated objective of the IMO GHG Strategy is to ultimately attain net-carbon neutrality by 2050, it is vital that the LCA adopted has an expansive scope, capable of assessing climate impact between different energy carriers against a consistent benchmark. To safeguard consistency, we suggest that fuel GHG performance be measured on basis of energy delivered to the engine (shaft power) and encompassing the contributions of all greenhouse gases considering the environmental impact of one MJ of fuel , expressed as $_{g}CO_{2}eq/MJ$.

System Boundary

A system boundary defines which parts of the value chain are covered under the scope of the LCA. Ensuring a comprehensive but fair *Well-to-Wake (WTW)* LCA methodology means applying an attributional approach with a consequential element pertaining to negative emission feedstocks.

What this means is to utilize fact-based, measurable data to assess emissions from the fuel's upstream inputs, production process, and its downstream use and end-of-life value chain. The following illustration aims to clarify the approach, which is consistent with ISO 14044 and other LCA models addressing the environmental performance of fuels:

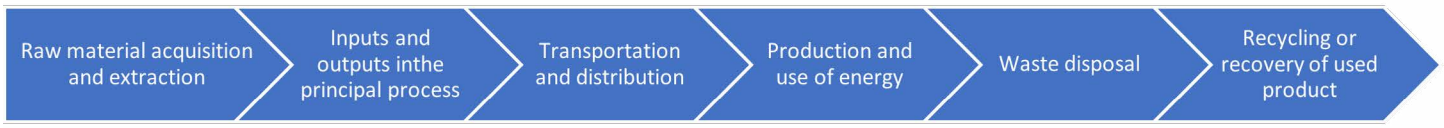

Figure 1: Recommended components covered by LCA

Negative emission technologies, those that avoid GHG emissions from the atmosphere, are an essential part of most scenarios for achieving the Paris Agreement goals. Thus, the *WTT* contributions of biogas production from manure, direct air captured CO_2, diversion of waste feedstock from landfills or incineration facilities, and carbon capture utilization and sequestration should be incorporated. The LCA aims to address a global sector and correspondingly regulate multiple fuel supply chains across all regions of the world. Thus, we find that incorporating further consequential LCA elements and the corresponding variability of the assumptions behind the assessment of various indirect effects risks undermining the credibility and operability of the mechanism.

Fugitive Emissions

The International Panel for Climate Change (IPCC) defines fugitive emissions as GHG that are not produced intentionally by a stack or vent. Practically speaking, this refers to accidental emissions, leaks, and unintentional discharges. While these may be difficult to quantify, it is essential to address in the LCA by setting default values and allowing for the possibility of certifying a lower value if measurements can be proven.

PRIMARY FEATURES

Methodology

The Methanol Institute is supportive of adapting the existing Carbon Intensity Indicator formula described in *MARPOL Annex VI*, multiplying annual fuel consumption with the emission factor, divided by the transport work.

The primary adjustment factor we propose is to a) incorporate a CO_2eq conversion factor in place of CO_2 only, described by C_{FJ} and b) referencing default emissions under the fuel type category depicted in the equation by $\sum_j C_{FJ}$ .. These modifications would maintain a clear emphasis on the energy carrier's capacity to deliver GHG reductions, as omitting CH_4 and N_2O fails to capture emissions that have high global warming potential. Additionally, the previously mentioned elements pertaining to negative emissions need to be added to the equation.

Default Values

To ensure consistency between existing regulation and avoid multiplication of efforts, default emission values for various marine fuels should be established on basis of annex 2 of the EU regulation on the use of renewable and low-carbon fuels in maritime transport (FuelEU Maritime). Importantly, certification of actual emission of all fuels should be allowed, by enabling certifications from specified voluntary schemes on basis of GHG intensity as determined by the LCA methodology. Actual emission certification would serve to unlock contributions of existing low-carbon fuels, ensuring swift near-term progress as the renewable fuel supply reacts to policy signals and ramps up supply. As an accredited list of 14 voluntary schemes vetted by the European Commission already exists, we suggest these be acknowledged by the IMO as a starting base of service providers. Furthermore, there should be a differentiation of default factors for fossil fuel pathways, as natural gas holds a much lower GHG intensity compared to coal feedstock.

Fuel Definitions

The IMO's GHG strategy aims to facilitate the uptake of particularly sustainable fuels via mandates for fuels sourced from sustainable biomass or renewable electricity. To support such a mechanism, the LCA approach should incorporate definitions concerning what constitutes sustainable fuels. In line with the previously described approach, a threshold for GHG savings delivered by a fuel relative to a fossil baseline of $94gCO_2eq/MJ$ should be established. As instituted by *EU Directive 2018/2001* (RED), we propose a 60% threshold for the definition of such fuels. The 60% threshold enables the contributions of various feedstocks, such as Municipal Solid Waste and landfill case, which will support the integration of sustainable fuels at an accelerated pace. Recognizing the plurality of supply chains capable of delivering GHG reductions, we recommend not restricting sustainable fuel definitions to particular feedstocks or production pathways, maintaining a technology neutral approach focused on attaining the objectives of the GHG strategy. However, as an exception to that principle, the LCA should include a consequential factor related to indirect land use change (ILUC), to avoid the cultivation of crops for biofuel production that displace traditional production of crops for food and feed purposes.

Captured Carbon

The large-scale production ramp-up and delivery of sustainable alternative fuels capable of addressing the needs of shipping is contingent on a framework that fully recognizes the contributions of carbon capture and utilization as several key energy carriers are sourced from captured and re-used emissions. The Methanol Institute supports the methodology reported in *paragraph 5.3 annex I of the MEPC 80/7/4*, on the method to incorporate the contributions of carbon capture and utilization for fuel production. The annex also recognizes the importance of not distinguishing between sources of CO_2 as long as the carbon burden is documented and included in the chain of custody under the term efecu, as per *equation 1, paragraph 4.4 of the MEPC 80/7/4 Annex 1.* This is in line with the European Commission's Technical assistance of how to assess the potential GHG reduction of renewable fuels of non-biological origin released on February 2023 "...as long as CO_2 sources from industrial exhaust gases are available, it is logical to use these sources because CO_2 is available in high concentrations and can be captured with comparatively low efforts." (chapter 2.1.7./p 36).

ADDITIONAL COMPONENTS COMPLIMENTARY TO LCA

Mass Balance Approach

Deploying a mechanism to trace the flow of materials along a supply chain, from feedstock to fuel product on basis of predefined, robust and transparent rules will be instrumental in realizing the GHG reduction set out with under the IMO GHG Strategy. It is essential that the LCA approach developed for the IMO GHG reduction measures recognizes the mass-balance principle in that for each ton of renewable or circular feedstock materials fed into a fuel production process and substituting fossil-based feedstock, approximately a ton of the output material can be classified as either renewable or circular. This should apply irrespective of input materials, including the acceptance to use the mass balance approach on the gas grid to allocate the environmental benefits of biomethane to bio-LNG and bio-methanol.

Co-Processing and Blended Fuels

The Methanol Institute recommends to the LCA working group of the IMO to ensure that the adopted approach encompasses fuel products derived from co-processing of biomass and fossil waste feedstock and/or renewable energy of non-biological origin. As above, a fair approach, in line with established practices, consists of allocating environmental attributes to final output on basis of the share of the GHG intensity of the respective inputs and to provide default values which may be deviated from by certification of actual emissions for all fuel categories. The same principle should apply for fuel blends, meaning that the blend's total GHG intensity be determined on basis of the percentage share of each input material.

Book and Claim Chain of Custody Mechanism

In general, the Methanol Institute would like to underscore the importance of considering the application of the LCA approach to a possible book and claim system. A system in which a fuel supplier books the sustainability attributes of a fuel product into a distribution system which can then be claimed by a consumer, eliminating the need for physical transport of fuel across the globe. Such a system must be supplemented with a robust LCA scheme and a transparent virtual paper trail to ensure the authenticity of the sustainability claims.

Onboard Carbon Capture

The Methanol Institute would recommend the LCA framework to consider possible contributions of onboard carbon capture. Measurement methods may vary depending on capture technologies which are yet under development. Thus, it seems premature to fix clear measurement methods and identify equipment needed. Fundamentally, we recommend that the LCA framework establish the key principles of the onboard capture approach accompanied by a robust set of procedures are needed to assure a reliable and certifiable measurement of onboard measurements to establish emission factors.

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FOUNDED IN 1989

The Methanol Institute (MI) serves as the trade association for the global methanol industry, representing the world's leading producers, distributors, shippers, and technology companies. MI now represents its members from five offices around the world in Singapore, Washington DC, Beijing, Brussels, and Delhi.

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