ZEMBA RFP 2 Emission Intensity Calculation Requirements

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Introduction

ZEMBA will evaluate proposal submissions based on the emissions intensity of the offered transportation service, that is, the amount of greenhouse gas (GHG) emissions generated for a certain amount of transport activity reflected on a Sustainable Maritime Fuel Certificate (SMFc). Two principal components of this transportation service emission intensity are:

1. The life cycle GHG emission factor of the fuels used to conduct the transportation activity. The emission factor of a fuel is the mass of GHG emitted per unit of fuel.
2. The amount of transportation activity conducted with those fuels. Transportation activity is the product of the amount of freight transported and the distance that freight was transported.

Bidders must submit the expected GHG emission intensity of the transportation service calculated according to the requirements in this document[1].

ZEMBA also requires that the emissions associated with transportation fuels used in the generation of an SMFc be verified and certified. Certification of fuels supports the integrity of emission factors included in transportation emission intensity calculations, and helps to ensure that non-GHG emission environmental and social impacts of fuel production and use are addressed. This document describes requirements for certification of these non-GHG sustainability attributes of fuels accordingly.

[1] ZEMBA recognizes that bidders may not be able to submit transportation service emission intensity information based on data that is not yet available. Estimated transportation service emission intensity may therefore be reported based on historic data or calculated through modelling, and the method chosen for estimating data disclosed to ZEMBA along with supporting information and assumptions.

Life Cycle Emission Factors of Fuels

Life Cycle Emissions of Fuels

Consistent with the IMO LCA Guidelines[2], ZEMBA requires a Well-to-Wake (WtW) accounting of the emissions associated with ZEMBA Eligible fuels and all fuels associated with the generation of environmental attributes reflected on an SMFc. Such an accounting includes the emissions impacts from:

- Extraction, cultivation, or acquisition of feedstocks and raw materials;
- Processing;
- Transportation and distribution;
- The fuel in use (e.g., fuel slip);
- Annualized emissions from carbon stock changes caused by land use change; and
- Savings from carbon dioxide capture and storage or utilization.

A WtW emission factor, then, is comprised of the emissions associated with two general categories of emissions – Well-to-Tank (WtT) emissions, and Tank-to-Wake (TtW) emissions:

$$GHG_{WtW} = GHG_{WtT} + GHG_{TtW} \text{ (in } gCO_{2eq}/MJ_{(LCV)})$$

Term	Units	Explanation
GHG_{WtT}	$gCO_{2eq}/MJ_{(LCV)}$	Total Well-to-Tank GHG upstream emissions per energy unit of the fuel provided to the ship
GHG_{TtW}	$gCO_{2eq}/MJ_{(LCV)}$	Total Tank-to-Wake GHG downstream emissions per energy unit from the utilization of the fuel or per energy unit of electricity used in a consumer on board the ship
GHG_{WtW}	$gCO_{2eq}/MJ_{(LCV)}$	Total Well-to-Wake GHG emissions per energy unit of the fuel (provided and utilized onboard a ship) or electricity used in a consumer on board the ship

Certification of Fuels

All fuel associated with the generation of environmental attributes reflected on an SMFc[3] must be procured from fuel suppliers certified to a relevant sustainability standard[4] by an independent certification body accredited to standards issued by one of the following standard holders:

- Roundtable on Sustainable Biomaterials (RSB);
- International Sustainability and Carbon Certification (ISCC); or
- Another standard holder recognized by the European Commission.

Fuel emission factor calculations must conform with the life cycle emission calculations methods described in the standards issued by one of these standard holders. Additional variables that may need to be included in fuel emission factor calculations are described below.

[2] See Resolution MEPC.376(80).
[3] ZEMBA understands that certification may not yet be completed for all fuel producers supplying bidders at the time those bidders reply to this RFP.
[4] Examples of relevant standards are RSB Global and ISCC Plus.

Fuel Slip and Shipboard Carbon Capture and Storage

ZEMBA recognizes that the calculation methods described in standards issued by one of these standard holders may not address:

- Emissions from fuel slip, that is, emissions associated with any fuel that escapes from an energy converter without being oxidized.
- Emissions credits from carbon dioxide capture and storage occurring onboard a vessel.

As such, these emissions must be reported separately and third-party verified prior to the generation of an SMFc as part of the verification process. Where slip emissions and emission credits from shipboard carbon dioxide capture and storage are not addressed in the standards listed above, these emissions must also be included in the life cycle emission factor of a fuel according to the following formula.

$$GHG_{TtW} = \frac{\left(1 - \frac{C_{slip}}{100}\right) * (C_{fCO2} * GWP_{CO2} + C_{fCH4} * GWP_{CH4} + C_{fN2O} * GWP_{N2O}) + \left(\frac{C_{slip}}{100} * C_{sfx} * GWP_{fuelx}\right) - e_{oCCS}}{LCV}$$

Term	Units	Explanation
C_{fCO2}	g CO_2 / g fuel	CO_2 emission "conversion" factor for emissions of the combustion and/or oxidation process of the fuel used by the ship (g CO_2 / g fuel delivered in the engine)
C_{fCH4}	g CH_4 / g fuel	CH_4 emission "conversion" factor for emissions of the combustion and/or oxidation process of the fuel used by the ship (g CH_4 / g fuel delivered in the engine) For LNG/CNG: $C_{fCH4} = 0$ (the C_{slip} is covering the role of C_{fCH4})
C_{fN2O}	g N_2O / g fuel	N_2O emission "conversion" factor for emissions of the combustion and/or oxidation process of the fuel used by the ship (g N_2O / g fuel delivered in the engine)
C_{sfx}	g GHG / g fuel	Factor accounting for the share of GHG in the components of the fuel (for LNG/CNG this value is 1.0)
LCV	MJ / g	Lower Calorific Value which is the amount of heat that would be released by the complete combustion of the fuel
e_{oCCS}	gCO_{2eq} / g fuel	Emission credit from carbon capture and storage, where capture of CO_2 occurs onboard. This should properly account for the emissions avoided through the capture and temporarily storage of emitted CO_2, if CCS occurs on-board
C_{slip}	% total fuel mass (consumed in the energy converter)	Factor accounting for fuel (expressed in % of total fuel mass consumed in the energy converter) which escapes from the energy converter without being oxidized (including fuel that escapes from combustion chamber/oxidation process and from crankcase, as appropriate)
GWP_{CO2}	g CO_{2eq} / g CO_2	Global Warming Potential of CO_2 over 100 years (based on the 5TH IPCC Assessment Report)
GWP_{CH4}	g CO_{2eq} / g CH_4	Global Warming Potential of CH_4 over 100 years (based on the 5TH IPCC Assessment Report)
GWP_{N2O}	g CO_{2eq} / g N_2O	Global Warming Potential of N_2O over 100 years (based on the 5TH IPCC Assessment Report)
GWP_{fuelx}	g CO_{2eq} / g GHG	Global Warming Potential of GHG in the components of the fuel over 100 years (based on the 5th IPCC Assessment Report)

Transportation Activity

As described in the Introduction to these requirements, the GHG emission intensity of a transportation service is defined as follows:

$$GHG\ Emission\ Intensity = \frac{Mass\ of\ GHG\ Emitted}{Transport\ Activity}$$

In this formula, transport activity is defined as follows:

$$Freight\ Transport\ Activity = Amount\ of\ Freight\ Transported \times Distance\ that\ Freight\ was\ Transported$$

To calculate a transportation service's GHG emission intensity, therefore, the WtW emissions of a fuel must be applied to the completion of a specific amount of transport activity. As such:

- ZEMBA requires reporting and verification of the distance travelled and transport activity conducted using ZEMBA Eligible fuel as described in the ZEMBA Verification Framework.[5] This requirement ensures the integrity of the transport activity data used in transport emission intensity calculations.
- Transport activity associated with the creation of environmental attributes (as represented on an SMFc) for ZEMBA must be generated over the span of the entire seagoing (versus in port) portion of a voyage (as described in the verification requirements in the ZEMBA Verification Framework). This requirement ensures that environmental attributes are not created selectively at intervals within a voyage, and are instead representative of the entire profile of a vessel's transport activity generation while at sea.

[5] The ZEMBA Verification Framework will be released with the comprehensive ZEMBA RFP materials upon launch in 2025.

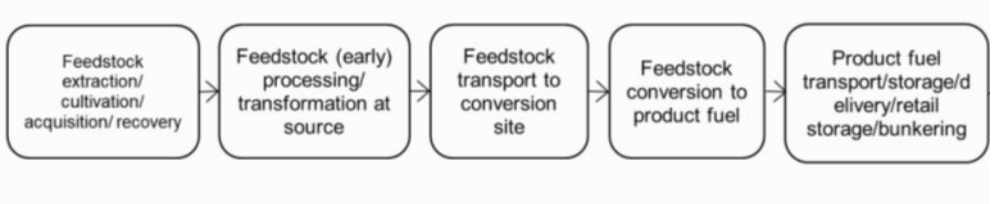
Proposal Requirements

Bidders are required to provide a description of the fuel pathway and emission factor information in the format shown in Table 1 below, for each proposed fuel.

Fuel Pathway

Bidders must describe the fuel pathway, including:

- The type of feedstock and any other inputs used;
- A description of the conversion process and technology used for producing the finished fuel;
- Fuel delivery and utilization, including fuel bunkering and intermediate transportation, storage, and distribution;
- Each of the steps of the fuel life cycle (see example below); and
- Any other relevant information required to fully represent the fuel production process.



Emission Factor Information

Bidders must:

- Provide the information described in Table 1 below, including supporting documentation (e.g., proof of sustainability for a fuel) wherever possible;
- Where supporting documentation is not available at the time the response is submitted, provide an explanation of how the information included in the table was obtained or estimated; and
- Provide an explanation of how the respondent can ensure such information will be available and certification obtained by the time attributes (as represented on a SMFc) are to be delivered to ZEMBA members.

Table 1

	Emission Factor[6] $\frac{gCO_{2eq}}{MJ\ Fuel}$	Source
FEEDSTOCK AND PRODUCTION		
Induced Land Use Change (ILUC)[7]	0	
Extraction, cultivation, or acquisition of feedstocks and raw materials		
Processing		
Conversion		
Emissions Credits from biomass growth		
Transportation and distribution (of the feedstock or intermediate products)		
Feedstock and Production Emissions (total)		
TRANSPORTATION		
Transportation and distribution of finished fuel (total)		
FUEL CONSUMPTION		
Emissions from fuel combustion		FuelEU Maritime or EU RED II[8]
FUEL SLIPPAGE		
Emissions from Fuel Slippage		FuelEU Maritime
CARBON CAPTURE AND STORAGE (CCS) CREDITS		
Credits from CCS at Fuel Production Facility[9]		
Credits from CCS onboard vessel		
Emissions Credits from CCS (total)		
Total Life Cycle Emissions Factor		

[6] All components must be calculated consistent with the methods described by the one of the sustainability standard holders listed in the Life Cycle Emission Factor of Fuels section of these requirements.
[7] ZEMBA Eligible Fuel Requirement for Waste-Based Feedstocks.
[8] ZEMBA requires the use of FuelEU Maritime (Annex I of Fuel EU Maritime Regulation) default emissions factors until the IMO has finalized a detailed life cycle analysis methodology and comprehensive set of default emissions factors. When default emissions factors from FuelEU Maritime are not available, default factors from EU RED III (See Annexes V and VI of the EU RED II Regulation) must be used.
[9] Geological sequestration of CO_2 captured at a processing unit in the supply chain processing the fuel's raw materials and finished fuel products, or onboard a vessel, can be deducted from the emission footprint of the fuel up to a value of zero, provided that all other fuel requirements are still met.