

# MEASUREMENTS AND OPERATIONAL EFFICIENCY WORKSTREAM

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Scope 1 Greenhouse Gas Emissions  
Calculation Methodology Recommendations

March 2021



## Introduction

The Blue Sky Maritime Coalition (BSMC) is a group of companies with marine operations in North America that recognizes the importance of reducing emissions from vessels and cargo transport operations. These companies recognize the need to accelerate the transition of waterborne transportation in Canada and the United States toward net zero greenhouse gas (GHG) emissions and have agreed to participate in the BSMC as industry leaders.

As part of this initiative, BSMC established several working groups to apply members' experience and expertise towards achieving emissions reductions. The Measurement and Operational Efficiency (M&OE) Workstream is focused on the following:

- Provide a framework for companies to voluntarily report and publish their absolute and relative emissions so that members can understand their emissions footprint and set reduction targets for the future.
- Encourage each marine emission producing participant to develop a company-specific plan that details milestones and operational efficiency improvements to be achieved between 2026 and 2050 for relative and absolute CO<sub>2</sub>e emissions reductions.
- Adopt standardized measurements and methodologies to establish common baseline emissions.

The following was developed by M&OE Workstream members to establish a common approach to managing data, selecting Scope 1 emissions calculation methods, and determining relative comparison criteria. This document provides for the potential of future improvements through the refinement of current methodologies as well as the emergence of new technologies or methods not currently available. In all cases, companies should use the most accurate data available to apply the recommended methods for determining absolute and relative emissions.

## Data Management

A common basis for the data used in emissions calculations is necessary to ensure emissions results across all participating members reflect reliable accuracy and consistency, both from year-to-year for individual company results and in comparative analyses of different types of vessels. This section provides Coalition members with a framework to be used in preparing emissions calculations, as well as a common point of reference to determine when improvements in emissions calculation methodologies and data management become available.

Member companies should use the most accurate data available in determining emissions. Where fuel or other operations data are to be used, information that has been vetted and that can be supported should be used in preference over data that is estimated or that is not directly related to the calculation methodology. Internal data collection and management systems should be developed and improved as necessary to support the most accurate calculation method available. It may be necessary to use more than one calculation or data management method where different vessel types, fuels, or operations are used. Current methodologies focus on fuel use and accepted emissions factors from scientific and regulatory organizations. These are discussed in more detail in the following sections.

The M&OE Workstream reviewed the available methods for calculating greenhouse gas emissions from ships and vessels. Fuel use is the current basis recommended by the International Maritime Organization, International Panel on Climate Change, and U.S. Environmental Protection Agency. After reviewing the available methods for determining emissions, the working group recommends that member companies base emissions calculations on fuel usage. As such, companies should develop data management systems to support accurate and reliable tracking of fuel usage for vessel operations. Usage should be applied on a calendar year basis and should reflect data taken from bunker delivery notes, direct measurement, or flow meter data.

Similarly, operations data should reflect the work the vessel performs. Coalition member companies should develop data capture and management systems to support the relative comparison metrics identified in the Relative Emissions section. The same approach to fuel data validation should be applied towards mileage, tonnage, capacity, etc. in that data that can be supported by direct measurement or a documented source should hold preference over information derived from estimates.

It is possible that more refined and more accurate means of determining emissions will become available in the future. There may also be cases in which fuel usage data is not available or where emissions factors are not available for certain alternative fuels. As such the following order of preference should be used, applicable by individual fuel:

- Continuous emissions monitoring systems. These systems are not yet available for greenhouse gases but may become so in the future. Data recorded from exhaust gas monitoring is considered to be more reliable and more accurate than the other methods identified.
- Emission factors and fuel usage. This method is currently recognized and is recommended by several regulatory and industry organizations. It is the method currently recommended for use by Blue Sky Maritime Coalition members.
- Engine manufacturer data. Where fuel usage data may not be available or may not be recorded such that the recognized emission factors can be applied, engine manufacturer data may be used.<sup>1</sup>

The Blue Sky Maritime Coalition – Measurements and Operational Efficiencies Workstream should meet every 3 years to provide the membership companies with an evergreen resource for maintaining a consistent effort towards emissions calculations and reductions. As needed, the Workstream may convene more frequently if significant advancements in data management, emissions factors, emissions measurement technology, or other applicable issues are identified.

Note that it is not the intent of the working group to require anything that conflicts with emissions reporting that may be required for regulatory compliance. Members should align data management methods to support the methods and calculations described in this document to the extent possible, but it is anticipated that flexibility may be needed to allow members to ensure ongoing compliance for other emissions reporting obligations.

## Emission Factors

Fuel emissions factors are often used to convert fuel consumed into carbon dioxide (CO<sub>2</sub>) emissions where data based on the direct measurement of emissions is not available. The fuel emissions factors used to calculate transport emissions are critical to ensuring that a consistent methodology is applied across the industry; these factors must be based on credible sources and the best available science as developed by specialists in the emissions sector.

Because of the variability associated with the production and supply of marine fuels, a representative non-dimensional conversion factor between fuel consumption and CO<sub>2</sub> emissions associated with each general type of fuel has been developed and accepted for use in lieu of exact values for each batch of fuel. This representative value is typically identified as “CF.”

There are a number of organizations that actively participate in the research, reporting or evaluation of greenhouse gas emissions including but not limited to the United Nations Intergovernmental Panel on Climate Change (IPCC), the International Maritime Organization (IMO) Marine Environmental Protection Committee (MEPC), and the United States Environmental Protection Agency (EPA). The emission factors recommended by the Blue Sky Maritime Coalition – Measurements and Operational Efficiencies Workstream have been

chosen with the aim of ensuring consistency with existing standards and values used by the representative regulatory agencies that oversee waterborne transportation, as well as those utilized by other voluntary greenhouse gas emission calculation and reporting initiatives such as the Global Logistics Emissions Council (GLEC) Framework, Clean Cargo, and Green Marine.

The below listed emissions factors represent direct CO<sub>2</sub> emissions at the point of use otherwise referred to as “Tank to Wake” (TTW) emissions, and are derived from IMO Resolution MEPC.245(66) as amended - 2014 Guidelines on the Method of Calculation of the Attained Energy Efficiency Design Index (EEDI) for New Ships.

TYPE OF FUEL		REFERENCE	$C_F = T\text{-CO}_2 / T\text{-FUEL}$
1	Diesel/gas oil	ISO 8217 Grades DMX through DMB	3.206
2	Light fuel oil (LFO)	ISO 8217 Grades RMA through RMD	3.151
3	Heavy fuel oil (HFO)	ISO 8217 Grades RME through RMK	3.114
4	Liquefied petroleum gas (LPG)	Propane	3.000
5	Liquefied petroleum gas (LPG)	Butane	3.030
6	Liquefied natural gas (LNG)		2.750
7	Methanol		1.375
8	Ethanol		1.913
9	Biofuels	Vendor	To be provided by vendor for the specific blend

If member companies utilize fuels that do not fall into one of the categories as described in Resolution MEPC.245(66) (as amended) and have no CF assigned, the fuel supplier should provide a CF for the respective product supported by documentary evidence such as a Bunker Delivery Note or Fuel Specification Sheet.

The annual total amount of direct TTW CO<sub>2</sub> emissions is calculated by multiplying annual fuel consumption and CF for the type of fuel.

Member companies are recommended to calculate and report the emissions footprint associated with the production and delivery of fuels and energy sources, referred to as “Well to Tank” (WTT) emissions. Studies have found a consistent ratio between WTT and TTW emissions<sup>9</sup>. An emissions factor of 20% of calculated or measured TTW Emissions can be applied to calculate the WTT component of a company’s emissions footprint where exact values are not known.

Member companies are also recommended to calculate and report their emissions footprint as “carbon dioxide equivalent” (CO<sub>2</sub>e or CO<sub>2</sub>eq). CO<sub>2</sub>e is a term used to describe different greenhouse gases in a common unit. Studies have also found a consistent ratio between CO<sub>2</sub>e to CO<sub>2</sub> emissions<sup>9</sup>. An emissions factor of 101% of CO<sub>2</sub> emissions can be applied to calculate the value of CO<sub>2</sub>e emissions where exact values are not known for the various component GHGs that are included in CO<sub>2</sub>e.

Where member companies report and publish their absolute and relative emissions, they should identify the emissions factor utilized for calculation, especially where those emissions factors may differ from the commonly accepted representative values for CF.

Member companies will review emissions factors recommended in this document and apply the most current version of the factors in calculating emissions. Where company data management does not support the use of some emission factors, companies will use the factors that provide for the highest accuracy in determining emissions. In publishing emission results, member companies will identify where updated emission factors have been used and will include 5 years (if possible) history using the new factors to provide context and comparison to the use of the new factors.

It is not the intent of the Blue Sky Maritime Coalition – Measurements and Operational Efficiencies Workstream to suggest use of emissions factors that conflict with emissions reporting that may be required for regulatory compliance. Member companies should identify and align with emissions factors described in this document to the extent possible, but it is anticipated that flexibility may be needed to allow members to ensure ongoing compliance for other emissions reporting obligations.

## Absolute Emissions

Absolute Emissions are intended to represent the total quantity of greenhouse gas emissions being emitted directly by a company or organization (Scope 1). At a high-level, the absolute emissions of a maritime services company are comprised of the total volume of fuels burned by both mobile and stationary assets multiplied by the relevant emissions factor(s). The understanding, tracking, and reducing where possible of absolute emissions is essential according to the world's foremost climate experts if the most significant impacts of climate change are to be avoided.

To calculate absolute emissions, Blue Sky Maritime Coalition recommends following the detailed guidance set forth by both the GHG Protocol, an internationally recognized framework designed by the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD), and the U.S. EPA's guidance documents.

## Relative Emissions

Estimating emissions to develop reduction strategies and targets is a dynamic process that requires a baseline understanding of total emissions. However, absolute emissions only provide magnitude visibility and do not enable companies to understand emissions in relation to work performed or service provided (i.e., emissions efficiency). To equip the Blue Sky Maritime Coalition members with the necessary parameters for designing emission reduction strategies and understanding company operational efficiencies, the M&OE Workstream identified relative emissions metrics for specific vessel types. Capturing these metrics will enable each member to measure its emissions with respect to the specific type of work it performs.

The M&OE Workstream reviewed a variety of available metrics to best compare and understand a company's greenhouse gas emissions data. The International Maritime Organization (IMO) currently prescribes guidelines for the adoption of the ship energy efficiency operational indicator (EEOI) for existing vessels<sup>3</sup>. The IMO is also developing requirements for the measurement and reporting of Carbon Intensity Indicator (Cii) for marine vessels. While the EEOI and Cii frameworks provide a published basis for determining relative emissions comparisons, not all Blue Sky member companies operate vessels regulated under IMO. As such, the working group recommends using the EEOI and/or Cii as a reference for vessel types identified in the guidance, but for the purposes of reporting emissions to the Blue Sky Maritime Coalition, the vessel-specific relative emissions metrics identified in this section should be used<sup>3</sup>. As mentioned above the maritime industry is expansive and unique. The working group believes these recommended vessel-specific relative emissions metrics will provide an effective understanding of emissions efficiencies.

As with the emission factors and other elements of this white paper, the working group reviewed published standards and methods for relative emissions metrics. The metrics below incorporate, where applicable, standards already in use by the IMO or other governing organizations. Where expertise gaps existed within the working group, such as no participating member operating a particular vessel type, consensus was obtained for using an operating time-based unit.

VESSEL		RELATIVE EMISSIONS UNIT
1	Harbor tug	Per hours of operation
2	Towboats and barges	Per barrel of capacity (liquid cargo)
3	Towboats and barges	Per ton-mile (dry cargo)
4	Container ship	Per TEU-mile
5	RoRo, ConRo, or other cargo	Per deadweight ton (DWT)-mile
6	Tanker/Dry bulk	Per ton-mile
7	Heavy lift	Per ton of cargo
8	OSV	Per hours of operation
9	Passenger/Vehicle ferry	Per number of passengers or gross tons of the ship
10	Ferries	Per number of units carried or occupied lane meters

## Conclusion

The Blue Sky Maritime Coalition – Measurement and Operational Efficiency Workstream recommends that member companies apply the methods and recommendations presented in this white paper to estimate emissions and ultimately to do their part in reducing emissions from maritime operations. Building a reliable and transparent data management system can assist a company in assessing emissions consistently and accurately. It is also vital that member companies apply the same emission factors, which will allow for a consistent methodology and a more consistent understanding of emissions. BSMC believes that once all member companies develop absolute and relative emissions targets, long-term goals can be achieved. Through these efforts and initiatives the marine transportation industry can serve as an example and play a key role in decarbonization.



## References

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3. International Maritime Organization: MEPC.1/Circ.684 – Guidelines for the Voluntary Use of the Ship Energy Efficiency Operational Indicator (EEOI).
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6. International Maritime Organization: Resolution MEPC.292(71)-2017 Guidelines for Administration verification of ship fuel oil consumption data
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