Golar LNG methodology statement

Introduction

It is important that we have reliable data supporting our operations and it is required to comply with the ISAE 3000 (revised) and ISAE 3410 standards for external assurance. In addition, it is important to Golar that our data is transparent and meaningful to the reader; this can only be achieved if reported data is traceable and supported by evidence.

This document outlines the criteria and supporting methodologies that have been adopted to prepare reporting figures on which we will receive external assurance.

1. General reporting overview

Basis for reporting

The metrics and disclosures in our Environment, Social and Governance Report 2020 were selected based on our ESG internal and external materiality assessments, explained within our report. This document supports the preparation and reporting of the indicators subject to external assurance, namely:

- LNGC Co2 emissions
- FSRU Co2 emissions
- FLNG Co2e emissions
- LNGC SOx emissions
- FSRU SOx emissions
- FLNG SOx emissions
- LNGC NOx emissions
- FSRU NOx emissions
- FLNG NOx emissions
- LNGC PM emissions
- FSRU PM emissions
- FLNG PM emissions
- LNGC EEOI
- LNGC AER
- FSRU emissions per tonne LNG send out
- FLNG emissions per tonne produced

Reporting scope

Unless otherwise noted, this report includes the operations and practices for the entire Golar fleet, encompassing assets owned and operated by Golar LNG, Golar LNG Partners and Hygo Energy Transition, including those vessels in cold layup or being converted (a detailed list of our vessels can be seen on our website). Emissions sources outside of the fleet itself, for example land office locations, are not included and are expected to be immaterial. The more detailed scope of each reporting item can be seen below.

The reporting figures stated in this report relate to the year ending 31 December 2020.

Standards and methodology

To facilitate comparability, most of our reporting figures are calculated based on industry specific standards. Where industry specific standards are not available we follow an alternative method as described in more detail below, being our view of best practice and the most accurate data available to us.

Uncertainty and estimates

Every effort is made to capture all relevant data, however where we have used estimates or assumptions, we have made this clear and has been explicitly defined in the specific criteria for each indicator below, where appropriate.

Restatement

Where information is available, we will restate prior year's figures using the latest available data to make data as comparable between years as possible. Restatements are only considered necessary where there is a change of greater than 5% of the reported data. We will clearly outline where restatements for specific indicators have been made.

Our responsibility

We ensure that appropriate procedures are in place to report our performance data, in all material respects, as set out in this document. We further acknowledge and fulfil our responsibilities in:

- designing, implementing and maintaining internal controls over information relevant to the preparation of the selected information that is free from material misstatement, whether due to fraud or error;
- establishing objective reporting criteria for preparing the selected information;
- measuring and reporting the selected information based on the reporting criteria; and
- the content of the Environment, Social and Governance Report 2020.

2. Reporting specifics and methodology

The below sections have been split between the different fleet that we own and operate:

2.1 LNGC and FSRU specifics

General overview

The majority of our LNGC and FSRU emissions are mainly from the combustion of fuel in our engines.

Standards and Methodology followed

To facilitate comparability, we follow industry standards to calculate our reporting figures, unless otherwise stated. We mainly follow the IMO methodology when calculating our Co2, Nox, Sox and PM figures.

Scope and boundaries

We measure, monitor, and report our emissions derived from our Engines which includes emissions from our Gas combustion unit and our boilers (where applicable). Our calculation excludes gas used in the kitchens onboard our vessels, as well as emissions from our waste incinerators.

Fuels used: Our vessels use a variety of fuels, the main fuels are; Natural Gas, LSFO and LSMGO (we also consume a small amount of MGO) all of which is included in our calculations, unless otherwise stated.

Calculation, conversion factors and assumptions

The below table sets out the details behind our LNGC and FSRU reporting items.

Calculation	Conversion factors and assumptions
Emission figures	
CO2: The total of each fuel type consumed multiplied by the respective CO2 conversion factors. Co2= Fuel consumed (tonnes) x relevant TCO2 conversion factor. *Applicable to our LNGC and FSRU fleet.*	The conversion factors used are those per the Third IMO GHG Study 2014 - final. When calculating our CO2 emissions from our LNG consumption, we take the density of the fuel into account.
NOx: The total of each fuel type consumed multiplied by the respective NO2 (NOx) conversion factors. NOx = Fuel consumed (tonnes) x relevant NO2 (NOx) conversion factor. *Applicable to our LNGC and FSRU fleet.*	The conversion factors used are those per the Third IMO GHG Study 2014 - final.
SOx: the total Sox emissions from the total fuel consumed and its sulphur content multiplied by its respective conversion factors. SOx= Fuel consumed (tonnes) x relevant SO2 (SOx) conversion factor from Sulphur content in fuel *Applicable to our LNGC and FSRU fleet.*	The conversion factors used are those per the Third IMO GHG Study 2014 - final. We use the IMO average sulphur content for each fuel type (2017) to determine the sulphur content.
PM: The total of each fuel type consumed multiplied by the respective PM conversion factors.	The conversion factors used are those per the Third IMO GHG Study 2014 - final.

PM = Fuel consumed (tonnes) x relevant PM conversion factor. *Applicable to our LNGC and FSRU fleet.*	
Intensity figures	
Energy Efficiency Operational Indicator (EEOI)= Annual average Co2 emission per transport work (volume) [g CO_2 / (MT cargo x nm)] *Applicable to our LNGC fleet only*.	See Co2 emission calculation above for our calculation, methodology and assumptions used. Transport work is calculated by taking the actual cargo quantity (LNG m3) on board and then multiplying that with the observed distance. Port operation and ballast voyages, as well as voyages which are not used for transport of cargo, such as voyages for docking services, are included within our transport work calculation. Relocation of FSRUs and vessels being converted are not included in our calculation. Our calculation aligns to the IMO methodology[1].
Average Efficiency Ratio ("AER") =Annual C02 emissions divided by design deadweight (MT) of the vessels multiplied by distance travelled (nm) [g CO_2 / (MT dwt x nm)] *Applicable to our LNGC fleet only.*	See C02 emission calculation above for our calculation, methodology and assumptions used. Design deadweight is given by vessel specification from yard. Distance travelled is observed distance. Our calculation aligns to the IMO methodology [2]
FSRU per tonne LNG send out *Applicable to our FSRU fleet only*	See C02 emission calculation above for our calculation, methodology and assumptions used. Send out rate (LNG) is recorded in MMSCF (Standard Cubic Foot) and converted into metric tonnes for disclosure.

Data collection and quality

All our vessels capture vessel performance data, which includes fuel consumption, sailed distance, cargo quantity and more, every noon and at specific events, like departure, arrival and interruption of sea passage. The fuel consumption data are based on flow meter readings. The data captured is subjected to instant validation in our internal system to avoid clerical errors.

Fuel consumption volumes are multiplied by relevant conversion factors, as described above in the table, to create the relevant performance metrics.

Internal reviews are also performed to validate the accuracy and completeness of the data captured on a weekly basis through anomalies analysis.

In addition to the assurance on our 2020 emissions and emission intensity data (in accordance with ISAE3000 and ISAE3410) as mentioned above, we are also subject to other audits to certify our compliance with the EU MRV and IMO DCS reporting.

Furthermore, all our vessels are certified in accordance with ISO 14001 to ensure compliance with relevant regulations and consistent management of environmental improvements.

1 IMO Calculation MEPC.1/Circ684

2 Fourth IMO GHG Study 2020

2.2 FLNG specifics

General overview

Our FLNG emissions are derived from the following processes on board our FLNG vessel: inlet gas handling, amine treating, dehydration, liquefaction, heavy hydrocarbon separation, product handling, refrigeration, flash gas/fuel gas compression and utility systems.

Standards we follow

Due to the bespoke nature of Hilli Episeyo, there are currently no suitable widely accepted industry standards to calculate our environmental footprint. Therefore we have performed our own studies on the various emission sources of the vessel to determine our environmental footprint and to accurately report on our emissions.

Scope and boundaries

Owner information: In 2020 the Hilli was owned equally by Golar LNG and Hygo Energy Transition. The emissions figures reported are the total emissions for both companies (100% of the asset's emissions).

Source of emissions: Our emissions including CO2, NO2 (NOx), SO2 (SOx) and PM are derived and calculated from the below sources:

- Fuel combustion (including estimated methane slip)
- Flaring (fuel and refrigerant)
- Amine treating system
- Venting (refrigerant)

Equipment and fuel: The following equipment operate on fuel gas; Main Boilers and Gas Engines (with a low-pressure fuel gas stream) and the Gas turbines (high pressure fuel gas stream). The Main Boilers (with a low-pressure fuel gas stream) are dual fuel engines that can also operate on MGO. The Generators (which include both essential and emergency generators) operate on MGO. We include all equipment above in our calculations, unless otherwise stated. MGO consumed are measured in tonnes and fuel gas is measured in standard cubic feet.

Refrigerants: We use Ethylene, Propane and Iso-pentane in our mixed Refrigerant loops in our liquefaction trains and Freon, specifically R407C and R407F, in our air conditioning units. We include refrigerant in our calculations, unless otherwise stated.

Venting: CO2 venting occurs in our Amine Treating System. Freon used in air conditioning units is lost to the atmosphere through flange leaks. We include all emissions from venting in our calculations, unless otherwise stated.

Flaring: The flare system safely disposes gases to the atmosphere in situations that require evacuation of such and could otherwise pose a risk to the plant, equipment and personnel. The gases from the independent sub systems are disposed to the atmosphere via flare stacks. We include emissions from Flaring in our calculations unless otherwise stated.

Calculation, conversion factors and assumptions

The below table sets out the details behind our FLNG reporting items:

Calculation	Conversion factors and assumptions
Emission figures	
CO2e: The sum of CO2 emissions from the total fuel consumed, vented, flared and refrigerant consumed and flared multiplied by its respective conversion factors. CO2e= (Fuel consumed x relevant CO2 conversion factor) + (flaring x relevant CO2 conversion factor) + (Refrigerant x relevant CO2	**Fuel consumption:** The conversion factors used for equipment that consume gas fuel are based on a direct calculation of CO2 emissions using the carbon content and take into account the following for each of the different streams of gas fuels; Fuel gas volume flow, fuel gas mole weight, Carbon content. Our calculations are based on conversion factors provided Low pressure and High Pressure Fuel gas users. The HP Fuel Gas composition was stable during 2020 and therefore the average for

conversion factor) + Venting of CO2 from feed gas through Amine treating system (CO2 material balance based on feed gas composition) + (Freon venting x CO2e conversion factor) + (methane slip x relevant CO2e conversion factor) + (total N2O x relevant Co2e conversion factors)	December 2020 compositions and properties were used in the calculation. The conversion factors used for equipment that consume MGO are based on manufacturers data (main boiler) or Industry standards[3] (Generators). **Refrigerant:** The conversion factors used for Ethylene, Propane and Iso-pentane are based on stoichiometric conversion factors for complete combustion. **Venting:** The quantity of Co2 vented from Freon is calculated based on the material balance for the feed gas quantity and its molar concentration. Freon's conversion factor is based on the UK Government GHG Conversion Factors for Company Reporting 2020. **Flaring:** The conversion factors used are based on the carbon content, the flare efficiency (% carbon combusted), the gas density and CO2/C "molecular" weight ratio[4].
SOx: the sum of SO2 (SOX) emissions from the total fuel consumed and its sulphur content multiplied by its respective conversion factors. SOx= Fuel consumed (tonnes) x relevant SO2 (SOx) conversion factor from Sulphur content in fuel	**Fuel consumption:** The conversion factors used for equipment that consume MGO are based on direct calculation based on the sulphur content in the fuel. We use the maximum sulphur content limits in MGO of 0.37% S (w/w) (this is a prudent approach as the sulphur content of the fuel is normally much lower) and assume that we combust 100% of the sulphur.
NOx: the sum of NO2 (NOx) emissions from the total fuel consumed and flared multiplied by its respective conversion factors. NOx= (Fuel consumed x the relevant NO2 (NOx) conversion factor) + (gas flared x relevant NOx conversion factor)	**Fuel consumption:** The conversion factors used for our equipment that operate on fuel gas, excluding Main boilers, are based on manufacturers data which also takes into account the average fuel gas parameters for the different stream types. The Conversion factors used for the Main boilers are based on manufacturers data which also takes into account the density and the lower heating value of the fuel gas. The conversion factors used for our equipment that operates on MGO are based on manufacturers data. For the Generators we use emission data based on the assumption of 75% engine load. **Flaring:** The conversion factors used are based on manufacturing data and use the highest heating value.
PM: the sum of PM emissions from the total fuel consumed and flared multiplied by the respective conversion factors. PM = (Fuel consumed x relevant PM conversion factor) + (gas	**Fuel consumption:** The conversion factors used for our equipment (Gas turbines) that operates on high pressure fuel gas are based on manufacturers data which also takes into account the average gas parameters for the fuel gas flow. The fuel LHV and molecular weight is adjusted from the manufacturer standard using our data. The conversion factors for the Gas engines & Main boiler: are based on IMO

3 Lloyds Register emission factors (Table C5)

4 CO2/C "molecular" weight ratio = One Carbon atom is giving one CO2 molecule when the gas is combusted.

flared x relevant PM conversion factor.)	data[5] and takes into account the fuel density and the relevant PM conversion factors. The conversion factors used for our equipment that operates on MGO are based on manufacturers data, where we assume a 75% engine load (Generators). Conversion factors for the Main boilers are based on IMO data. **Flaring:** The conversion factors used are based on manufacturing data and uses the Higher Heating value (HHV).
Intensity figure	
Carbon intensity (Emission per tonne produced): this indicator measures the average GHG emissions for each tonne LNG produced. The indicator takes into account: The numerator: Total CO2e excluding CO2e emission from Amine treating system. The Denominator: Total tonnes LNG produced	CO2e emissions follow the same methodology as stated above, although we remove the Co2 emissions from our Amine treating systems.

Data collection and quality

Vessel performance data, which includes fuel consumption, LNG exported and gas flared etc, are captured on a daily basis. The source of information, relevant to this report, are detailed below:

- **Fuel consumption:** MGO consumed is based on the sounding measurements of the MGO liquid levels in storage tanks. All other fuels are measured through flow transmitters.
- **Refrigerant:** Consumption are calculated through liquid levels, measured by level transmitters.
- **Feed gas:** Feed gas is measured through flow transmitters.
- **Heating values and concentrate of CO2 in gas**: Is measured through a Gas chromatograph (gas composition analyser).
- **Freon:** Is measured through calculating the weight of freon in the portable cylinder before and after a re-fill.
- **Flaring:** Is calculated through valve values. It is the difference between hydrocarbon in (Feed Gas) and out (Fuel Gas+ LNG to Tank).
- **LNG produced**: Is measured by accumulated liquid levels during each day, recorded by radar type liquid level transmitters installed in each LNG cargo tank.

Capturing performance data allows real-time analysis of the data. The data captured is subjected to internal reviews to validate the accuracy and completeness of the data captured. Our internal processes also get audited by an external party on a regular basis through the year.

5 IMO data/document: MEPC 67/INF.3: REDUCTION OF GHG EMISSIONS FROM SHIPS. (Table 67).