# Assertion Report of GHG Emission for Financial Year 2018-2019

## The Great Eastern Shipping Co. Ltd.

# Chapter 1 – Organization Profile

## 1.1 History of Organization

THE GREAT EASTERN SHIPPING COMPANY LTD., incorporated in 1948, has expanded steadily first under the leaderships of Late Vasant J. Sheth, Mr. K.M. Sheth and now Mr B.K. Sheth to become India's largest shipping company in the private sector.

Although established in 1948, the Company traces its roots back to the First World War.

During World War 1, the firm of Jagjiwan Ujamshi Mulji was set up in Bombay by Chunilal, Maneklal and Jagjiwan, the three sons of Ujamshi Natalia. The firm operated as a trader in various commodities for 15 years, until the Great Depression of the late 1920s. In 1929, the brothers joined forces with Sir Dossabhai Bhiwandiwalla, and set up the firm of A.H. Bhiwandiwalla & Co. (AHB as the firm came to be popularly known).

In 1948, AHB acquired a cargo vessel, the Fort Ellice, renamed Jag Vijay. This was meant to be an adjunct to the trading operations: however, it soon became clear that a capital intensive business like shipping needed an autonomous Company.

The Great Eastern Shipping Company Ltd. was, therefore, set up with 40% of its equity subscribed to by Shree Changdeo Sugar Mills, and the rest by the Sheth-Mulji and Bhiwandiwalla families. The operations of the Company were left to Vasant J. Sheth, youngest son of Jagjiwan Ujamshi Mulji, one of the founders of the original trading firm.

During the late 1970s, the Bhiwandiwallas retired from the business, selling their interest in AHB (by now an incorporated Company) to their partners.

Given the cyclic nature of the shipping industry, the need for diversification was always in the mind of the management. When the government decided to throw open the area of offshore supply vessels to the private sector, The G E Shipping was the first to take the plunge in 1982, at the initiative of Mr. K.M. Sheth.

From the very beginning, The G E Shipping has been on the leading edge. The company has not been afraid to try out new technologies, not worried about going against the tide. Not surprisingly the Company has an impressive history of firsts to its credit, e.g. in 1956, the company acquired its first oil tanker – it was also India's first. It proved so successful that Company's tanker fleet has just kept growing. In the same year German ship building company Blohm & Voss produced a revolutionary "pioneer" type of ship. The G E Shipping was the first company in the world to opt for it, and there after ordered four more ships in India, to that design. In 1962, the company was the first shipping company to start regular liner services to carry general cargo from the Pacific coast of the US and Canada to India.

The fleet now comprises tramp ships which includes oil tankers, chemical tankers, gas carriers and bulk carriers. The company's operations are global.

The Company has at its helm the Executive Chairman Mr. K. M. Sheth and the Deputy Chairman and Managing Director Mr. Bharat Sheth. Under their stewardship Company continues to perform and deliver results in an increasingly competitive environment duly deserving the honour of India's premier shipping organization.

### 1.2 Brief Description of present activities

G E Shipping enjoys a formidable presence in the international maritime industry. The shipping business operates under two main sectors: dry bulk carriers and tankers (oil, chemical and gas). The tankers enjoy approvals from oil giants like SHELL, BP, EXXONMOBIL, CHEVRON TEXACO, TOTALFINA to name a few. As of 31st March 2019, the fleet consisted of 48 vessels (35 Tankers and 13 Bulk Carriers) totalling 3.9 million Deadweight Tonnes with an average age of 11.19 years.

Backed by an enviable clientele comprising industry leaders, international oil companies and governments who vouch for its services, the division has earned the status of being the most preferred shipping service provider. With a pulse on the global market and a thorough understanding of the ever-evolving market needs, the division is well-equipped to anticipate the demands of its clients and to deliver on its commitments, successfully and satisfactorily.

The Company operates its vessels on voyage charter (spot) as well as period charter (time).

The company management system is certified to ISO 9001: 2015, ISO 14001: 2015 and ISO 45001: 2018 standards by DNV-GL.

### 1.3 Objective of this report

The objective of this report is to capture and quantify GHG emission from our owned vessels in a transparent and standardized manner for the information of stakeholders of the Company on a voluntary basis. G. E. Shipping is committed to reduce GHG emission from its vessels and has been taking several measures to do so by way of retrofitting vessels with energy saving devices, better hull surface management, close monitoring of fuel efficient operation of vessels and quantification and reporting of GHG emission from its vessels to facilitate taking informed decisions with respect to further enhancing energy efficiency of ships.

The GHG emission quantification and reporting is done taking into account:

- ISO 14064-1 (2006) "Greenhouse gases – Part 1: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals, and
- The Greenhouse Gas Protocol – A Corporate Accounting and Reporting Standard (Revised edition) published by World Business Council for Sustainable Development and World Resources Institute.

### 1.4 Roles and responsibilities of Vessel Performance Management Department

Vessel Performance Management Department was established in early 2014 with following responsibilities:

- Fuel Efficiency Performance monitoring of vessels
- Establishing and monitoring related Operational KPIs

- Providing MIS to Management (Quarterly, Annually)
- Identification and review of Energy Saving Technologies
- Preparation / presentation of decision support documents for Management approval;
- Enhancing Fuel Efficiency of Vessels through retrofitment of Energy Saving Devices / Operational Measures in co-ordination with Technical / Operation / IT Depts.;
- Training / Awareness building on Energy Efficiency of Personnel ashore and onboard vessels
- Quantification and reporting of GHG inventory.

The Head of Department reports to Executive Director and President (Shipping).

### 1.5 Management System and Policies

#### 1.5.1 Mission Statement

Consistent with the Company's policy and philosophy of maintaining professional excellence in all spheres of activity involving marine bulk transportation service, including Quality, Heath, Safety, Security Environment (QHSSE) and Social Responsibility, our mission shall be:

• To own, operate and manage ships with zero spills to sea, zero incidents, zero tolerance to drugs and alcohol, while protecting the lives of shipboard personnel, cargo and company's own assets and reducing environmental emissions by employing best management practices;

• To provide a highly efficient and competitive marine bulk transportation service of quality, cost, reliability delivery and security;

• To achieve excellence in our management systems and standards through continual improvement and by employing best practices through an efficient and responsive management and an empowered and highly motivated work force;

• To create enhanced value for our shareholders and other stake holders.

#### 1.5.2 COMPANY POLICY

With utmost consideration for the Safety of Life and Property and the Protection of Environment, the Company dedicates itself to meet the expectations of its Customers and the aspirations of its Stakeholders by ensuring that an effective Integrated Management System is in place that complies with the relevant National and International Codes, Standards, Statutory and Regulatory requirements.

In line with our strategy to be a market leader, an Organization caring for the environment and society, and a preferred safe and secure service provider, we shall monitor and ensure the effectiveness and continual improvement of our systems, leading to excellence.

With our firm belief in team success, we shall achieve our objectives by providing training and adequate resources to a highly motivated and an empowered workforce with due regard to their health, safety, security and welfare.

We commit to fulfil our social responsibility with conviction and determination, for the betterment of society at large.

#### 1.5.3 INTEGRATED MANAGEMENT SYSTEM POLICY

Recognizing that achieving excellence in respect of Quality, Health, Safety, Security, Environment and Social Responsibility is paramount to the success of our business, we give highest importance to these aspects. Accordingly, we commit ourselves to:

- Understanding the requirements of our customers and striving to exceed their expectations;
- Building mutually beneficial relationships with service providers and company personnel;
- Improving safety, environmental, operational, technical and commercial performance of ships operated by us;
- Complying with applicable Flag and Port State legislations and other requirements, as applicable;
- Maintaining an optimum spare parts inventory based on critical equipment and system redundancy identified on all vessels;
- Providing for safe practices in ship operation and ensuring safe, secure and healthy working environment to personnel ashore and on board ships by employing best management practices;
- Identifying all relevant hazards to safety, health and security, assessing risks and establishing safeguards against all identified hazards;
- Safeguarding all IT and OT assets ashore and on board our ships from cyber-attacks by continuously mitigating cyber risks;
- Ensuring that adequate attention is paid towards selection and career development of shore-based and shipboard personnel, with a view to ensure that all responsible persons are fully competent to perform the task with which they are entrusted;
- Continually enhancing the safety management skills of personnel ashore and on-board ships, including preparing for emergencies related to safety, protection of environment and security;
- Establishing and monitoring the health standards of employees working in shore-based offices and on-board the ships;
- Continually improving the performance and effectiveness of our integrated management system;
- Preventing all types of pollution of sea by oil, garbage, sewage and other harmful substances;
- Reducing air pollution and reducing-recycling-reusing all types of waste;
- Preventing injury, accidents, illnesses, damages, losses and deficiencies in our service;
- Following and enforcing a zero tolerance policy towards drugs and alcohol;
- Conserving all types of natural resources including energy, and committing to fulfill our social responsibility with conviction and determination for the betterment of society at large.

It shall be ensured that all personnel ashore and on-board ships have appropriate experience and training relevant to their roles. Company provides career development for junior officers and aims to recruit senior officers from within the company where possible. Senior officers are encouraged and appraised to always lead by example in safety related issues.

Company commits itself to providing adequate resources and training to its personnel, whether shore-based or on board ships, to meet the requirements of this policy. It shall be ensured that all personnel understand the policy and endeavor their utmost to implement the same at all times.

### 1.5.4 Policy on Conservation of Energy

As a part of Company's policy for conservation of natural resources and protection of environment, the Company lays importance on conservation of energy. The Company is aware that we all depend on natural resources for all our energy requirements and the Company considers these resources as treasure.

The Company is concerned about the challenges presented by earth's diminishing natural resources and global warming in general and energy supply in particular.

To make our existing energy resources last longer and reduce green house gas emission, the Company is committed to:

- Making a sincere and conscientious effort in reduction of use of fossil fuel with a view to reduction of Green House Gas emission;
- Avoiding inefficient and improper use of resources thus controlling waste of energy;
- Adopting better methods in work area such as proper and timely maintenance of ship and her machinery and equipment.

**1.5.5 Corporate Social Responsibility Vision Statement and Objective**

For Great Eastern, CSR means responsible business policies that are ethical, equitable, environmentally conscious, gender sensitive, and sensitive towards the differently abled. This policy, which has been formulated in alignment with the vision of the company, lays down guidelines and mechanisms to be adopted by the Company in order to carry out CSR Projects/Programs.

The objectives of this policy are to–

- Demonstrate commitment to the common good through responsible business practices and good governance.
- Actively support the state's development agenda to ensure sustainable and equitable change.
- Set high standards of quality in the delivery of services in the social sector by creating robust processes and replicable models.
- Engender a sense of empathy and equity among employees of GES to motivate them to give back to the society.

The structure for identification of these causes, and the modalities of the investment in these causes, are spelled out in detail in the following sections.

**1.5.5.1 Focus Area**

The Company's CSR efforts will be focused in the areas of:

a. Promoting education and knowledge enhancement, including but not limited to:
i) Establishment and management of educational and knowledge enhancement infrastructure;
ii) Provision of financial or other assistance to the needy and/or deserving students;
iii) Providing financial assistance to any Agency involved in education, knowledge enhancement and sports;
iv) Contribution to technology incubators located within academic institutions which are approved by the Central Government.
b. Eradicating hunger, poverty, and malnutrition

c. Promoting health care and sanitation

### 1.5.6 Overall strategy on energy saving and pollution prevention

The Company has established, implemented and maintains procedure(s) to identify the environmental aspects of its ship and shore-based operations defined within the scope of the environmental management system that it can control and those it can influence, taking into account planned or new developments or new or modified activities and services. The Company determines which environmental aspects have or can have a significant impact on the environment. The Company has documented this information and keeps it up-to-date. Proactive steps are taken to not only ensure compliance with statutory requirements but to stay ahead of the regulatory curve.

The Company ensures that the significant environmental aspects are taken into account in establishing, implementing and maintaining its environmental management system.

### 1.5.7 Reporting Period

This assertion report is for Financial Year 2018-2019 i.e. 1st April 2018 to 31st March 2019. The first year of GHG emission accounting as per ISO 14064-1 standard was Financial Year 2015-2016.

## Chapter 2 – Scope and Boundary of GHG Reporting

### 2.1 Description of GHG emissions

### 2.1.1 Organizational Boundary

The organizational boundary for accounting of GHG emission is taken as vessels owned and managed by G.E. Shipping, electricity consumption at its Registered Office in Ocean House, Mumbai and electricity consumption at training academy of the Company known as Great Eastern Institute of Maritime Studies at Lonavala in Maharashtra.

On 31st March 2018 the fleet size was 47 vessels and 3.88 million Deadweight Tonnes. During the reporting period Jag Viraat, Jag Vayu, Jag Vasant were acquired and Jag Ratan and Jag Arya were sold making the total fleet size as 48 vessels and 3.9 million Deadweight Tonnes.

Since this reporting is being voluntarily made for the stakeholders, the **control approach** is the most appropriate since the Company can be held accountable for vessels under their ownership and technical management only. It is to be also borne in mind that responsibility for ensuring compliance with international regulatory requirements for a vessel rests with ship owner and technical manager. Ships are generally employed under either “Voyage Charter” or “Time Charter”.

A voyage charter can be defined as the hire contract for a vessel for one or a specified number of voyages to carry specified cargo/es at stipulated freight rates (or lumpsum) on agreed terms and conditions between designated load and discharge ports, port ranges or regions. The shipowner pays for all fuel the vessel consumes.

A time charter can be defined as the hire contract of a vessel for a specific period of time; the owner still manages the vessel but the charterer selects the ports and directs the vessel where to go. The charterer pays for all fuel the vessel consumes. The Charterers pay a daily hire for the vessel.

G E Shipping charters out its owned vessels either on Voyage Charter or on Time Charter depending on the nature of charter that will provide best commercial benefit for a vessel at a given point in time. During the financial year, for all completed voyages, the number of sailing days of the fleet vessels was broadly 60% under Voyage Charter and 40% under Time Charter.

G. E. Shipping occasionally, to supplement its owned fleet, hires vessels under time charter over which it has no technical management control and as such these vessels are excluded from boundary of reporting under Scope 1 and Scope 2.

Greatship (India) Limited (GIL), wholly owned subsidiary (WOS) of G. E. Shipping is one of India's largest offshore oilfield services providers by way of owning and operating fleet of vessels. It is a separate company operated by its own Board of Directors and hence it is not included within the scope of this assertion report.

### 2.1.2 Operational Boundary

G E Shipping accounts for and reports its emissions of all applicable Kyoto GHGs (i.e. carbon dioxide ($CO_2$), methane ($CH_4$), nitrous oxide ($N_2O$) and hydrofluorocarbons (HFCs) from all direct sources of emissions.

Sulphur Hexafluoride SF6

Sulphur hexafluoride ($SF_6$) is a colourless, odourless, non-toxic, non-flammable gas that has a high dielectric strength. It has been used as a dielectric in microwave frequencies, as an insulating medium for the power supplies of high-voltage machines on board ships. The use of $SF_6$ in electrical switchgear in general (all land, air and sea installations) is primarily (90%) concentrated on the high-voltage segment (>36 kV) and the remaining 10% for the medium (1 kV–36 kV) voltage segment (Schneider 2003). None of the G E Shipping vessels have such high voltage installations and consequently $SF_6$ emission is not applicable.

Perfluorocarbons (PFCs)

Several binary and ternary blends of various HFC, HCFC, PFC and hydrocarbon refrigerants have been developed to address continuing service demand for CFC-12. These blends are tailored to have physical and thermodynamic properties comparable to the requirements of the original CFC-12 refrigerant charge. In shipping industry this refrigerant is used for deep-freezing purposes (-40°C to -70°C) on reefer vessels and fishing vessels. None of our fleet vessels has such deep freezers and consequently use of PFCs is not applicable.

**Scope 1 (Direct GHG emissions)**

- Emission resulting from combustion of fuel oils in company owned and managed vessels' main engines, auxiliary engines, boilers, inert gas generators (fitted on some of the tankers) and auxiliary engines for Framo hydraulic power units (fitted on some of the tankers).

- Emission resulting from unintentional releases of hydrofluorocarbon (HFC) used as refrigerants for air conditioning and provision refrigeration plants on company owned and managed vessels.

**Scope 2 (Indirect GHG emissions from electricity consumption)**

- Emission from generation of purchased electricity consumed at Ocean House, Head Office of G E Shipping based in Mumbai and training academy of the Company known as Great Eastern Institute of Maritime Studies at Lonavala in Maharashtra.

## 2.2 Description of Assets

### 2.2.1 Assets in FY 2018-2019

**Table 2.2.1 – Assets (FY 2018-2019)**

| Name of Vessel | IMO No. | Type of Vessel | Date of Built | Deadweight (DWT) |
|---|---|---|---|---|
| Suezmax | | | | |
| JAG LAKSHITA | 9208057 | Oil Tanker | 22-May-00 | 147079.56 |
| JAG LATEEF | 9208069 | Oil Tanker | 31-Jul-00 | 147079.56 |
| JAG LOK | 9293507 | Oil Tanker | 01-Mar-05 | 158145.20 |
| JAG LALIT | 9297905 | Oil Tanker | 19-May-05 | 158344.00 |
| JAG LEENA | 9516105 | Oil Tanker | 09-Feb-2010 | 157671.70 |
| JAG LAKSHYA | 9516117 | Oil Tanker | 05-Jan-2011 | 157641.60 |
| JAG LAADKI | 9194983 | Oil Tanker | 03-Aug-2000 | 150284.00 |
| Aframax | | | | |
| JAG LAVANYA | 9237412 | Oil Tanker | 19-Jan-04 | 105010.40 |
| JAG LATA | 9237618 | Oil Tanker | 19-May-03 | 105716.00 |
| JAG LYALL | 9308443 | Oil Tanker | 02-Jan-06 | 110530.80 |
| JAG LEELA | 9568184 | Oil Tanker | 23-Sep-2011 | 105525.20 |
| JAG LAXMI | 9568196 | Oil Tanker | 05-Jan-2012 | 105525.20 |
| LR2 | | | | |
| Jag LOKESH | 9390599 | Oil Tanker | 05-Jan-2009 | 105599.00 |
| LR1 | | | | |
| JAG AABHA | 9388948 | Oil Tanker | 03-Nov-08 | 74867.70 |
| JAG APARNA | 9388936 | Oil Tanker | 09-Jun-09 | 74859.30 |
| JAG AMISHA | 9388924 | Oil Tanker | 03-Apr-09 | 74889.20 |
| JAG AANCHAL | 9390161 | Oil Tanker | 05-Dec-08 | 74811.16 |
| MR | | | | |
| JAG PRANAV | 9281932 | Oil Tanker | 05-Jan-05 | 51383.00 |
| JAG PRANAM | 9310680 | Oil Tanker | 13-Dec-04 | 48694.00 |
| JAG PRABHA | 9270749 | Oil Tanker | 28-Oct-04 | 47999.00 |
| JAG PUSHPA | 9315733 | Oil/Chemical Tanker | 27-Apr-07 | 47848.00 |
| JAG PRERANA | 9321952 | Oil/Chemical Tanker | 04-Oct-07 | 47824.23 |
| JAG PRAKASH | 9315721 | Oil/Chemical Tanker | 28-Mar-07 | 47848.23 |
| JAG PANKHI | 9258686 | Oil Tanker | 21-May-03 | 46272.70 |
| JAG PAHEL | 9289506 | Oil Tanker | 12-Oct-04 | 46319.30 |
| JAG PADMA | 9325348 | Oil Tanker | 27-Sep-2005 | 47999.00 |
| JAG POOJA | 9310692 | Oil Tanker | 25-Jun-2005 | 48539.00 |
| JAG PUNIT | 9709984 | Oil Tanker | 01-Apr-2016 | 49717.40 |
| JAG PAVITRA | 9387956 | Oil Tanker | 24-Dec-2008 | 51463 |

| | | | | |
|---|---|---|---|---|
| Gas Carrier | | | | |
| JAG VISHNU | 9052331 | Gas Carrier | 25-Mar-1994 | 49353.00 |
| JAG VIDHI | 9115303 | Gas Carrier | 31-Jan-1996 | 49849.00 |
| JAG VIJAYA | 9139696 | Gas Carrier | 30-July-1997 | 26897.00 |
| JAG VIRAAT | 9307762 | Gas Carrier | 25-July-2007 | 54450.00 |
| JAG VAYU | 9108099 | Gas Carrier | 29-May-1996 | 38518.00 |
| JAG VASANT | 9307750 | Gas Carrier | 30-Nov-2006 | 54478.00 |
| Capesize | | | | |
| JAG ANAND | 9463308 | Bulk Carrier | 09-Jun-2011 | 179250.00 |
| Kamsarmax | | | | |
| JAG ARNAV | 9705354 | Bulk Carrier | 03-Jun-15 | 81732.00 |
| JAG AARATI | 9478200 | Bulk Carrier | 25-Feb-11 | 80325.20 |
| JAG ADITI | 9478195 | Bulk Carrier | 01-Apr-11 | 80325.20 |
| JAG AJAY | 9723849 | Bulk Carrier | 30-Jun-2016 | 82094.20 |
| JAG AALOK | 9706566 | Bulk Carrier | 29-Jul-2016 | 82022.60 |
| JAG AKSHAY | 9706554 | Bulk Carrier | 29-Aug-2016 | 82044.30 |
| JAG AMAR | 9723851 | Bulk Carrier | 11-Jan-2017 | 82083.80 |
| Supramax | | | | |
| JAG ROOPA | 9317145 | Bulk Carrier | 19-Sep-06 | 52454.00 |
| JAG RANI | 9456355 | Bulk Carrier | 08-Jul-11 | 56718.80 |
| JAG RISHI | 9456343 | Bulk Carrier | 01-Mar-11 | 56718.80 |
| JAG RADHA | 9496135 | Bulk Carrier | 27-Nov-2009 | 58133.00 |
| JAG ROHAN | 9324631 | Bulk Carrier | 20-Jan-2006 | 52450.00 |

2.2.2 Assets acquired and sold in FY 2018 - 2019

| **Name of Vessel** | **IMO No.** | **Type of Vessel** | **Date of Built** | **Deadweight** | **Vessel Acquired on** |
|---|---|---|---|---|---|
| Jag Viraat | 9307762 | Gas Carrier | 25-July-2007 | 54450.00 | 18-April-2018 |
| Jag Vayu | 9108099 | Gas Carrier | 29-May-1996 | 38518.00 | 10-May-2018 |
| Jag Vasant | 9307750 | Gas Carrier | 30-Nov-2006 | 54478.00 | 19-Sep-2018 |

| **Name of Vessel** | **IMO No.** | **Type of Vessel** | **Date of Built** | **Deadweight** | **Vessel Sold on** |
|---|---|---|---|---|---|
| Jag Ratan | 9222613 | Bulk Carrier | 20-July-01 | 52179.79 | 13-July-2018 |
| Jag Arya | 9491288 | Bulk Carrier | 01-Jan-11 | 80480.40 | 07-Dec-2018 |

2.2.3 Vessels operated on Time Charter in FY 2018 – 2019

Nil

**2.3 Uncertainty assessments and materiality threshold**

2.3.1 Uncertainty Assessment
There are a few known sources of uncertainty in our assessment and these are as follows:

1. Accuracy margin of ±1.4% of the fuel flow meters in use on board ships. The fuel flow meters are calibrated against fuel tank soundings for each voyage as per procedure documented in Fleet Operation Manual para 7.7.1.5.

2. Procedure for calculation of mass of fuel consumed from fuel flow meter readings is given in Fleet Operation Manual para 7.7.1.4. Uncertainty due to human error in incorrect use of the procedure is estimated to be ±0.5%.
3. Total uncertainty is thus considered to be < ±2.0%.

2.3.1.1 Completeness of data
In Live Vessel Information System (LIVIS) a Vessel Report Checklist is incorporated which identifies status of Noon Report received from vessels for any selected period. Safety feature also exist which prevents sending Noon Report for a day without sending Noon Report of the preceding day. This ensures completeness of data.

2.3.2 Materiality threshold
Materiality threshold is considered to be 1% and all emissions aggregated to that amount are not considered.

**2.4 Inclusion / exclusion of assets and emissions**

Emission from incineration of oil residue / sludge on board vessels – *MEPC.1/Circ.642 – 2008 Revised guidelines for systems for handling oily wastes in machinery spaces of ships incorporating guidance notes for an integrated bilge water treatment system (IBTIS)* defines Oil Residue (Sludge) as follows:
Oil residue (sludge) means the residual waste oil products such as those resulting from the purification of fuel or lubricating oil from main or auxiliary machinery or separated waste oil from bilge water separators, oil filtering equipment or oil collected in drip trays, and waste hydraulic and lubricating oils.

The volume of Oil Residue (sludge) ($M^3$) incinerated for the entire fleet for FY 2018-2019 was 2352.07 $M^3$. It is to be noted that the sludge consists of mixture of water, fuel oil and to certain extent used lubricating oils with constituents varying in uncertain proportions. This makes assessment of carbon content and $CO_2$ emission factor most uncertain. The sludge generated during the reporting year constituted about 0.73% of total fuel burnt under scope 1.

MARPOL Annex V Garbages in categories "C" (Domestic waste), "D" (Used cooking oil) and "F" (Operational waste) – Quantity of such garbage incinerated on board are reported by vessels and the aggregate quantity is found to be 139.44 $M^3$ for the entire fleet during the reporting period. It is to be noted that the garbage burnt is a mixture of various constituents making it very uncertain to establish carbon content and the GHG emission.

Since the total sludge and garbage quantity incinerated falls below Material Threshold limit, it is excluded.

**Scope 3**
An emission under this head has not been considered. Scope 3 emissions for G E Shipping are as follows:
- Commuting and business travel by employees;
- Fuel used by inchartered vessels;
- Transportation of purchased fuel in bunker barge or road tankers;
- Disposal of waste generated in operation;
- Supply of electricity to vessel during dry docking etc.

The followings are not applicable to the activities of G E Shipping:

- Transportation of an organization's product and materials – G E Shipping transports commodities between different locations and thereby emissions arising from consumption of fuels for propulsion and operation of vessels are included within Scope 1 emission. It does not manufacture or process any product, hence this is not applicable.
- Outsourced activities, contract manufacturing and franchises – None of companies business is outsourced, sub-contracted or franchised.

### 2.5 Listing of all GHG emission sources and sub-systems

Emissions from combustion of fuel are found from individual vessel's Noon Reports.

Emissions from Main engines, auxiliary engines, boilers, inert gas generators (fitted on some of the tankers), auxiliary engines for Framo pumps (fitted on some of the tankers) have been considered. Emissions from other energy-consuming sources (e.g. emergency generator, lifeboat engines etc.) were omitted because the contribution falls below Material Threshold limit.

### 2.6 Method for estimation for non-combustion emissions (Refrigerants, halogenated hydrocarbons)

R-22, R404a and R407c are used on board vessels for air conditioning and provision cooling purposes.

All these refrigerants have significant Global Warming Potential (GWP). The GWP is reported as $CO_2$ equivalent ($CO_2e$): this describes the equivalent amount of $CO_2$ that would be needed to achieve the same warming effect. The numerical values of GWP for different substances used in this report were taken from the IPCC Fifth Assessment Report and are based on the latest IPCC estimate of $CO_2$ concentration in the atmosphere.

### 2.7 Global warming potential of refrigerant emission from ships

The GWP100 is described relative to $CO_2$ warming potential (IPCC Fifth Assessment Report: Climate Change 2014)

**Table 2.7**

| Refrigerant | $CO_{2e}$ |
|---|---|
| R-22 | 1760 |
| R404a | 3922* |
| R407c | 1774* |

(*Based on manufacturer's declaration)

## Chapter 3 – Methodology for GHG quantification

### 3.1 Consolidation Approach

The organizational boundary for accounting of GHG emission is taken as vessels owned and managed by G.E. Shipping. Since this reporting is being voluntarily made for the stakeholders, the control approach is the most appropriate since the Company can be held accountable for vessels under their technical management only.

Emission, for vessels that have been sold or acquired during a specific financial year, have been reported for the period the vessels were under the ownership of the Company.

### 3.2 Type of Fuel Consumed on fleet vessels and Conversion Factor

Emission Factors are taken from MEPC.281(70) – Amendment 2016 Guidelines on the Method of Calculation of the Attained Energy Efficiency Design Index (EEDI) for New Ships.

**Table 3.2**

| Type of Fuel | Reference | Carbon content | Emission Factor (t-CO2 / t-Fuel) |
|---|---|---|---|
| Diesel / Gas Oil | ISO 8217 Grades DMX through DMB | 0.8744 | 3.206 |
| Heavy Fuel Oil (HFO) | ISO 8217 Grades RME and RMG | 0.8493 | 3.114 |

### 3.3 Method used for quantification of GHG emission

Engineers onboard ships quantify volume ($M^3$) of fuel used in main engines, auxiliary engines and boilers by taking fuel flow meters readings every noon. Some oil tankers are additionally fitted with Inert Gas Generators for supplying inert gas into cargo oil tanks for fire safety. Volume ($M^3$) of gas oil used in IGGs is quantified from gauging of gas oil tanks every noon. On oil tankers where Framo Pumps (submerged cargo pumps) are used fuel oil used in auxiliary engines for Framo hydraulic power units are quantified from gauging of fuel oil tanks every noon. These readings are recorded in vessel's log book.

Volume ($M^3$) of different grades of fuel consumed is converted on daily basis into mass (Tonnes*) of fuel at reference temperature of $15^0C$ by multiplying with appropriate density and application of temperature correction factor. The relevant procedure is given in para 7.7.1.4 of Fleet Operation Manual. The daily consumption figures are reported ashore through GE Nautical platform.

*(*Tonne - a metric system unit of mass equal to 1,000 kilograms (2,204.6 pounds) or 1 megagram (1 Mg). To avoid confusion with the smaller "short ton" and the slightly larger "long ton", the tonne is also known as a "metric ton"; in this report, the tonne is distinguished by its spelling.)*

At the end of financial year quantities of different grades of fuel consumed on each vessel are collated from GE Nautical platform and multiplied by applicable Emission Factor to arrive at $CO_2$ emission from combustion of fuels. The same is shown in Table 5.1.

### 3.4 Estimation of emissions factors

Emission Factors (EFs) for $CH_4$ and $N_2O$ are obtained from Table 34 – Emissions factors for top-down emissions from combustion of fuel given in Third IMO GHG Study 2014. The estimation was also compared against Annex 6, Table 22 – Baseline Emission Factors given in the same study derived from bottom-up approach. Some differences with respect to some of the gases were noted however these were not significant in nature. Also, as per IPCCC Assessment Report 5, Global Warming Potential ($CO_{2e}$) for $CH_4$ is 25 and for $N_2O$ is 298. The emission factors used are as follows:

**Table 3.4a**

| Emission substance | Marine HFO emission factor g/g fuel | Marine MDO emissions factor (g/g fuel) | $CO_{2e}$ |
|---|---|---|---|
| $CH_4$ | 0.00006 | 0.00006 | 25 |
| $N_2O$ | 0.00016 | 0.00015 | 298 |

**Table 3.4b – Emission sources, type of fuel consumed and conversion factors.**

| Source | Type of fuel oil | Emission Factor ($t\text{-}CO_2$ / t-Fuel) |
|---|---|---|
| Main Engine | Heavy Fuel Oil – High Sulphur (HSFO) | 3.114400 |
| | Marine Diesel Oil (MDO) | 3.206000 |
| | Low Sulphur Marine Gas Oil (LSMGO) | 3.206000 |
| | | |
| Auxiliary Engine | Heavy Fuel Oil – High Sulphur (HSFO) | 3.114400 |
| | Marine Diesel Oil (MDO) | 3.206000 |
| | Low Sulphur Marine Gas Oil (LSMGO) | 3.206000 |
| | | |
| Boiler | Heavy Fuel Oil – High Sulphur (HSFO) | 3.114400 |
| | Marine Diesel Oil (MDO) | 3.206000 |
| | Low Sulphur Marine Gas Oil (LSMGO) | 3.206000 |
| | | |
| Inert gas generators | Marine Diesel Oil (MDO) | 3.206000 |
| | Low Sulphur Marine Gas Oil (LSMGO) | 3.206000 |
| | | |
| Auxiliary engines for Frame pumps | Marine Diesel Oil (MDO) | 3.206000 |
| | Low Sulphur Marine Gas Oil (LSMGO) | 3.206000 |

### 3.5 Quality assurance and control of data

Fuel consumption data is recorded manually on board either from fuel flow meters or tank soundings in absence of flow meters. There can be errors in measured fuel consumption values due to various reasons, namely human error (during reading, measuring, recording), inaccuracy of measuring devices (mostly stated by the manufacturer: precision, drift, bias, non-linearity). However, since we have aggregated the data to yearly total for each vessel this process of aggregation reduces the uncertainty in daily observations.

Several procedures are in place to ensure accuracy of data. Chief Engineers and Second Engineers are specifically briefed during their pre-joining briefing on the importance of accuracy in reporting of speed and fuel consumption values for meaningful fuel efficiency performance evaluation of vessels. Method for calculation of fuel oil consumption has been standardized through documented procedure given in Fleet Operation Manual Section 7.7.1.4. Procedure of periodical calibration of fuel flow meters has been introduced in the same Manual in Section 7.7.1.5.

Vessels report the data in electronic form daily to the office in standardized formats (Arrival, Departure and Noon Reports). The data is then stored, processed, and analyzed ashore. Data is stored for at least 5 years.

Backup Servers will occur every day after regular business hours. Full Back up includes all the source files. Only one full backup is done every fourth day. Incremental Backups includes only files that have changed since the last full backup. The next time an incremental backup is done, files that have not been modified since previous backup are skipped.

Back up data are tested every 6 weeks by IT Department.

Apart from storage in backup server of the Company data it is also replicated in 3rd Party Data centre in Hyderabad (different location) in Disaster Recovery Server.

If required by any Department, backup data is retrieved by IT Department assigned personnel and provided to the concerned Department. Password for access is retained within IT Department.

For the FY 2018-2019 the number and types of errors found in the fuel consumption data is shown in Table 3.5 below. All errors were corrected prior to quantification.

**Table 3.5**

| Types of errors | Number of cases | Difference in fuel oil quantity accounting for the year (Tonnes) |
|---|---|---|
| Error with placement of decimal point | 1 | 4.95 |
| Interchanged reporting of fuel consumption values between main engines and auxiliary engines i.e. aux engine consumption is reported as main engine consumption and main engine consumption is reported as aux engine consumption. | 26 | Nil |
| Other errors* | 415 | 8421.43 |

*Missing data which were later on filled in and incorrect data (higher or lower values and anything which didn't fall under decimal error or interchange error)

### 3.5.1 GHG reporting roles and responsibilities

Chief Engineers of vessels are responsible for reporting of fuel consumption values in GE Nautical IT platform as per Company procedures given in Fleet Operation Manual.

Head of Information technology Division is responsible for maintaining IT platform for storing and transmission of data ashore.

Shore Based Personnel:

Data Analyst - Vessel Performance Management Cell is responsible for

- accurate quantification of GHG emission ensuring that all sources of emissions are accounted for;
- Indexing and retention of all relevant supporting records in easily retrievable condition.

Manager – VPM Cell is responsible for

- Uncertainty assessment of fuel flow meters and fuel measurement procedure and documentation of the data.

Head – Vessel Performance Management Cell is responsible for

- developing and maintaining documented procedure for quantification and reporting of GHG emission taking into account GHG reporting principles of "relevance", "completeness", "consistency", "transparency" and "accuracy";
- reviewing and approving GHG emission report;
- Co-ordination with 3rd Party Verification Bodies

## Chapter 4 – Energy Saving Initiative

### 4.1 Description of energy saving initiatives implemented in FY 2018-2019 and earlier years.

#### 4.1.1 Energy Saving Devices FY 2018-2019

During FY 2018-2019 following Energy Saving Devices (ESDs) were retrofitted for reducing fuel consumption of main propulsion system:

Jag Lalit, Jag Lata, Jag Aabha and Jag Pavitra were retrofitted with Propeller Boss Cap Fins (PBCF), a device which improves propulsive efficiency. The propeller's rotational motion forms a strong vortex at the center, which causes overall loss of propulsive efficiency. The finned features of PBCF break up this vortex, thereby reducing the loss of energy.

Jag Pavitra and Jag Aanchal were retrofitted with Mewis Duct, a device which improves the flow of water on to propeller and thus its efficiency.

Total cost incurred on above five ships: USD 671,800.

#### 4.1.2 Year wise cumulative savings

**Table 4.1.4**

| Financial Years | Estimated Reduction of $CO_2$ emission due to retrofitment of Energy Saving Devices and application of superior antifouling hull coatings |
|---|---|
| 2014-2015 | 7008 MT |
| 2015-2016 | 13,900 MT |
| 2016-2017 | 13,973 MT |
| 2017-2018 | 15,771 MT |
| 2018-2019 | 16,550 MT |

### 4.2 GHG Reduction strategy and target

#### 4.2.1 Mandatory Requirements

Ships on international trade are subjected to mandatory requirement of reduction / control of GHG emission since 1st January 2013 as per Chapter 4, Annex VI of MARPOL Convention. The technical requirements aimed to reduce GHG emissions from ships include two types of measures:

.1 Energy Efficiency Design Index (EEDI) for new ships;
.2 Ship Energy Efficiency Management Plan (SEMP) for all ships

The intent of EEDI is to set a mandatory benchmark for the efficient design i.e. fuel consumption and thereby give an indication of its carbon dioxide emissions, of new ships. The formula is targeted at creating a benchmark level for emissions from ship types and size ranges by way of giving an indication of the grammes of CO2 emitted per tonne mile of cargo moved. The benchmark level is lowered in a phased manner as technology and design improvements make vessels more efficient.

SEEMP is a system for monitoring, recording and reporting of ship performance, which will be used by ship operators to enhance the energy efficiency and the emissions performance of their ships by applying technical and operational measures to improve fuel efficiency.

All our new buildings are built in compliance with EEDI requirements and existing ships are provided with SEEMP and issued with International Energy Efficiency Certificates as per MARPOL Convention.

### 4.2.2 Company GHG reduction strategy

G E Shipping, as a strategy, believes in maintaining its ships in as fuel efficient condition as possible for following reasons:

1. To maintain competitive advantage for its vessels in chartering market;
2. To reduce its carbon footprint for environmental benefit and as a fight against climate change;
3. To remain prepared for any future regulatory requirement related to GHG reduction and climate change;
4. Sustainability of business.

The Company has a strategy of replacing its older tonnage with younger and more fuel efficient ships as well as enhancing the energy efficiency of individual identified vessels through technological retrofits.

### 4.2.3 Setting GHG reduction target

G E Shipping is tracking energy efficiency intensity of its vessels as per "MEPC.1/Circ.684 - Guidelines for voluntary use of the Ship Energy Efficiency Operational Indicator (EEOI)" since 2010 and have been setting EEOI reduction targets against Baseline Average EEOI (Loaded voyages) values established during 2010-2011 for individual vessels based on their operational profiles for each biennial starting from 2012-2013. The intent of EEOI is to provide a measure of how efficiently a given ship is operated, i.e. how much cargo it moves for the fuel used. It works by calculating cargo, fuel and distance for each voyage leg, averaged over a period (usually 12 months) as it will provide a standardized way of communicating a ship's energy performance in operation. While some ships met the target some could not. Company found several limitations in setting a reduction target based on EEOI due to following reasons:

1. The speed of a ship varies in accordance with the prevailing charter hire rate and bunker price. These two elements, in varying degrees, influence a vessel's speed and consequently fuel consumption. These in turn create difficulty in trying to establish a fuel efficiency standard for the existing ships since a ship's speed is not constant over time.

2. It is also a fact that in a depressed freight market the fuel efficiency values of the individual ships (e.g. kg/nm, gm/t-nm) would remain low but with an improved freight market and/or with lower

bunker cost the ships will increase their speeds resulting in higher fuel consumption and consequently kg/nm and gm/t-nm values. This phenomenon was noted following world economic meltdown in 2008 and reduced trading activity when slow steaming was resorted to by the world fleet to reduce operational cost. This resulted in lower EEOI values. However, with crash of oil price since end-2014 with improved oil trading activity at least the oil tankers' operational speed had gone up and this had resulted in higher EEOI values for such types of vessels.

3. Moreover, fuel consumption of a ship (considering the machineries are in efficient condition) varies based on quantity of cargo carried, trim, weather condition (specifically wind force and wave) and hull roughness. All these factors influence the fuel efficiency of a vessel. Without carrying out detailed calculations normalizing the effects of all these factors it is futile trying to establish a fuel efficiency standard of ships.

However, a good correlation between the Energy Efficiency Design Index (EEDI) and the EEOI across different ship sizes were noted.

Notwithstanding above, in absence of any other internationally recognized energy efficiency matrix EEOI is continued to be used as a measure for GHG reduction for individual vessels after establishing Baseline EEOI (Loaded voyages) values for the vessels based on one or two years of operations. The reduction targets are set based on operating profiles of individual vessels.

G E Shipping is committed on continuous improvement in energy saving and reduction of GHG emission from ships. Towards this end we as a leading stakeholder actively contribute in development of international regulatory regimes and guidelines related to reduction of GHG emission from international shipping at Marine Environment Protection Committee of International Maritime Organization.

## Chapter 5 – GHG Disclosure

**Scope 1 emission**

- Emission resulting from combustion of fuel oils in company owned and managed vessels' main engines, auxiliary engines, boilers, inert gas generators (fitted on some of the tankers) and auxiliary engines for Frame pumps (fitted on some of the tankers).

- Emission resulting from unintentional releases of hydrofluorocarbon (HFC) used as refrigerants for air conditioning and provision refrigeration plants on company owned and managed vessels.

**Table 5.1 - FY 2018-2019 (All figures are in MT)**

| Vessels | HSFO | LSFO | MDO | LSMGO | Total $CO_2$ |
|---|---|---|---|---|---|
| Suezmax | | | | | |
| Jag Lakshita | 9373.37 | 0.00 | 0.00 | 274.70 | 30073.11 |
| Jag Lateef | 9257.25 | 0.79 | 0.00 | 441.19 | 30247.69 |
| Jag Lok | 11165.10 | 0.00 | 0.90 | 389.80 | 36025.17 |
| Jag Lalit | 11135.00 | 0.00 | 0.00 | 252.00 | 35486.76 |
| Jag Leena | 12216.10 | 0.00 | 0.00 | 430.40 | 39425.68 |
| Jag Lakshya | 10730.26 | 0.00 | 0.00 | 984.90 | 36575.91 |
| Jag Laadki | 10957.65 | 0.00 | 0.00 | 303.99 | 35101.10 |
| Aframax | | | | | |
| Jag Lavanya | 8697.13 | 0.00 | 0.00 | 30.56 | 27184.32 |
| Jag Lata | 6827.25 | 0.70 | 0.00 | 431.40 | 22648.04 |
| Jag Lyall | 8351.07 | 0.10 | 0.00 | 936.07 | 29009.92 |
| Jag Leela | 5868.91 | 0.00 | 0.00 | 3329.40 | 28952.19 |
| Jag Laxmi | 5172.50 | 0.20 | 37.00 | 2143.00 | 23098.94 |
| LR1 | | | | | |
| Jag Aabha | 7265.89 | 0.00 | 0.00 | 475.30 | 24152.70 |
| Jag Aparna | 7015.47 | 0.20 | 0.00 | 353.99 | 22984.49 |
| Jag Amisha | 6346.08 | 0.00 | 11.90 | 144.48 | 20265.59 |
| Jag Aanchal | 5229.28 | 0.00 | 138.90 | 219.06 | 17433.69 |
| LR2 | | | | | |
| Jag Lokesh | 9577.42 | 0.70 | 0.30 | 288.10 | 30754.71 |

| Vessels | HSFO | LSFO | MDO | LSMGO | Total $CO_2$ |
|---|---|---|---|---|---|
| MR | | | | | |
| Jag Pranav | 5217.15 | 0.30 | 97.50 | 192.12 | 17177.75 |
| Jag Pranam | 4352.61 | 0.00 | 0.00 | 50.78 | 13718.57 |
| Jag Prabha | 4360.07 | 0.00 | 0.00 | 61.24 | 13775.34 |
| Jag Pushpa | 4934.49 | 0.00 | 0.00 | 234.47 | 16119.69 |
| Jag Prerana | 5048.50 | 0.00 | 0.00 | 186.30 | 16320.33 |
| Jag Prakash | 4585.20 | 0.00 | 60.28 | 121.10 | 14861.65 |
| Jag Pankhi | 3211.14 | 0.10 | 0.00 | 92.62 | 10298.03 |
| Jag Pahel | 4064.74 | 0.00 | 41.14 | 44.04 | 12932.31 |
| Jag Padma | 4724.64 | 4.83 | 0.25 | 90.99 | 15021.98 |
| Jag Pooja | 5468.25 | 0.00 | 0.00 | 144.70 | 17494.23 |
| Jag Punit | 3925.48 | 0.00 | 0.00 | 667.49 | 14365.49 |
| Jag Pavitra | 4050.06 | 0.00 | 1.73 | 340.78 | 13711.59 |
| Gas Carrier | | | | | |
| Jag Vishnu | 6717.28 | 0.20 | 68.84 | 4.80 | 21157.01 |
| Jag Vidhi | 8899.71 | 0.80 | 36.67 | 38.30 | 27960.10 |
| Jag Vijaya | 4573.14 | 0.01 | 0.00 | 69.30 | 14464.79 |
| Jag Viraat | 6706.84 | 0.00 | 17.35 | 59.61 | 21134.52 |
| Jag Vayu | 3152.60 | 0.00 | 120.79 | 5.90 | 10224.63 |
| Jag Vasant | 4533.30 | 0.00 | 0.00 | 204.02 | 14772.60 |
| Capesize | | | | | |
| Jag Anand | 8261.13 | 0.00 | 0.00 | 1000.86 | 28937.22 |
| Kamsarmax | | | | | |
| Jag Arnav | 5338.52 | 0.00 | 0.00 | 412.94 | 17950.17 |
| Jag Aarati | 4595.35 | 0.00 | 21.00 | 244.23 | 15162.09 |
| Jag Aditi | 5662.09 | 0.00 | 0.00 | 179.45 | 18209.33 |
| Jag Arya | 4231.40 | 0.00 | 1.50 | 203.77 | 13836.37 |
| Jag Ajay | 4592.67 | 0.00 | 1.07 | 389.87 | 15556.77 |
| Jag Aalok | 5471.40 | 0.00 | 0.00 | 441.40 | 18455.26 |
| Jag Akhsay | 4655.60 | 0.10 | 10.40 | 420.28 | 15880.47 |
| Jag Amar | 5725.56 | 0.70 | 0.00 | 34.81 | 17945.47 |
| Supramax | | | | | |
| Jag Roopa | 4669.23 | 0.01 | 0.00 | 272.42 | 15415.26 |
| Jag Ratan | 988.80 | 0.00 | 0.00 | 72.70 | 3312.59 |
| Jag Rani | 4454.34 | 0.00 | 117.21 | 55.44 | 14425.98 |
| Jag Rishi | 3702.63 | 0.00 | 0.60 | 199.92 | 12174.34 |
| Jag Radha | 4679.89 | 0.90 | 0.00 | 179.50 | 15153.33 |
| Jag Rohan | 4124.20 | 0.00 | 0.00 | 254.67 | 13660.88 |
| | | | | **Total** | **1011006.12** |

Emission of CH4 and N2O from combustion of above fuel is derived from Table 3.4 and given in Table 5.2 below in CO2e.

**Table 5.2 – $CO_2e$ from emission of $CH_4$ and $N_2O$ from fuel burnt during FY 2018-2019**

| Type of Fuel | Mass of Fuel (MT) | $CO_2e$ of CH4 (MT) | $CO_2e$ of N2O (MT) | Total $CO_2e$ (MT) |
|---|---|---|---|---|
| Total HFO (HSFO + LSFO) | 304874.38 | 457.31 | 14536.41 | 14993.72 |
| Total MDO (MDO + LSMGO) | 19184.45 | 28.78 | 857.54 | 886.32 |
| | | | **Total** | **15880.04** |

Emission of refrigerants from Provision cooling plants and Air conditioning plants of individual vessels were recorded from Monthly EMS data sent from ships. Total emission from refrigerants during the Reporting period and its $CO_2e$ is given in Table 5.3 below. Emission Factors are taken from Table 2.7.

**Table 5.3 – Emission of refrigerant and its CO2e**

| Type of refrigerant | Mass in Kgs. | $CO_2e$ (MT) |
|---|---|---|
| R 22 | 337.00 | 593.12 |
| R 404a | 1037.20 | 4067.90 |
| R 407c | 123.00 | 218.20 |
| | **Total** | **4879.22** |

Total Scope 1 CO2e emission from all sources Table 5.1 + Table 5.2 + Table 5.3 = **1031765.38 MT**

**Scope 2 Emission**

- Emission from generation of purchased electricity consumed at Ocean House, Head Office of G E Shipping based in Mumbai and training academy of the Company known as Great Eastern Institute of Maritime Studies at Lonavala in Maharashtra.

**Table 5.4 - Electricity Consumed and $CO_2e$ Emission during FY 2018-2019**

| Purchased and consumed electricity | | | | |
|---|---|---|---|---|
| **At Ocean House, Head Office of G E Shipping in Mumbai (MWh)** | **At Great Eastern Institute of Maritime Studies at Lonavala in Maharashtra (MWh)** | **Total (MWh)** | **$CO_2$ emission Factor as per CO2 Baseline Database for the Indian Power Sector (Version 14.0, December 2018) published by Government of India** | **Total $CO_2e$ (MT)** |
| 878.04 | 775.00 | 1653.04 | 0.82 | **1355.49** |

Total Scope 2 $CO_2e$ emission from all sources Table 5.4 = **1355.49 MT**

## Chapter 7 – Report Conclusion

G E Shipping is committed to low carbon shipping for sustainable development.

G E Shipping has been taking proactive steps for reduction of GHG emission from its vessels for past many years and has been monitoring GHG emission per unit of transport work for fleet vessels since 2010 for bench marking its performance. In order to ensure that the quantification and reporting of GHG emission from fleet vessels is done as per recognized international standard duly verified by third party, G E Shipping has decided to follow ISO 14064-1 and is publishing this report for all its stakeholders.

| Financial year | Scope 1 | Scope 2 |
|---|---|---|
| 2018-2019 (1st April 2018 – 31st March 2019) | **1031765.38 MT** | **1355.49 MT** |

## Chapter 8 - References


- MEPC.281(70) – Amendment 2016 Guidelines on the Method of Calculation of the Attained Energy Efficiency Design Index (EEDI) for New Ships.
- Third IMO GHG Study 2014
- IPCC Fifth Assessment Report: Climate Change 2014


## Chapter 9 -Abbreviations

CSR – Corporate Social Responsibility

CFC - Chlorofluorocarbons

HFC – Hydrofluorocarbons

HCFC – hydrochlorofluorocarbons

HFO – Heavy fuel oil

EF – Emission factor

HSFO – High sulphur fuel oil

GHG – Green House Gas

IT – Information Technology

IMO – International Maritime Organization

KPI – Key Performance Indicator

GWP – Global Warming Potential

IPCC – Intergovernmental Panel on Climate Change

ISO – International Organization for Standardization

LSMGO – Low sulphur marine gas oil

MIS – Management information system

MARPOL - International Convention for the Prevention of Pollution from Ships

MEPC – Marine Environment Protection Committee

MDO – Marine diesel oil

## Annexure I

## Conversion Factors

### 1. The various conversion factors / emission factors used in this assertion Report are as follows:

### 1.1 Global warming potential of refrigerant emission from ships

The GWP100 is described relative to $CO_2$ warming potential (IPCC Fifth Assessment Report: Climate Change 2014)

| Refrigerant | $CO_{2e}$ |
|---|---|
| R-22 | 1760 |
| R404a | 3922 |
| R407c | 1774 |

### 1.2 Type of Fuel Consumed on fleet vessels and Conversion Factor

| Type of Fuel | Reference | Carbon content | Emission Factor (t-CO2 / t-Fuel) |
|---|---|---|---|
| Diesel / Gas Oil | ISO 8217 Grades DMX | 0.8744 | 3.206 |
| Heavy Fuel Oil (HFO) | ISO 8217 Grades RME and RMG | 0.8493 | 3.114 |

### 1.2.1 Sources of emission, types of fuels used and their conversion factors

| Source | Type of fuel oil | Emission Factor ($t\text{-}CO_2$ / t-Fuel) |
|---|---|---|
| Main Engine | Heavy Fuel Oil – High Sulphur (HSFO) | 3.114 |
| | Marine Diesel Oil (MDO) | 3.206 |
| | Low Sulphur Marine Gas Oil (LSMGO) | 3.206 |
| | | |
| Auxiliary Engine | Heavy Fuel Oil – High Sulphur (HSFO) | 3.114 |
| | Marine Diesel Oil (MDO) | 3.206 |
| | Low Sulphur Marine Gas Oil (LSMGO) | 3.206 |
| | | |
| Boiler | Heavy Fuel Oil – High Sulphur (HSFO) | 3.114 |
| | Marine Diesel Oil (MDO) | 3.206 |
| | Low Sulphur Marine Gas Oil (LSMGO) | 3.206 |
| | | |
| Inert gas generators | Marine Diesel Oil (MDO) | 3.206 |
| | Low Sulphur Marine Gas Oil (LSMGO) | 3.206 |
| | | |
| Auxiliary engines for Framo pumps | Marine Diesel Oil (MDO) | 3.206 |
| | Low Sulphur Marine Gas Oil (LSMGO) | 3.206 |

### 1.3 Estimation of emissions factors

Emission Factors (EFs) are obtained from Table 34 – Emissions factors for top-down emissions from combustion of fuel given in Third IMO GHG Study 2014. The estimation was also compared against Annex 6, Table 22 – Baseline Emission Factors given in the same study derived from bottom-top approach. Some differences with respect to some of the gases were noted however these were not significant in nature. The emission factors used are as follows:

| Emission substance | Marine HFO emission factor g/g fuel | Marine MDO emissions factor (g/g fuel) | $CO_{2e}$ |
|---|---|---|---|
| $CO_2$ | 3.11400 | 3.20600 | 1 |
| $CH_4$ | 0.00006 | 0.00006 | 25 |
| $N_2O$ | 0.00016 | 0.00015 | 298 |

### 1.4 $CO_2e$ emission Factor for unit of electricity consumed

As per CO2 Baseline Database for the Indian Power Sector (Version 14.0, December 2018) published by Government of India, Ministry of Power, Central Electricity Authority $CO_2e$ emission factor for every MWh electricity consumed : 0.82.

*Table S-1: Weighted average emission factor, simple operating margin (OM), build margin (BM) and combined margin (CM) of the Indian Grid for FY 2017-18 (adjusted for cross-border electricity transfers), in t $CO_2$/MWh*

| Average | OM | BM | CM |
|---|---|---|---|
| 0.82 | 0.95 | 0.86 | 0.91 |

Average is the average emission of all stations in the grid, weighted by net generation.
OM is the average emission from all stations excluding the low cost/must run sources.
BM is the average emission of the 20% (by net generation) most recent capacity addition in the grid.
CM is a weighted average of the OM and BM (here weighted 50: 50).

**Annexure II**

**Trend Charts**