Prepared by First Climate (India) Private Limited

GHG FOOTPRINT REPORT

ORIENT CEMENT LIMITED 2016

firstclimate

CK BIRLA GROUP | ORIENT CEMENT

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Disclaimer

The information contained in this report has been compiled by First Climate (India) Private Limited (FCIPL) on the basis of information provided by Orient Cement Limited (OCL) and information received from OCL personnel during visit to the project sites at Devapur and Jalgaon through e-mail or hard copy correspondences /data provided.

No liability of any kind whatsoever is assumed by FCIPL, or any of its directors, officers, employees, advisors or agents in relation to any findings, conclusions, opinions, forecasts, projections, or otherwise in relation to this study report.

DECLARATION BYORIENT CEMENT LIMITED

Orient Cement Limited (hereafter referred as OCL) has undertaken Greenhouse Gas (GHG) accounting study for its 2 sites namely:

- *Devapur Integrated Cement Unit (3.0 MTPA)&*
- *Clinker Grinding Unit Jalgaon (2.0MTPA)*

The study was undertaken by First Climate (India) Pvt. Ltd. (FCIPL) to evaluate the greenhouse gas (GHG) emission of OCL for the above mentioned units for the period April 2015 to March 2016.
The following methodologies and standards were used for assessment of the GHG inventory from the operations of the two units of OCL:

1. *"Greenhouse Gases – Part 1: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals"*
   International Standard ISO 14064 Part-I, 2006
2. *"GHG Protocol Corporate Accounting and Reporting Standard"*

   - Greenhouse Gas Protocol

3. *"CO_2 Accounting & Reporting*
   - WBCSD Cement Sustainability Initiative Cement $CO_2$and Energy Protocol Version 3.1, Emissions and Energy Inventory

The entire accounting exercise has been carried out and the GHG inventory report has been prepared in line with the ISO 14064-1:2006 and WBCSD Cement Sustainability Initiative Cement CO_2 and Energy Protocol Version 3.1, Emissions and Energy Inventory standard as mentioned above. The ISO 14064-1:2006 requires[1] that:

"The organization should prepare a GHG report to facilitate GHG inventory verification, participation in a GHG programme, or to inform external or internal users."

Accordingly, this report has been prepared to facilitate GHG verification of the emission inventory and to enhance transparency of stakeholder communication. The compliance to ISO14064-1:2006 in the inventory estimation and reporting exercise has been objectively demonstrated in different sections of the report. Various assumptions, inclusions and exclusions of data; and deviations from methodologies/standards, wherever applicable, have been appropriately documented with explanations in the report. The GHG Inventory Report is yet to be verified and certified by any third party.If facts that could materially affect the validation or verification statement are discovered after the conclusion of the verification, the report will be revised as necessary and the verifier shall be informed for considering appropriate action as required by ISO 14064-I:2006.
This report covers direct and indirect Carbon Dioxide (CO_2) emissions. Other GHG's i.e. Methane (CH_4), Nitrous Oxide (N_2O), Sulphur Hexafluoride (SF_6),Perfluorocarbon (PFCs)Nitrogen Tri-fluoride (NF_3)and Hydrofluorocarbon (HFCs) emissions have not been accounted for since the emissions of these gases do not have any material impact on the overall emissions from the operations of the above mentioned two unitsand are hence not considered relevant for the present study. The scope covers emissions under "Direct" and "Energy Indirect" (i.e. scope 1&scope 2 respectively as defined in GHG protocol) categories.

The assignment required collection, compilation and analysis of data from the field in line with the above methodologies / standards.

[1]*ISO 14064-I:2006 - Page 21; Section 7: Reporting of GHG; Subsection 7.1: General*

On behalf of Orient Cement Limited

Dr. Anil Kumar Trivedi

General Manager (Sustainability)

The struggle against poverty in the world and the challenge of cutting wealthy country emissions all has a single, very simple solution. Here it is: Put a price on carbon.

-Al Gore

Foreword

Corporate Environmental, Health and Safety Policy of Orient Cement Limited

OCL actively promotes corporate environment responsibility as one of its core business values and follows a Corporate Environmental Health & SafetyPolicy. As part of this policy, OCL is committed towards environmental protection and providing healthy & safe work environment by way of:

- Compliance with all applicable legal, social and other requirements
- Improvement in environmental performance and resource efficiency
- Reviewing objectives and targets for continual improvement in environment, work place, health & safety
- Engaging and training human capital to enhance their skills and augment resources for effective EHS performance.
- Controlling pollution
- Prevention of occupational injuries and health hazards

Corporate Energy Policy of Orient Cement Limited

OCLalso actively promotes energy efficiency as key driver to its business values and follows a Corporate Energy Policy. As part of this policy, OCL is committed toimprovement Energy efficiency and performance by using alternative fuels and by identification and reduction of energy losses by:

- Establishing a framework for setting energy objectives and targets
- Reviewing, monitoring and analysing Energy consumption
- Conducting audits for improvement of overall Energy Efficiency of the plant
- Purchasing equipment and appliances with consideration of the Bureau of Energy Efficiency Star Ratings and energy efficiency.
- Ensuring Energy conservation, management and awareness throughout the organization.
- Always complying with relevant and applicable Laws and Regulations.

Intended Use and Intended Users of the report

This report is a voluntary communication to various stakeholders of OCL including,Customers, Management, Investors, Financiers, Government and the public at large. Stakeholders can obtain necessary information on GHG performance of the facility/company and track the performance with respective to organisation's objectives with respect to GHG performance. This report will further serve as the launching pad for more detailed and inclusive studies of all the installations and operations of OCL. Since GHG emission and energy /fuel costs have a direct correlation, this may serve as an ideal platform to identify GHG hotspots for any future GHG emission/fuel consumption reduction program. This report will also be the referencepoint for any verification of GHG inventory to be estimated in future, should the management so decide.

Overall and specific responsibilities for preparing and producing the report:

OCL owns the overall responsibility for preparing and producing this report. M/s First Climate (India) Private Limited has assisted OCL in data collection, collation & calculation of GHG emissions as per applicable standards and has drafted the report. The responsibility of ascertaining calculation methods in line with ISO 14064-1:2006 was entrusted to FCIPL and the data has been supplied by OCL officials. For any clarification with respect to this report, stakeholders are requested to contact the following personnel from OCL and FCIPL:

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Frequency and base year selection

OCL envisages assessing its GHG performance on an annual basis. Hence Inventorization of GHG emissions will be taken up on an annual frequency.The present study period includes data from 1st April 2015 to 31st March 2016, both days inclusive.As this is the first year of evaluation, hence **The base year for the present GHG Inventorization Study has been selected as 2015-16.**

Period of validity

This report is valid until a future revision of this report is published which supersedes this present version or OCL publishes any report which modifies the approach and calculation rationale presented in this report, whichever is earlier.

Format & Contents

The report is organized in 3 chapters excluding the Executive Summary. The first section provides the **background & scope** of the GHG estimation study including the corporate EHS and Energy policy of OCLand relevance of the study, Objectives and Scope of the exercise. The second chapter deals with the **approach** for calculation of emissions including description of **operational boundary and quantification methodology**. The third and final section provides the detailed organization-wise, unit-wise and GHG-wise break-up of the emissions and **results.**

Policy on availability and methods of dissemination

OCL wishes to make this report available in its website for free and easy access of all stakeholders concerned and ensurestransparency and consistency of all such future communications.

OCL may consider its policy of external communication from time to time as per changes in statutory / regulatory reporting requirements and voluntary disclosures.

I remember, as a boy of 17 years of age, this was a fascinating thing for me: how we human beings breathe out carbon dioxide into the air, the leaves of plants pick this carbon dioxide up, and the plant gives off oxygen, which we can breathe in and keep our life going.

- Percy Julian

Table of Contents

List of Tables

Those who deny human-caused climate change offer no compelling evidence to better explain the undeniable rise in atmospheric concentrations of greenhouse gases and global temperature.

- ***Alan Lowenthal***

1. Executive Summary

1.1 Statement of Intent

As a responsible corporate citizen OCL aims to own and manage the greenhouse gas emission inventory due to its operations. Through this exercise, the twosites of OCL intends to

→ Volunteer its resources to adopt sustainability as a core business value and thereby showcase its commitment towards clean and green future to its stakeholders.
→ To monitor, inventorize, report and own the Greenhouse Gas emissions due to its operations
→ Lay the foundation for future roll up of the inventory to arrive at corporate inventory for OCL

1.2 Emission Summary

The overall emission inventory has been calculated as aggregated emissions from the operations of twoOCL sites. The table below presents the emission inventory for the year 2015-16:

Table 1.1: Absolute GHG emissions in tCO_2e for the two units of OCL

Emissions	Classification	Devapur	Jalgaon
Direct Emissions (Scope 1)	Total CO_2 from Raw Materials	15,16,630	
	Total CO_2 from fossil based kiln fuels	9,22,747	
	total CO_2 from non-kiln fossil fuels	4,97,276	2839
	Total Direct Emissions	29,36,653	2839
Indirect Emissions (Scope 2)	CO_2 from External Power Generation	8,491	33968

*Both direct emission and indirect emission figures have been rounded-up to the nearest integer. The total figure reported is the sum of the rounded-up figures. The emission figures reported

The emission sources for OCL (both Devapur and Jalgaon units) have been tabulated below:

Table 1.2: Explanation of Direct Emission Sources

Emission Type	Direct Emissions
CO_2 Emissions from Raw Materials	Emissions from Calcination of raw materials consumed for clinker production
	Emissions from organic carbon content of raw meal
CO_2 Emissions from Kiln Fuels (incl. of Drying of Fuels &Raw Materials)	Emissions from fossil fuel consumption (conventional)
	Emissions from alternative fossil fuel consumption
CO_2 Emissions from Non- Kiln Fuels	Emissions from fossil fuel consumption
	Emissions from fossil fuel consumption for onsite vehicles and equipments
	Emissions from fossil fuel consumption in onsite power generation

Table 1.3: Explanation of Indirect Emission Sources

Emission Type	Indirect Emissions
Main Sources	Emissions from External Power Generation

The emission sources have been referenced rom WBCSD Cement Sustainability Initiative Version 3.1

Climate change is a controversial subject, right? People will debate whether there is climate change... that's a whole political debate that I don't want to get into. I want to talk about the frequency of extreme weather situations, which is not political.

-Andrew Cuomo

2. Background and Scope

2.1 Orient Cement Limited- Organizational Background

Orient Cement's plant situated at Devapur in Adilabad District, Telangana (which is a Greenfield project), began cement production in the year 1982. In 1997, a split-grinding unit (also a Greenfield project) at Nashirabad in Jalgaon, Maharashtra was added. In 2015, Orient Cement started its commercial production at its Greenfield integrated cement plant located at Chittapur, Gulbarga, Karnataka. With a total capacity of 8 MTPA, and ambitious expansion plan, Orient Cement is aspiring to reach 15 MPTA by 2020.

The product mix includes Ordinary Portland Cement (OPC) & Pozzolana Portland Cement (PPC) sold under the brand name of Birla A1. Good quality and suitability for critical structures gives Birla A1 the edge over other brands in the market. Our continuous research and development have made our products create benchmarks in the markets. A fully integrated NABL accredited quality control lab adhering to the best standards ensure that our quality is not compromised upon.

Orient Cement is certified for both ISO 9001:2008, and ISO 14001:2004 and also OHSAS 18001:2007 from Det Norske Veritas (DNV), Netherlands. In fact, Devapur plant is the first cement plant in Telangana to be certified for ISO 14001:2004 by DNV, in recognition of its outstanding environment management system. By virtue of winning the TPM Excellence Award from JIPM, Japan, Orient Cement has been adjudged as a world-class cement unit making it the first cement company in South India and second pan India unit to earn this distinction. The TPM certification is a direct result of Orient Cement's continuous up-gradation and plant modernization processes with special emphasis on energy conservation, pollution control, increasing productivity and improving the quality of cement.

Products

Birla A1 Premium Cement	Birla A1 Premium Cement 53 Grade	Birla A1 Premium Cement 43 Grade
Launched as a corollary to the magnificent success of Orient Gold 53 Grade Cement, Birla A1 Premium Cement has carved a niche in the market and is already among the best known brands in south-west India. Our flagship brand in the PPC category, Birla A1 Premium Cement is an inter-grinding of Portland cement clinker, gypsum and very fine-grained highly reactive fly ash. Its biggest advantage is better particle size distribution for greater strength, which helps achieve higher density with lower porosity in the hydrated cement, leading to increased durability	*One of the pioneers of 53-Grade Cement in India, Orient Cement opened up a whole new dimension in building construction with the launch of Orient Gold 53-Grade Cement in 1992. The runaway success of Orient Gold is a testimony to our efforts to provide consumers with only the very best. The brand has now been integrated under our umbrella brand and rechristened as Birla A1 Premium Cement – OPC 53 Grade.*	*Originally named Orient 43 Grade Cement, it was amongst the earliest successes of Orient Cement paving the way for the others to follow. Manufactured under controlled process conditions deploying sophisticated plant machinery, it gained immense popularity in a short span of time and was instrumental in making Orient Cement a household name. The brand has now been integrated under our umbrella brand and rechristened as Birla A1 Premium Cement – OPC 43 Grade.*

Various grades of Cement Manufactured by Orient Cement Limited

2.2 Orient Cement Limited: Corporate Environment, Health & Safety (EHS) Policy

Orient Cement actively promotes corporate environment, health & safety responsibility as one of its core business values and is committed towards environmental protection and providing healthy & safe work environment by way of

- *Compliance with all applicable legal, social and other requirements.*
- *Improvement in environmental performance and resource efficiency*
- *Reviewing objectives and targets for continual improvement in environment, workplace, health and safety*
- *Engaging and training human capital to enhance their skills and augment resources for effective EHS performance.*
- *Controlling Pollution*
- *Prevention of occupational injuries and health hazards*

2.3 Orient Cement Limited: Corporate Energy Policy

Orient Cement is also committed towards improvement of Energy Efficiency and performance by using alternative fuels and by identification and reduction of energy losses by:

- *Establishing framework for setting energy objectives and targets*
- *Reviewing, monitoring and analysing Energy Consumption*
- *Conducting audits for improvement of overall Energy Efficiency of the plant*
- *Purchasing equipment and appliances with consideration of the Bureau of Energy Efficiency Star Ratings and energy efficiency.*
- *Ensuring Energy conservation, management and awareness throughout the organization*
- *Always complying with relevant and applicable Laws and Regulation*

OCL has initiated estimation of Greenhouse Gas inventory from two cement manufacturing units in the same spirit. OCL management has already reported the GHG emissions as a key performance indicator in Carbon Disclosure Project under the Climate Change programme for the year 2015-16. OCL is also in the process of participating in Cement Sustainability Initiative (CSI) which indeed is a giant step towards achieving organizational sustainability.

2.4 GHG Footprint Assessment: Drivers and Benefits

Greenhouse gas emissions being one of the key concerns of "cost to environment" for modern businesses, OCL wishes to embark on a low carbon growth trajectory in its operations. Managing GHG emissions is only possible with effective monitoring set-up and practices to measure, record, calculate and report emissions over a period of time. Hence, OCL has decided to calculate the GHG inventory of 2 of its installations at Devapur and Jalgaon. The initial study will help to fulfil the following objectives:

1. Review its monitoring set-up and improve it to enable a corporate level replication for future.
2. Increase know-how of the employees for future repetitions of the exercise.
3. Capitalize on the benefits of GHG inventory estimation.

Various business goals that may be served by GHG footprint estimation include:

I. Managing GHG risks and identifying reduction opportunities – By becoming cognizant to the current emission status of the organization a company can:

   a. **Evaluate its position with respect to industry leaders**
   b. **Identify risks associated with GHG constraints in the future** - Identification and quantification of the carbon assets and liabilities of an organization which are the two essential components for understanding climate change risk-return perspective of the organization.
   c. **Identify cost effective reduction opportunities** - Identification of potential opportunities of GHG emission reduction (Energy optimization, Process modifications and improvements, adoption of clean technologies etc.). Orient Cement has already implemented CDM projects at Devapur and Jalgaon plant. The project activity titled **"Blended cement with increased blend" at Orient cement's Devapur and Jalgaon plants in India" (Project Ref #0456)** is a registered CDM project activity.
   d. **Set GHG targets, measuring and reporting progress**

II. Public reporting and participation in voluntary GHG programs – Voluntary GHG abatement initiatives are globally acknowledged. It requires:
   a. Voluntary stakeholder reporting of GHG emissions and progress towards GHG targets.
   b. Reporting to Government and NGO reporting programs, including GHG registries.
   c. Eco-labelling, benchmarking and GHG Certification

III. Participating in GHG markets – GHG emission profile also helps in participating in carbon trade. This includes:
   a. Supporting internal GHG trading programs
   b. Participating in external cap and trade allowance trading programs

IV. Recognition for early action and associated intangible benefits, which include:

a. Recognition for early accounting and taking ownership of its emission inventory leading to enhancement of brand image and pan industry recognition.

b. Preparedness for a future spectre of litigations like Kyoto Protocol and Paris Climate Treaty 2015 or Carbon Tax on GHG emissions, both in India, as well as globally.

c. Greater preparedness to effectively align present and future business policies in line with the GHG risk exposure.

d. Optimum utilisation of the carbon market to avail financial incentives and credits for GHG abatement measures, as applicable presently.

e. Participation in National INDC schemes and align with government climate policy

I believe we should reframe our response to climate change as an imperative for growth rather than merely being a way of being green or meeting environmental commitments.

- ***William Hague***

3. Approach and Methodology

3.1 Approach

The GHG Inventorization assignment was carried out in the below mentioned way:

→ Training Programs on GHG Inventorization were conducted at each of the two manufacturing units to facilitate the understanding of the GHG Inventorization exercise for OCL project personnel on-site
→ An understanding of the cement manufacturing process was developed from the OCL personnel
→ Determination of operational boundary and emission sources in discussion with OCL personnel
→ This was followed by data collection for the exercise for each of the twounits and subsequent analysis
→ Determination of GHG Inventory and Submission of Results to OCL

3.2 Methodology

The methodology for GHG Footprint Estimation has been designed in line with ISO 14064-1:2006 Guidelines. The key steps followed in the determination of the GHG Footprint are as follows:

→ Confirmationof Organizational Boundary
→ Determination of Operational Boundary
→ Quantification of GHG emission and removal
→ Quantification of directed actions in the organization
→ Reporting of GHG emissions and removals

3.2.1 Determination of Organizational Boundary

As per ISO 14064-1:2006, paragraph 4.1, page 6,

The organization may comprise one or more facilities. Facility-level GHG emissions or removals may be produced from one or more GHG sources or sinks. The organization shall consolidate its facility-level GHG emissions and removals by one of the following approaches:

a) Control: the organization accounts for all quantified GHG emissions and/or removals from facilities over which it has financial or operational control; or

b) Equity share: the organization accounts for its portion of GHG emissions and/or removals from respective facilities.

It is imperative from the above guidance that if the reporting company wholly owns all operations, its organizational boundary will be the same, whichever approach is used. The two units of OCL covered under this study are operationally directly controlled by OCL and hence the **Operational Control** approach for setting the organizational boundaries has been selected.

Thus, in the context of the present assignment, organizational boundaries were defined as the operations within the administrative control of OCL in the two cement manufacturing units covered under the study.

3.2.2 Determination of Operational Boundary

Clause 4.2 of ISO 14064-1:2006 requires that the reporting organization shall "establish and document its operational boundaries. The establishment of operational boundaries includes identifying GHG emissions and removals associated with the organization's operations, categorizing GHG emissions and removals into direct emissions, energy indirect emissions and other indirect emissions. It includes choosing which of the other indirect emissions will be quantified and reported."

In line with the above guidance, the operational boundary for OCL has been determined. The boundary encompasses the process operation of OCL at the following locations:

- Integrated Cement Unit at Devapur in Adilabad District, Telengana
- Clinker Grinding Plant in Jalgaon, Maharashtra

This includes the cement manufacturing operations in the above mentioned sites. The following operations/activities are included in the operational boundary of OCL:

- Calcination of raw materials consumed for clinker production (for Devapur site only)
- Kiln Fuel Consumption (for Devapur site only)
- Non-Kiln Fuel Consumption
- Alternative Fuel Consumption (for Devapur site only)
- Fossil fuel consumption in onsite vehicles and equipments
- Purchased Electricity

The standard ISO 14064-1:2006

- mandates quantification of Direct GHG emissions in the boundary
- recommends quantification of Direct GHG removals in the operational boundary
- mandates quantification of energy indirect GHG emissions from the generation of imported electricity, heat or steam consumed
- provides for the choice to (or not to) quantify other indirect GHG emissions.

Accordingly, OCL has chosen to quantify and report **direct GHG emissions (scope 1) and energy indirect GHG emissions (scope 2)** from all sources within the chosen operational boundary.

Direct emissions accounts for all operations related emissions due to Raw Material consumption for clinker production, Kiln and Non Kiln Fuel Consumption, Alternative Fuel Consumption, Fossil Fuel consumption in onsite vehicles and equipments, the Kiln related emissions are only for the Devapur site.

Energy Indirect emissions accounts for emissions due to electricity purchased from the grid.

OCL has decided not to report Scope 3 (**Other Indirect)** emissions due to non-availability of data

3.2.3 Quantification of GHG emissions and removals

Quantification of GHG emissions have been carried out as per the steps outlined in ISO14064-1:2006 and WBCSD Cement Sustainability Initiative (Cement CO_2 and Energy Protocol, Version 3.1, CO_2 Emissions Energy Inventory). GHG removals in the operational boundary have not been quantified due to absence of verifiable data.The steps of calculation are as presented in the list below:

3.2.3.1 Identification of GHG Sources and sinks

In line with paragraph 4.3.2 of ISO 14064-1:2006, sources of emissions ought to be identified by the reporting organization. An activity wise or process wise approach was considered for evaluating the GHG emissions. The following sources were identified and accordingly data collection templates were prepared and circulated.

Table 3.1: Direct and Indirect Emission Sources for OCL

Source		GHG	Unit
Scope 1 (Direct Emissions)			
Kiln operations	Raw Material Consumption for clinker production	CO_2	tCO_{2e}
	Organic Carbon Content of Raw Material	CO_2	tCO_{2e}
	Consumption of Fossil based kiln fuels	CO_2	tCO_{2e}
Non-kiln Operations	Consumption of non-kiln fossil fuels	CO_2	tCO_{2e}
Mobile Emissions	Fossil Fuel Consumption usage in onsite vehicles and equipments	CO_2	tCO_{2e}
Scope 2 (Energy Indirect Emissions)			
Consumption of purchased electricity from grid	Emissions associated with power generation in the power plants connected to the regional grid	CO_2	tCO_{2e}

Memo Item:

Table 3.2: Memo Item representing Biomass consumption

Source		GHG	Unit
Direct CO_2 from Biomass			
Biomass Consumption	Combustion of Biomass (kiln fuel)	CO_2	tCO_{2e}

The only GHG sink relevant is due to afforestation within the physical boundaries. However, quantification of these being extremely difficult due to requirement of tree species specific data which is unavailable, GHG sinks have not been reported in this study. Further, OCL would like to focus on reducing emission at source for mitigating their GHG inventory.

3.2.3.2 Selection of quantification methodology

Paragraph 4.3.3 of ISO 14064-1:2006requires the reporting organization to select and use quantification methodologies that reasonably minimize uncertainty and yield accurate, consistent and reproducible results; the organization also ought to explain the selection.

The calculations have been compiled based on WBCSD Cement Sustainability Initiative **(Cement CO_2 and Energy Protocol, Version 3.1, CO_2 Emissions and Energy Inventory). The GHG Inventorization has been done using the GNR (Getting the numbers Right) Spread sheet version – 9/12/2013. The calculation is done using B1 methodology as defined under *Cement CO_2 and Energy Protocol version 3.1 of CSI*.** The quantification methodology employed by OCL uses combination of calculation based (GHG activity data multiplied by GHG emission or removal factors, the use of models, facility-specific correlations, and mass balance approach) and measurement based (either continuous, or intermittent) approach. This is because direct measurement of GHG emissions by monitoring concentration and flow rate is not common. Emission factors have been sourced from publicly available documents. The emission factor for purchased electricity has been sourced from 10 whereas emission factors for stationary combustion sources have been sourced from 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Global Warming Potential values have been sourced from the IPCC Fourth Assessment Report. This corresponds to use of Tier-02 approach for determination of GHG emissions.

3.2.3.3 Selection and Collection of GHG activity data

As per the ISO 14064-1:2006 requirement, GHG activity data used to quantify GHG emissions and removals ought to be consistent with the requirements of the selected quantification methodology. Accordingly, data collection templates in line with the process activities of OCL were prepared and the same were circulated among responsible departments and personnel at both the units of OCL for collection of data. Post receipt of the activity data from the corresponding departments, calculation and analysis of GHG emissions were initiated using the

GNR (Getting Numbers Right) database for interested stakeholders. The calculations are using B1 option of the methodology.

The different emission sources, activity data required and algorithm for determination of emissions is presented below:

I. Direct Emissions:

The following sources were considered while computing the direct emissions:

- *Emissions from calcination of raw materials consumed for clinker production*
- *Emissions from organic carbon content of raw meal*
- *Emissions from consumption of fossil based kiln fuel*
- *Emissions from consumption of fossil based non-kiln fuel*
- *Emissions from consumption of fossil fuel in onsite power generation*

The computation for direct GHG Emissions have been done based on WBCSD Cement Sustainability Initiative (Cement CO_2 and Energy Protocol, Version 3.1, CO_2 Emissions and Energy Inventory) GNR database.

II. Indirect Emissions

The following sources were considered while computing the indirect emissions:

- *Emissions from external power generation*

The computation for indirect GHG Emissions have been done based on GHG Protocol (Scope 2 Guidance on how corporations measure emissions from purchased or acquired electricity, steam, heat, and cooling)

3.2.3.4 Selection or development of GHG emission factors

OCL has selected GHG emission factors as per recognized sources such as 2006 IPCC Guidelines for National Greenhouse Gas Inventories, IPCC Fourth Assessment Report, CSI default and CEA. The following emission factors have been used in the calculations:

Table 3.3: List of emission factors and other constants

Type	Category		IPCC default kg CO_2/GJ	CSI default kg CO_2/GJ	CSI default % biomass
	Fossil fuels				
1		coal + anthracite + waste coal	96		
2		petrol coke		92.8	
3		(ultra) heavy fuel	77.4		
4		diesel oil	74.1		
5		natural gas (dry)	56.1		
6		oil shale	107		
6a		lignite	101		

7		gasoline	69.3		
	Alternative fossil fuels				
8		waste oil		74	
9		tyres		85	27.0%
10		plastics		75	
11		solvents		74	
12		impregnated saw dust		75	
12a		mixed industrial waste		83	
13		other fossil based wastes		80	
	Biomass fuels				
14		dried sewage sludge		110	
'15		wood, non-impregnated saw dust		110	
16		paper, carton		110	
17		animal meal		89	
18		animal bone meal		89	
19		animal fat		89	
20		agricultural, organic, diaper waste, charcoal		110	
21		other biomass		110	

The values have been sourced from IPCC Guidelines for National Greenhouse Gas Inventories, Prepared by the National Greenhouse Gas Inventories Programme, and WBCSD Cement Sustainability Initiative Cement CO_2 and Energy Protocol, Version 3.1, CO_2 Emissions and Energy Inventory

Table 3.4: Grid Emission Factor

Parameter	Unit	Value
Grid Emission Factor (NEWNE Grid)	tCO_2/MWh	0.82
Grid Emission Factor (Southern Grid)	tCO_2/MWh	0.82

This may be noted that the CEA Data base version 10 has been used to compute the GHG emissions from external power generation

3.2.3.5 Calculation of GHG emissions and removals

Using the activity data collected as explained above and the emission factors selected (see previous section), emissions due to different processes / activities are calculated.The next chapter provides the result of the calculations for FY 2015-16for OCL

There's a lot of evidence that shows that if we push as hard as we need to for net-zero emissions, we'll find ourselves with cities that are more secure, healthier, and have more economic opportunity - are frankly better cities to live in - than if we settle for the status quo.

- ***Alex Steffen***

4. GHG Emissions & Performance Indicators

This section provides the specific activity wise details on data and information that has been collated, verified and used as per the computation methodology described in the previous sections of this report, to estimate the greenhouse gas emissions due to the operations of OCL.

This chapter includes the following:

I. Total GHG emission (Direct &Energy Indirect) for Devapur
II. Total GHG Emissions (Direct &Energy Indirect) for Jalgaon
III. CO_2 Specific Performance Indicators
IV. Other Performance Indicators

4.1 Total GHG Emissions (Direct & Indirect for Devapur)

Table 4.1: Sourcewise Direct GHG Emissions for OCL (Devapur Unit) (all units in tCO_2e)

Location	*Latitude*	*Longitude*	*Source*	*Total Emissions*
Devapur	*19°1'12"N*	*79°12'0"E*	*Calcination of Raw Materials consumed for Clinker Production*	***14,85,934***
			Organic Carbon Content of Raw Meal	***30,696***
			Consumption of Fossil based Kiln Fuels	***9,22,747***
			Consumption of Non Kiln Fossil Fuels	***4,97,276***
Total Direct Emissions (Scope 1)				***29,36,653***

**Total figures rounded-up to the nearest integer*

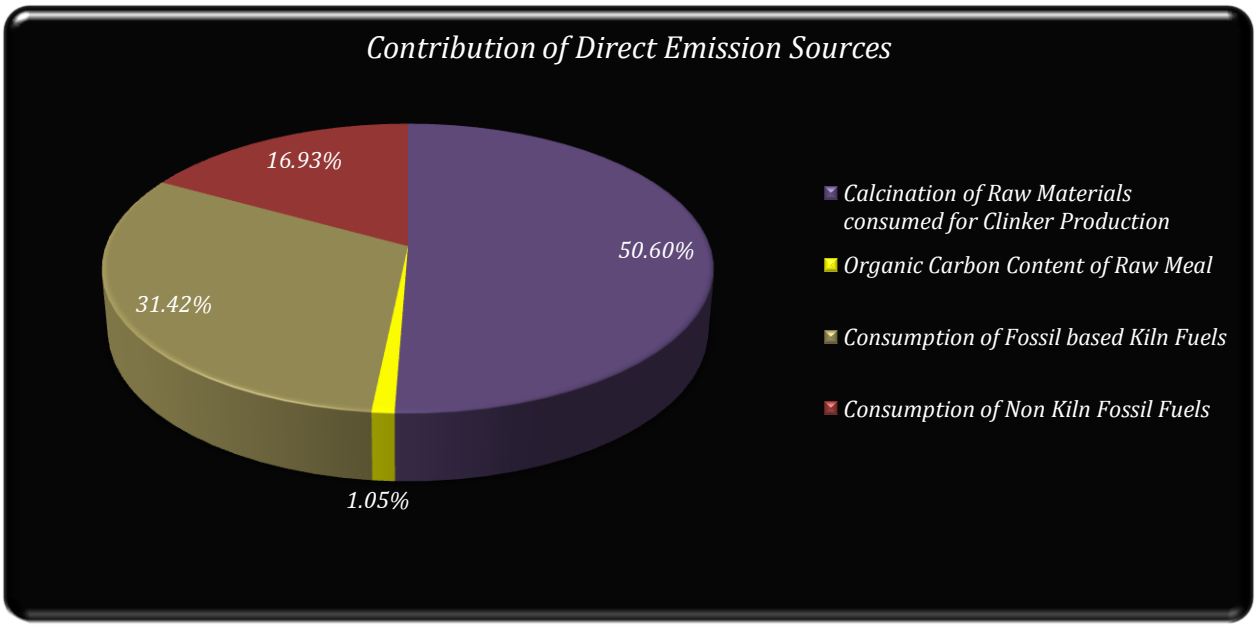


Table 4.2: Sourcewise Energy Indirect GHG Emissions for OCL (Devapur Unit) (all units in tCO_2e)

Location	Latitude	Longitude	Source	Total Emissions
Devapur	19°1'12"N	79°12'0"E	External Power Generation	**8,491**
Energy Indirect Emissions (Scope 2)				**8,491**

**Total figures rounded-up to the nearest integer*

4.2 Total GHG Emissions (Direct & Indirect for Jalgaon)

Table 4.3: Sourcewise Direct GHG Emissions for OCL (Jalgaon Unit) (all units in tCO_2e)

Location	Latitude	Longitude	Source	Total Emissions
Jalgaon	20°35'24"N	75°19'48"E	Non-Kiln Fossil Fuel Consumption	**2,839**
Total Direct Emissions (Scope 1)				

**Total figures rounded-up to the nearest integer*

Table 4.4: Sourcewise Energy Indirect GHG Emissions for OCL (Jalgaon Unit) (all units in tCO_2e)

Location	Latitude	Longitude	Source	Total Emissions
Jalgaon	20°35'24"N	75°19'48"E	External Power Generation	**33,968**
Energy Direct Emissions (Scope 2)				

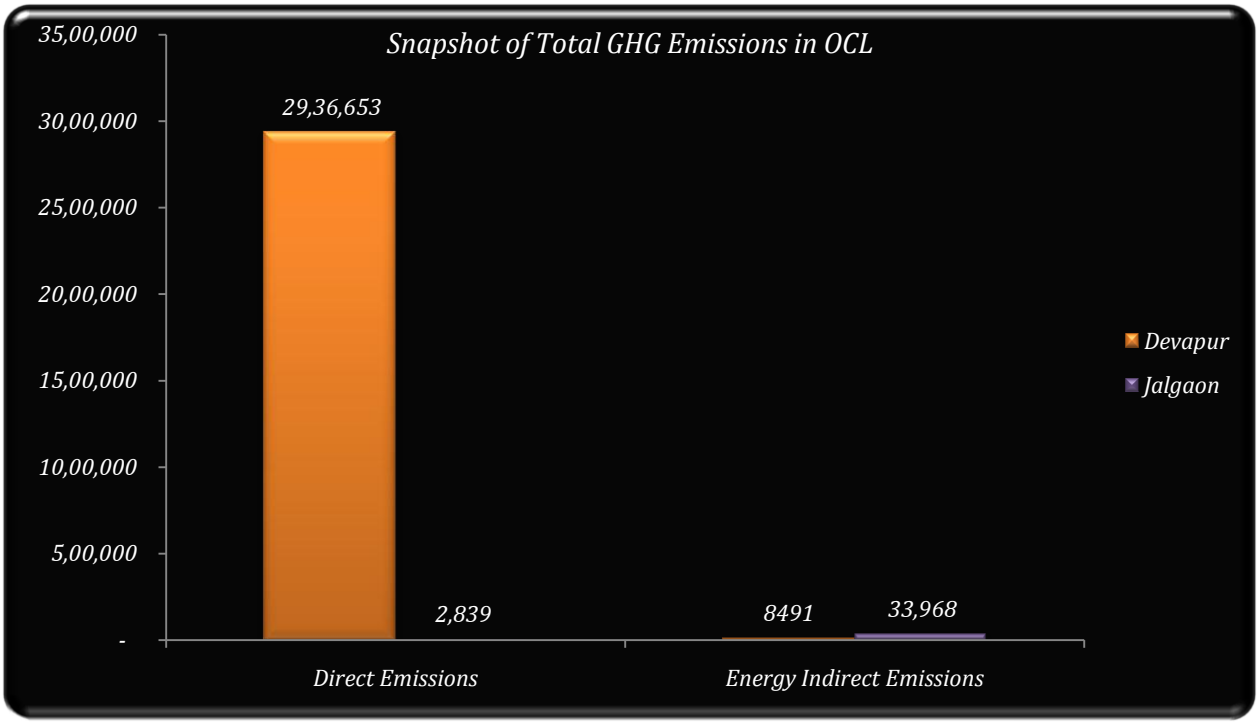
**Total figures rounded-up to the nearest integer*

4.3Snapshot of 2015-16 GHG Emissions of Orient Cement Limited

Table 4.5: Snapshot of Total GHG Emissions of OCL (all units in tCO_2e)

Location/Site	State	Direct Emissions	Energy Indirect Emissions
Devapur	Telengana	29,36,653	8,491
Jalgaon	Maharashtra	2,839	33,968
Total	For OCL	29,39,492	42459

**Total figures rounded-up to the nearest integer*



4.4 CO_2 specific Performance Indicators

Following performance indicators have been shown for Devapur Unit:

- Specific Gross CO_2 per tonne of cementitious product
- Specific Gross CO_2 per tonne of calcination component
- Specific Gross CO_2 per tonne of fuel component
- Specific Net CO_2 per tonne of cementitious product

Table 4.6: CO_2 specific performance indicators (all units in tCO_2e)

Location	*Specific Gross CO_2 per tonne of cementitious product*	*Specific Gross CO_2 per tonne of calcination component*	*Specific Gross CO_2 per tonne of fuel component*	*Specific net CO_2 per tonne of cementitious product*
Devapur	*$kgCO_2/t$ cem. prod*	*$kgCO_2/t$ cem. prod*	*$kgCO_2/t$ cem. prod*	*$kgCO_2/t$ cem. prod*
	696	***433***	***263***	***693***

Note: It may be noted that since Jalgaon does not have a clinker production unit, hence the CO_2P.I's for Devapur cannot be compared with Jalgaon unit. Since this is the first year of GHG Inventorization, hence yearly comparison could not be carried out. The comparison would be carried from next year, which would enable OCL to take up annual GHG reduction targets.

4.5Other performance parameters

Apart from the CO_2 specific parameters, other general performance indicators have been identified for Devapur Unit:

- Specific heat consumption of clinker production
- Biomass fuel rate
- Specific total power consumption
- Specific power consumption of clinker production
- Specific power consumption of cement production

Performance indicators and relevant values for Devapur Unit have been provided below:

Table 4.7: Other Performance Indicators -Devapur (all units in tCO_2e)

Performance Indicator	***Unit***	***Value***
Specific heat consumption of clinker production	*MJ/t clinker*	*3,487*
Biomass fuel rate (kiln fuels)	*%*	*1.9*
Specific total power consumption	*kWh/t cem. Prod.*	*97.9*
Specific power consumption of clinker production	*kWh/t clinker*	*57.9*
Specific power consumption of cement production	*kWh/t cem. Prod.*	*77.1*

Performance indicators for Jalgaon Unit have been provided below:

- Specific Total Power Consumption

Performance indicators and relevant values for Jalgaon Unit have been provided below

Table 4.8: Other Performance Indicators –Jalgaon (all units in tCO_2e)

Performance Indicator	***Unit***	***Value***
Specific total power consumption	*kWh/t cem. Prod.*	*29.2*
Specific power consumption of cement production	*kWh/t cem. Prod.*	*29.2*

Since this is the first year of reporting, yearly comparison was not possible. However the comparison of performance parameters would be taken up on a yearly basis from next year onwards. This would help OCL in taking targets in reducing GHG Emissions (Both absolute and specific) and increasing resource efficiency.

Table 4.9: Key performance Indicator –Combined (Devapur and Jalgaon) (all units in tCO_2e)

Performance Indicator	***Unit***	***Value***
Net CO_2 per tonne of cementitious product	*Kg CO_2 /t cem. Prod.*	*613*

This may be noted that the above figure has been calculated by dividing the total CO_2 Emissions for both locations (in $kgCO_2$) by the total cementitious product at both locations in (tCem. Produced)

4.6 Recalculation of GHG inventory

OCL would re-calculate the GHG inventory under the following conditions:

- Acquisition into the existing organisational boundary,
- Divestment from the existing setup or organisation,
- Change in methodology for calculation, or
- Change in default factors

In case of acquisitions/mergers or divestment from the organisation boundary, the base year inventory would be needed to be recalculated or adjusted by either inclusion or exclusions of emissions of the acquired/diverted asset in both the base year as well as the present year. An "**All year"** option would be taken for recalculation as per the procedure for "Base year recalculation methodologies for structural changes", version January 2005.

In case of change in calculation methodology or change in emission factors, the new version of methodology or emission factor would be used to determine the base year inventory as well as the recent year's inventory.

4.7 Uncertainty Assessment and Materiality

The methodology presented here addresses the estimation of CO_2 as the only GHG from OCL operations. CH_4, N_2O, SF_6, PFCs, $NF_3$and HFC's have not been estimated as part of this study since the emissions of these gases do not have any material impact on the overall emissions from the operations of the above mentioned two units of OCL and are hence not considered relevant for the present study. Uncertainty is used to characterize the dispersion of values that could be reasonably attributed to a measured quantity (IPCC, 2006).The overall uncertainty associated with a GHG inventory is driven primarily by the uncertainty associated with the largest ("key") sources of emissions. Although very high levels of uncertainty may be associated with some sources, their overall impact on the uncertainty of entity-wide emissions, or that of a specific installation, may often be very small. In turn, the uncertainty associated with each individual source depends on the quality and availability of sufficient data to estimate emissions and/or on the ability to measure emissions and properly account for measurement variability.

For the present study, the most relevant data parameters used for the GHG estimation are based on measured values. Hence, the uncertainty in the GHG emission calculation relates to uncertainty of the measurement of the parameters. Since in both cases the parameter value is also used for financial transactions between OCL and various other entities, the uncertainty of measurement of fossil fuel combustion and electricity purchased from grid are usually below 5% in all cases. When site-specific data are unavailable, good practice will usually be to develop emission estimates using emission factors drawn from references consistent with the IPCC Guidelines and the source category-specific good practice guidance. These factors will have been measured under particular circumstances that are judged to be typical. There will be uncertainties associated with the original measurements, as well as with the use of the factors in circumstances other than those associated with the original measurements. It is a key function of good practice guidance for each source category to guide the choice of emission factors to minimise this second source of uncertainty to the extent possible. The source categoryspecific guidance also indicates, wherever possible, the uncertainty ranges likely to be associated with using these factors. Considering the above, the overall uncertainty in the GHG estimation of the present study is not likely to be more than ±5% and may hence be considered free from material misstatements.

Cities generate most of the global economy, and most of its energy use, resource demands and climate emissions. How we build cities over the next decades will largely determine whether we can deliver a bright green future.

- Malcolm Turnbull

5. Energy Efficiency Measures

Why Focus on Energy Efficiency?

Cement is a highly energy intensive industry. The energy cost accounts to almost 50% of the total operational cost, hence reduction in the energy cost is OCL's prime target. BEE in this PAT cycle has given targets to 11 energy intensive sectors to reduce their specific energy consumption. OCL's Devapur unit has been a designated consumer under PAT is in the process of reducing its specific energy consumption. Thus OCL gives priority to fulfilling regulatory obligations arising out of the climate change policies of the government. The company also prioritizes and identifies improvement opportunities based on return on investment and effect on the organization on a mid to long term basis which reduces the input costs and increases operational efficiency.

5.1 Energy Efficiency Measures Taken by OCL during 2015-16

As a part of the improvement opportunities, OCL has identified and implemented the following improvement measures:

Table 5.1: Energy Efficiency Measures taken by Orient Cement Limited for both Units

Activity	Estimated CO_2 Savings	Annual Energy Savings	Payback Period
	tCO_2	kWh	Years
Installation of new coal feeding system in Line-3 (Coriolysis by SCHENCK)	365.26	445440	13.5
Reduction of Compressor air consumption by optimizing frequency of air blaster	80.79	98534	Immediate

operation at cooler			
Energy conservation by stopping Raw meal Silo extraction Blower (From 3 Blowers to 2 Blowers) in Line-3	50.38	61440	Immediate
Energy conservation by stopping Raw meal Silo extraction Blower (From 2 Blowers to 1 Blowers) in Line-2	39.67	48384	Immediate
By Optimising the Venting lines of Product air slide of RM-3 we have stopped one Dust Collector	53.52	65280	Immediate
Installed VFD in Cement Silo-5 top Dust Collector	79.70	97200	1.2
Replacement of Raw mill-1 vent HT motor with LT motor and Installed VFD	308.58	376320	0.6
Isolation of RABH Enmass Conveyor Bag Filter	53.52	65280	Immediate
Replacement of metal Halides by Luminaries-Set -1	2.09	2555	2.2 years
Replacement of metal Halides by Luminaries-Set -2	5.38	6570	2.6 years
Total	**1039**	**12,67,003**	

This is may be noted that the above mentioned energy efficiency measures have been already implemented and has resulted in an emission reduction of around 1039 tCO_2 and has also resulted in energy savings of around 1267 MWh.

With emission reduction and energy efficiency improvement measures in place, it is anticipated that Orient Cement Limited would take realistic and achievable GHG reduction targets which not only reduces the GHG emissions from present level but also increases the resource efficiency.

ANNEXES

Annex 1: Glossary of Terms

Greenhouse gas (GHG)
Gaseous constituent of the atmosphere, both natural and anthropogenic, that absorbs and emits radiation at specific wavelengths within the spectrum of infrared radiation emitted by the Earth's surface, the atmosphere, and clouds

Greenhouse gas source
Physical unit or process that releases a GHG into the atmosphere

Greenhouse gas sink
Physical unit or process that removes a GHG from the atmosphere

Greenhouse gas reservoir
Physical unit or component of the biosphere, geosphere or hydrosphere with the capability to store or accumulate a GHG removed from the atmosphere by a greenhouse gas sink or a GHG captured from a greenhouse gas source

Greenhouse gas emission
Total mass of a GHG released to the atmosphere over a specified period of time

Greenhouse gas removal
Total mass of a GHG removed from the atmosphere over a specified period of time

Greenhouse gas emission or removal factor
Factor relating activity data to GHG emissions or removals

Direct greenhouse gas emission
GHG emission from greenhouse gas sources owned or controlled by the organization

Energy indirect greenhouse gas emission
GHG emission from the generation of imported electricity, heat or steam consumed by the organization

Other indirect greenhouse gas emission
GHG emission, other than energy indirect GHG emissions, which is a consequence of an organization's activities, but arises from greenhouse gas sources that are owned or controlled by other organizations

Greenhouse gas activity data
Quantitative measure of activity that results in a GHG emission or removal

Greenhouse gas assertion
Declaration or factual and objective statement made by the responsible party

Greenhouse gas information system
Policies, processes and procedures to establish, manage and maintain GHG information

Greenhouse gas inventory
An organization's greenhouse gas sources, greenhouse gas sinks, GHG emissions and removals

Greenhouse gas project
Activity or activities that alter the conditions identified in the baseline scenario which cause GHG emission reductions or GHG removal enhancement

Greenhouse gas programme
Voluntary or mandatory international, national or sub-national system or scheme that registers, accounts or manages GHG emissions, removals, emission reductions or removal enhancement outside the organization or greenhouse gas project

Greenhouse gas report
Stand-alone document intended to communicate an organization's or project's GHG-related information to its intended users

Global warming potential (GWP)
Factor describing the radiative forcing impact of one mass-based unit of a given GHG relative to an equivalent unit of carbon dioxide over a given period of time

Carbon dioxide equivalent (CO_2e)
Unit for comparing the radiative forcing of a GHG to carbon dioxide

Base year
Historical period specified for the purpose of comparing GHG emissions or removals or other GHG-related information over time

Facility
Single installation, set of installations or production processes (stationary or mobile), which can be defined within a single geographical boundary, organizational unit or production process

Organization
Company, corporation, firm, enterprise, authority or institution, or part or combination thereof, whetherincorporated or not, public or private, that has its own functions and administration

Responsible party
Person or persons responsible for the provision of the greenhouse gas assertionand the supporting GHG information

Intended user

Individual or organization identified by those reporting GHG-related information as being the one who relies on that information to make decisions

Client
Organization or person requesting validation or verification

Directed action
Specific activity or initiative, not organized as a greenhouse gas project, implemented by anorganization to reduce or prevent direct or indirect GHG emissions or increase GHG removals

Level of assurance
Degree of assurance the intended userrequires in a validation or verification

Materiality
Concept that individual or an aggregate of errors, omissions and misrepresentations could affect thegreenhouse gas assertion and could influence the intended users'decisions

Material discrepancy
Individual or an aggregate of actual errors, omissions and misrepresentations in the greenhouse gas assertion that could affect the decisions of the intended users

Monitoring
Continuous or periodic assessment of GHG emissions and removals or other GHG-related data

Validation
Systematic, independent and documented process for the evaluation of a greenhouse gas assertion in a GHG project plan against agreed validation criteria

Validation criteria / verification criteria
Policy, procedure or requirement used as a reference against which evidence is compared

Validation statement / verification statement
Formal written declaration to the intended user that provides assurance on the statements in the greenhouse gas assertion of the responsible party

Validator
Competent and independent person or persons with responsibility for performing and reporting on the results ofa validation

Verification
Systematic, independent and documented process for the evaluation of a greenhouse gas assertion against agreed verification criteria

Verifier

Competent and independent person, or persons, with responsibility for performing and reporting on the verification process

Uncertainty
Parameter associated with the result of quantification which characterizes the dispersion of the values that could be reasonably attributed to the quantified amount

Annex 2: References

1. *"Greenhouse Gases – Part 1: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals" – International Standard ISO 14064 part-I, 2006*
2. *"Corporate Value Chain (Scope 3) Accounting and Reporting Standard - Supplement to the GHG Protocol Corporate Accounting and Reporting Standard"- Greenhouse Gas Protocol*
3. *"The Greenhouse Gas Protocol Corporate Accounting and Reporting Standard, Revised Edition" by the World Business Council for Sustainable Development (WBCSD) and World Resources Institute (WRI)*
4. *http://www.orientcement.com/plants/*
5. *Baseline Carbon Di Oxide Emission Database Version 10; http://www.cea.nic.in/reports/planning/cdm_co2/cdm_co2.htm*
6. *2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 3: Industrial Processes and Product Use, Chapter 2*
7. *IPCC Fourth Assessment Report*
8. *India's Second National Communication to the UNFCCC, MoEF, Govt. Of India, 2010*
9. *Cement Sustainability Initiative http://www.wbcsdcement.org/*
10. *CO_2 and Energy Accounting and Reporting Standard for the Cement Industryhttp://www.wbcsdcement.org/index.php/en/key-issues/climate-protection/co-accounting-and-reporting-standard-for-the-cement-industry*
11. *Global Cement Database on CO_2 and Energy Informationhttp://www.wbcsdcement.org/index.php/en/key-issues/climate-protection/gnr-database*
12. *CSI Key Performance Indicatorshttp://www.wbcsdcement.org/index.php/en/key-issues/climate-protection/key-performance-indicators*

Annex 3: List of Acronyms

CDM	Clean Development Mechanism
CO_2	Carbon Dioxide
CDP	Carbon Disclosure Project
CEA	Central Electricity Authority
CSR	Corporate Social Responsibility
CSI	Cement Sustainability Initiative
EF	Emission Factor
FCIPL	First Climate (India) Private Limited
FY	Financial Year
Gg	Giga gram
GHG	Greenhouse Gas
GWP	Global Warming Potential
GNR	Getting Numbers Right
HEMM	Heavy Earth Moving Machinery
HFC	Hydro Fluoro Carbon
IPCC	Intergovernmental Panel on Climate Change
Kg	Kilo Gram
KPI	Key Performance Indicator
MWh	Mega Watt-hour
NEWNE	North East West and North-east

OCL	Orient Cement Limited
PFC	Per Fluoro Carbon
R&D	Research and Development
TJ	Terra Joule
tCO_2	Tonnes of CO_2
tCO_2e	Tonnes of CO_2 equivalent
UNFCCC	United Nations Framework Convention on Climate Change
VFD	Variable Frequency Drive

About FCIPL

First Climate is one of the leading carbon asset management companies in the world with 15 offices in four continents. It has a track record in the voluntary and compliance markets and is investment advisor to several carbon funds.

First Climate (India) Private Limited (FCIPL) is pleased to state that it has been a part of Greenhouse Gas (GHG) Accounting study for Orient Cement Limited. FCIPL has been responsible for providing the technical assistance relevant to collection of the requisite data as per the ISO 14064–I:2006 and relevant sector specific guidelines as mentioned above. The GHG estimation has been done as per the GNR sheet conforming to CSI protocol.

While FCIPL is responsible for application of appropriate methodology to calculate emissions, the activity data has been provided by OCL.

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