Monitoring Report

CARBON OFFSET UNIT (CoU) PROJECT

Title: Emission Reduction in Aluminium Recycling process by CMR Group.

Version 2.0
Date 27/09/2023

First COU Issuance Period: 10 years, 00 months
Date: 01/01/2013 to 31/12/2022

Monitoring Report (MR)
CARBON OFFSET UNIT (CoU) PROJECT

Monitoring Report	
Title of the project activity	Emission reduction on account of process modification at Aluminium metal recycling unit.
UCR project registration code	315
Version	2.0
Completion date of the MR	27/09/2023
Monitoring period number and duration of this monitoring period	Monitoring Period Number: 01 Duration of this monitoring Period: (01/01/2013 to 31/12/2022) (first and last days included[1]
Project participants	CMR Green Technologies Limited
Host Party	India
Applied methodologies and standardized baselines	AMS III BD – Version 01 GHG emission reduction due to supply of molten metal instead of ingots for Aluminium Castings. Standardized Methodology: Not Applicable.
Sectoral scopes	04: Manufacturing industries.
Estimated amount of GHG emission reductions for this monitoring period in the registered PCN	2013 : 11,251 CoUs (11,251 tCO_{2eq})
	2014: 20,101 CoUs (20,101 tCO_{2eq})
	2015: 23,121 CoUs (23,121 tCO_{2eq})
	2016: 24,171 CoUs (24,171 tCO_{2eq})
	2017: 24,481 CoUs (24,481 tCO_{2eq})
	2018: 28,898 CoUs (28,898 tCO_{2eq})
	2019: 25,452 CoUs (25,452 tCO_{2eq})
	2020: 22,891 CoUs (22,891 tCO_{2eq})
	2021: 22,926 CoUs (22,926 tCO_{2eq})
	2022: 19,997 CoUs (19,997 tCO_{2eq})
Total:	**223,289 CoUs (223,289 tCO_{2eq})**

[1] Here first day refers to the respective date of commissioning of the plants or the date 01/01/2013 whichever is later, as can be referred in the Section A.1 of this report.

SECTION A. Description of project activity

A.1. Purpose and general description of project activity >>

a) Purpose of the project activity and the measures taken for GHG emission reductions >>

The project titled as "Emission Reduction in Aluminium Recycling process by CMR Group" is a grouped project activity with four aluminium recycling units of CMR Group located in Haridwar (Uttrakhand), Bawal, Gurugam & Manesar (Haryana) in India. The project units are operational with continuous reduction of GHG, currently being applied under "Universal Carbon Registry" (UCR) under the Project ID 315.

The details of the project activity under carbon cycle are as follows:

Purpose of the project activity:

The project activity is promoted by "CMR Green Technologies Limited" (hereinafter also referred to as (i) project proponent or PP and (ii) CMR Group), is a manufacturer of Aluminium and Zinc based alloys. CMR Group has pride of being the biggest producer for these alloys in India. These are the four aluminium metal recycling units located in two different states in India, wherein the metal will be supplied to the casting unit in the molten state (against the traditional solid ingots). The project units supply molten Aluminium to casting units, thus molten aluminium can reduce carbon emissions compared to solid ingots due to lower energy requirements. The production of molten aluminium requires less energy than producing solid ingots. This is because the melting point of aluminium is relatively low, so less energy is needed to melt the metal than to melt it and then solidify it. In order to supply the metal in the molten state the metal recycling facilities are being established by the side of the producer of the castings. CMR being a responsible company, continuously seeks opportunities for energy conservation and other environmentally and socially benign activities; and these units are the examples of such initiative towards sustainability.

The four units included under the UCR project activity are as follows:

Unit Reference	Location Reference	Commissioning Date	Remarks
Unit 1	Haridwar (Uttrakhand)	22 Aug 2008	Represented under "CMR Green Technologies Limited"
Unit 2	Gurugram (Haryana)	30 Dec 2009	Represented under "CMR Green Technologies Limited"
Unit 3	Manesar (Haryana)	01 Aug 2013	Represented under "CMR Green Technologies Limited"
Unit 4	Bawal (Haryana)	02 Dec 2013	Represented under "CMR Nikkei India Pvt. Ltd."

In line with the application of the carbon methodology AMS III.B.D, the emission reductions with these project units are on account of:
(a) energy savings due to avoidance of fossil fuel usage for re-melting the ingots at casting units;
(b) avoiding aluminium metal loss due to metal oxidation during re-melting of ingots at casting units.

Therefore, the purpose of the project activity can be summarized as to reduce GHG emissions by supplying metal for aluminium castings in the molten state. Prior the implementation of the project activity, the casting units procures aluminium ingots and re-melts it in in-house melting furnaces for subsequent use in die-casting of various automotive components/parts. The project activity involves supply of molten Aluminium and

utilization in die-casting operation directly. Therefore, the project activity reduces the dependence on fossil fuel and avoid associated aluminium metal loss due to oxidation during re-melting of ingots; thereby, effecting an overall reduction in GHG emissions.

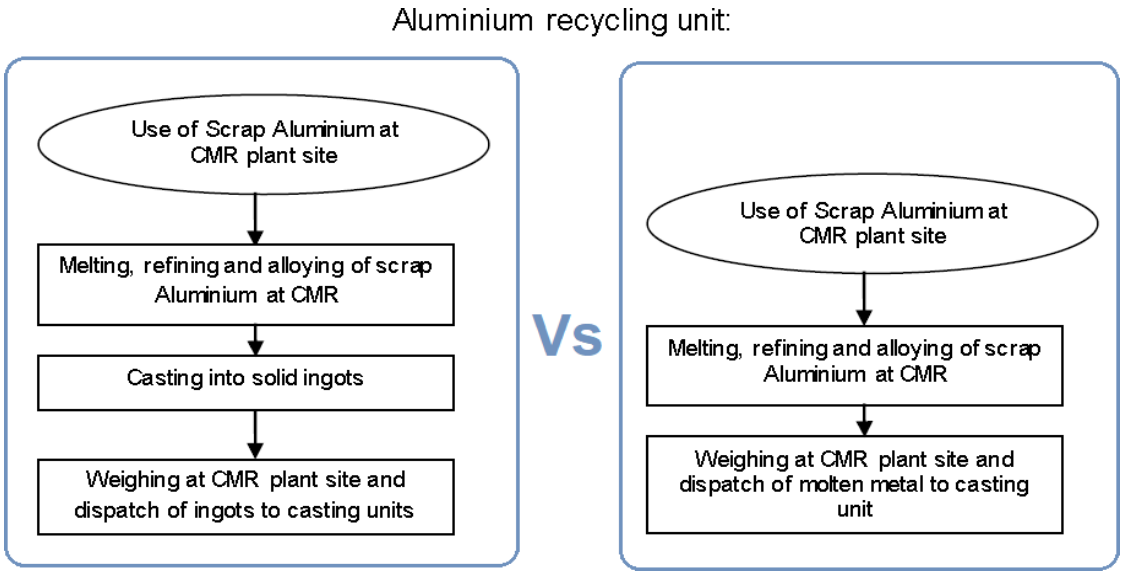
b) Brief description of the installed technology and equipment>>

The type of the project activity is Type III – "Other project activities".
The project activity involves supply of molten Aluminium and thereby eliminating the consumption of fossil fuel in the furnaces for melting of Aluminium ingots prior to casting. As already prescribed in the section above, the project activity will reduce GHG emission on account of the following:
1) Emissions associated with the use of fossil fuel and electricity used for melting of Aluminium ingots in the casting units;
2) Emissions associated with virgin Aluminium production apportioned to that quantity of Aluminium metal that is lost in the form of Aluminium oxide during the process of melting the ingots at the casting units.

The technology and processes involved in the pre-project and project scenario have been explained below:

Baseline Scenario: In the pre-project scenario, CMR group was following the common process in the units i.e., supply of aluminium ingots to the casting units. The solid ingots were re-melted at the casting units for utilization in casting operations. For casting operations casting units melt solid ingots in their in-plant FO fired furnaces and use the molten Aluminium for castings. The use of fossil fuel for melting of the ingots leads to emissions of GHG. The process of melting of the ingots also leads to loss of some quantity of metal due to oxidation of the molten metal.

Project Scenario: Under the project level, the main activity that forms the carbon project is primarily saving the fuel and metal in the production process through modification of the conventional existing process in the industry. The project activity involves supply of Aluminium alloy to casting units in molten state. Processes at Aluminium recycling facility in project scenario are same as that of process at Aluminium recycling facility in the pre-project scenario and baseline case. However, in project case molten aluminium produced from scrap Aluminium is supplied to the casting units for direct use in die-casting machines. Whereas in pre-project case molten Aluminium produced from melting of scrap Aluminium is casted into H-caster moulds to produce solid ingots. Solids ingots are then supplied to die-casting facilities for subsequent use.



The overall process flow value chain at CMR units are demonstrated below:

Thus, in all the units in the project activity supply molten Aluminium to casting units instead of supplying solid ingots by the Aluminium recycling unit. The technology used to produce Aluminium ingots or molten Aluminium remains the same in both the cases but it differs in the physical state in which the metal is delivered.

The major equipment used in Aluminium metal recycling unit to produce Aluminium metal are:

- Baling machine
- Nibbler Machine
- Furnaces

The key technical specifications of all the four units are provided under the Appendix to this report.

Attributes related to Sustainable Development Goals (SDGs):

Such industrial project can have several positive impacts on various aspects of society, the environment, and the economy. This is being a energy efficiency based project and working in one of the key sectors in the country, i.e metallurgy; hence project contributes directly contributes to natural resources conservation as well as optimization of energy usages in the process. Here are some of the positive impacts associated with the Project which has linkages to SDGs:

Explanation:
Aluminum production is energy-intensive, and enhancing energy efficiency contributes to reducing both energy consumption and greenhouse gas emissions which is the primary achievement of the project activity. Thus, it relates to **SDG 13** that calls for urgent action to combat climate change and its impacts.

SDG 1: Target 1.1: Eradicate extreme poverty for all people everywhere.
Job Creation: The project involved a significant labour force across the entire processes. As compared to regular plant, this molten metal unit is more resource intensive and also received more training and skill development across the process. Here local employment is achieved, so by providing employment, these projects can help lift people out of extreme poverty.

Income Generation: Also the vendors involved in the overall supply chain gets direct and indirect incomes. This additional income can be a crucial factor in reducing poverty levels, especially for small-scale vendors.

Local Economic Development: The establishment of such units stimulated local economic development by attracting investments, creating supply chains, and fostering entrepreneurship, all of which can contribute to poverty reduction.

SDG 8: Target 8.5: E Achieve full and productive employment and decent work for all.
The project demands technical skills for which regular training and related procedures are adopted, hence it enhances the qualitative aspects of their employment leading to decent works.

SDG 7: Affordable and Clean Energy: Improving energy efficiency in aluminum production aligns with SDG 7's goal of ensuring access to affordable, reliable, sustainable, and modern energy for all. It also promotes the use of clean and renewable energy sources, reducing the carbon footprint of energy use in the aluminum industry.

SDG 9: Industry, Innovation, and Infrastructure: Enhancing energy efficiency in the aluminum industry falls under SDG 9, which aims to build resilient and sustainable infrastructure and promote inclusive and sustainable industrialization and innovation.

SDG 11: Sustainable Cities and Communities
Target 11.6: Reduced the adverse per capita environmental impact of project areas and cities.

SDG 12: Responsible Consumption and Production: Improving energy efficiency as well as utilization of scrap metal directly reduces resource consumption and contributes to sustainable consumption and production patterns, which is a key focus of SDG 12. This goal encourages industries to minimize waste, improve resource efficiency, and reduce environmental impacts.

SDG 17: Partnerships for the Goals: Achieving energy efficiency in aluminum production often requires collaboration among industry stakeholders, governments, and research institutions. SDG 17 emphasizes the importance of partnerships and cooperation to achieve sustainable development goals.

Efforts to improve energy efficiency in aluminum production can include adopting more energy-efficient technologies, optimizing production processes, and utilizing waste heat recovery systems. These measures not only reduce energy consumption but also lower production costs, increase competitiveness, and contribute to a more sustainable and environmentally friendly aluminum industry.

CMR Group is currently not claiming the positive impacts against these SDGs, however these indicators are prominent and associated with the project, hence report as generic description.

c) Relevant dates for the project activity (e.g., construction, commissioning, continued operation periods, etc.)>>

UCR Project ID or Date of Authorization	: 315
Start Date of Crediting Period	: 01/01/2013
Project Commissioned	: Between 22/08/2008 to 02/12/2013 (referred under Section A.1)
Monitoring Period	: 01/01/2013 to 31/12/2022

d) Total GHG emission reductions achieved or net anthropogenic GHG removals by sinks achieved in this monitoring period>>

The total GHG emission reductions achieved in this monitoring period is as follows:

Summary of the Project Activity and ERs Generated for the Monitoring Period	
Start date of this Monitoring Period	01/01/2013
Carbon credits claimed up to	31/12/2022
Total ERs generated (tCO_{2eq})	223,289 (tCO_2eq)
Leakage	0

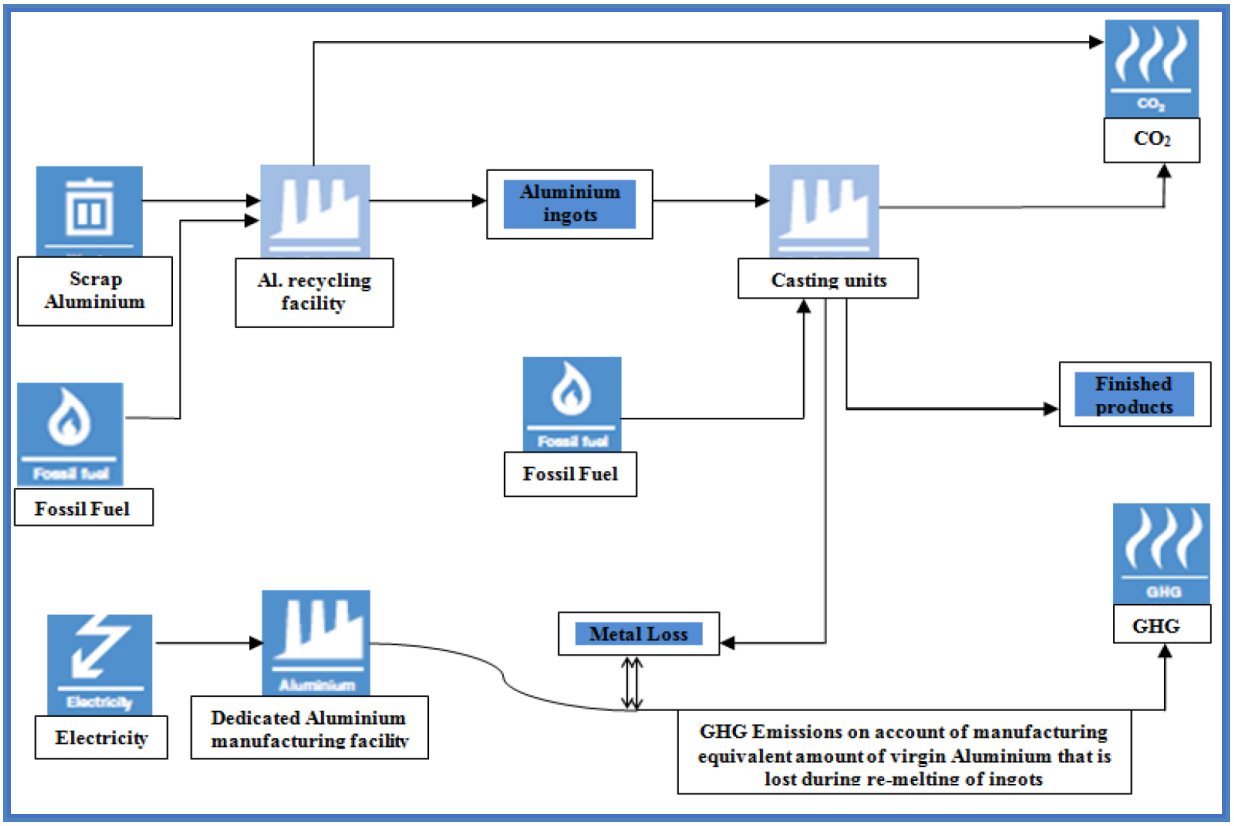
e) Baseline Scenario>>

The baseline scenario identified at the PCN stage of the project activity is:

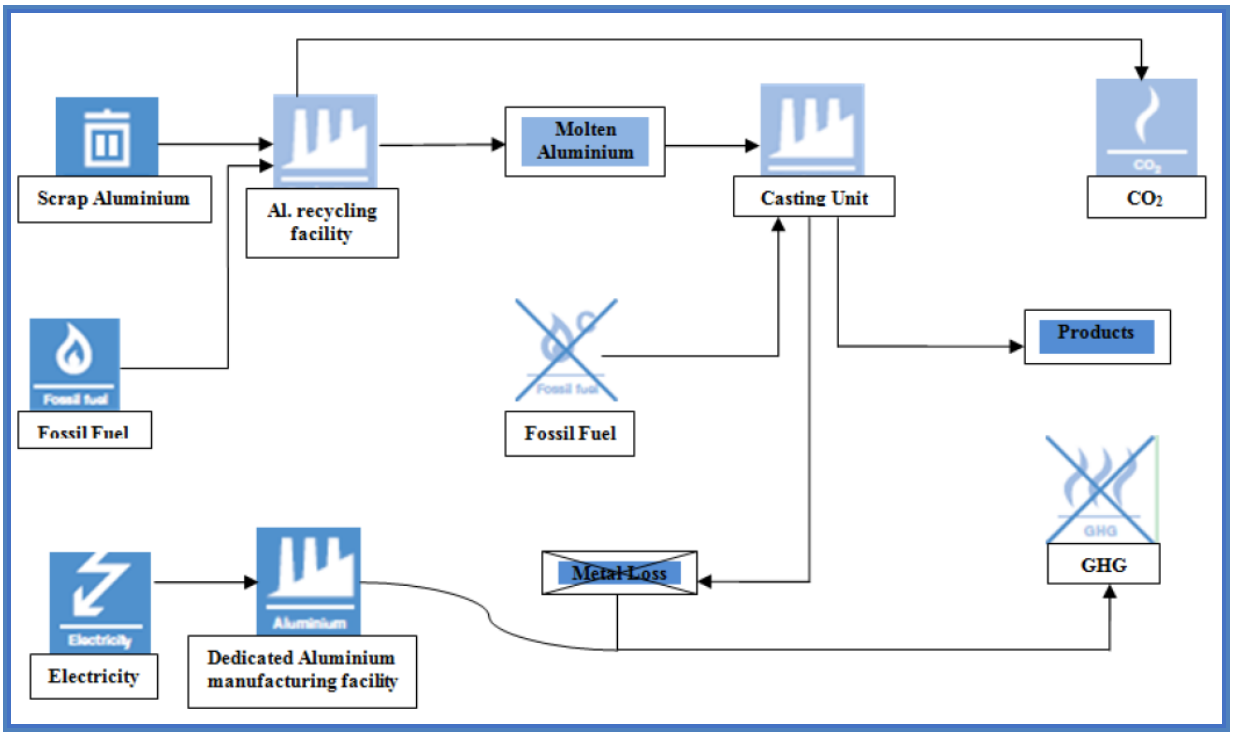
Baseline Scenario: In the pre-project scenario, CMR group was following the common process in the units i.e., supply of aluminium ingots to the casting units. The solid ingots were re-melted at the casting units for utilization in casting operations. For casting operations casting units melt solid ingots in their in-plant FO fired furnaces and use the molten Aluminium for castings. The use of fossil fuel for melting of the ingots leads to emissions of GHG. The process of melting of the ingots also leads to loss of some quantity of metal due to oxidation of the molten metal.

Project Scenario: Under the project level, the main activity that forms the carbon project is primarily saving the fuel and metal in the production process through modification of the existing process. The project activity involves supply of Aluminium alloy to casting units in molten state. Processes at Aluminium recycling facility in project scenario are same as that of process at Aluminium recycling facility in the pre-project scenario and baseline case. However, in project case molten aluminium produced from scrap Aluminium is supplied to the casting units for direct use in die-casting machines. Whereas in pre-project case molten Aluminium produced from melting of scrap Aluminium is casted into H-caster moulds to produce solid ingots. Solids ingots are then supplied to die-casting facilities for subsequent use.

A representative diagram of the pre-project scenario:



A representative diagram of the project scenario under UCR:



A.2. Location of project activity>>

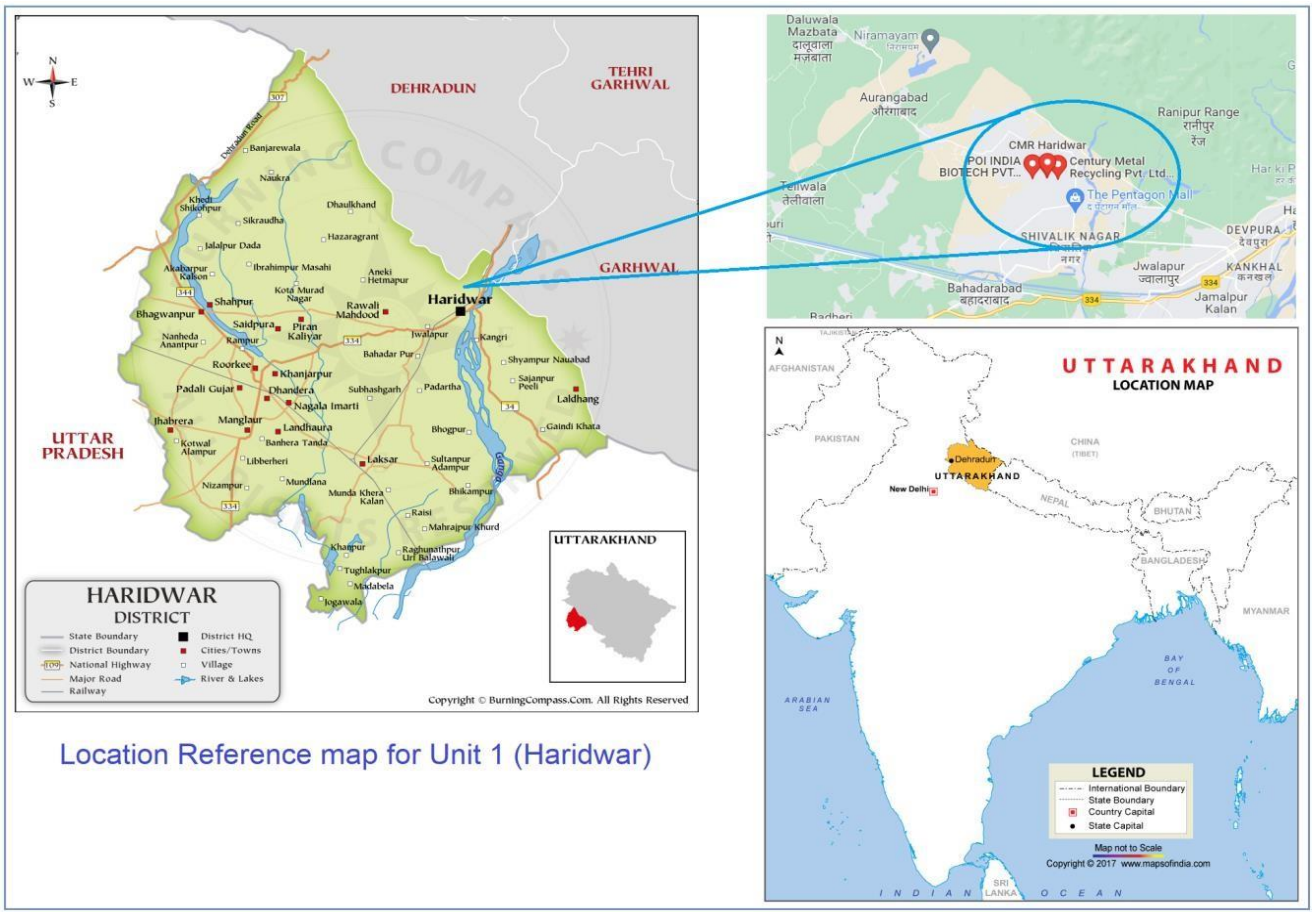
Country : India

District : Manesar, Gurgaon, Bawal and Haridwar
State : Haryana and Uttarakhand

The location details of the four units are given below:

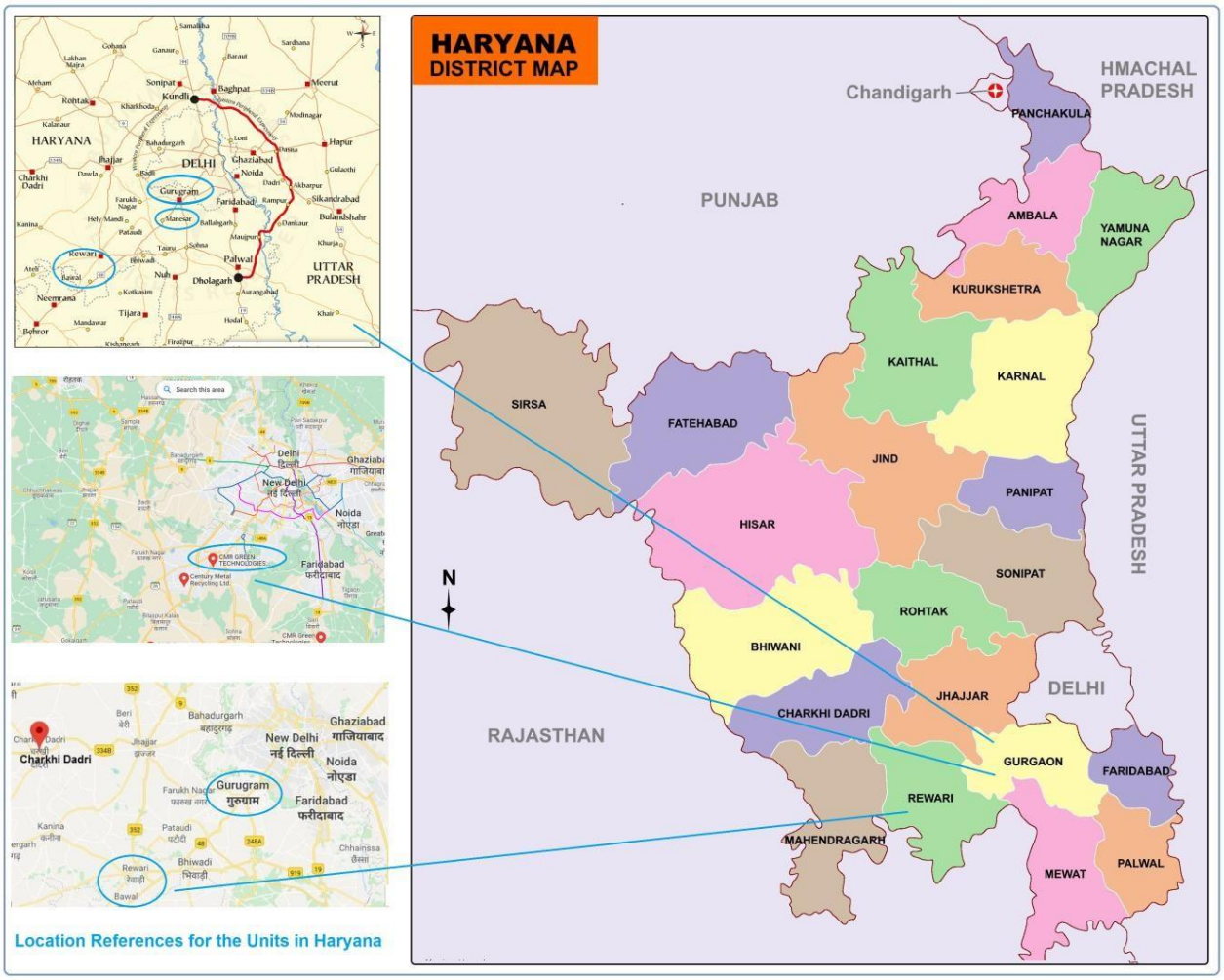
Unit Ref	Location Reference	Location Details
Unit 1	Haridwar (Uttarakhand)	Haridwar Sidcul, Plot 3/P2, Sector 10, Haridwar. Latitude: 29° 56' 44.4876", Longitude: 78° 9' 51.2928"
Unit 2	Gurugram (Haryana)	38/6, Miles Stone, Delhi-Jaipur highway, vill-Narsinghpur, Dist. – Gurgaon, Haryana. Latitude: 28.3715° N, Longitude: 76.9237° E
Unit 3	Manesar (Haryana)	68F6+2CW, Tatarpur, Manesar, Haryana 121102. Latitude:28.22311° N, Longitude: 77.31163° E
Unit 4	Bawal (Haryana)	Plot No 65 Sector 15, Patuhera, Rewari, Bawal 123501. Latitude: 28.1034° N, Longitude: 76.6210° E

The representative location maps are included below:



Location Reference map for Unit 1 (Haridwar)

(Image courtesy: Google maps & images)



(Image courtesy: Google maps & images)

A.3. Parties and project participants >>

Party (Host)	Participants
India	**CMR GREEN TECHNOLOGIES LIMITED** **(formerly Century Metal Recycling Ltd.)** **Contact details:** Contact Person: Mr. Ankur Singh Director Ph: +91 (0129) 4223050 Email: ankur.s@cmr.co.in **Address:** Corp. Office: 803, SSR Corporate Park, Opp NHPC Metro Station,Delhi Mathura Road, Faridabad- 121003, Haryana. India. **Other Parties:** Not applicable. All the four units are owned by the respective entities of CMRgroup, hence no additional parties are reported here.

A.4. References to methodologies and standardized baselines >>

SECTORAL SCOPE:
04, Manufacturing Industries

CATEGORY:
AMS. III.BD. (Title: "GHG emission reduction due to supply of molten metal instead of ingots for aluminium castings")

Standardized Baseline: Not Applicable.

Applicability of methodologies and standardized baselines >>
The scale of the activity is under the project Type-III B D. (Version 01|) and the project activity remained under the limit of 15 MW every year during the crediting period. Therefore, the GHG emission reductions that are claimed remains within the limit of its type as per the applied methodologies.

A.5. Crediting period of project activity >>

Length of the crediting period corresponding to this monitoring period: 10 years, 00 months.
Date: 01/01/2013 to 31/12/2022 (inclusive of both dates).

A.6. Contact information of responsible persons/entities >>

Particulars	Details
Name	Mr. Ankur Singh (Director)
Project Proponent:	CMR GREEN TECHNOLOGIES LIMITED (formerly Century Metal Recycling Ltd.)
Company	CMR GREEN TECHNOLOGIES LIMITED (formerly Century Metal Recycling Ltd.)
Address	Corp. Office: 803, SSR Corporate Park, Opp NHPC Metro Station,Delhi Mathura Road, Faridabad- 121003, Haryana. India.
E-mail	ankur.s@cmr.co.in
Contact	+91 (0129) 4223050

SECTION B. Implementation of project activity

B.1. Description of implemented registered project activity >>

A) Provide information on the implementation status of the project activity during this monitoring period in accordance with UCR PCN>>

a) Description of the installed Technologies, technical processes and equipment:

Reference: (Technical information given on **Section – A.1.(b)** & also given on appendix).

b) Information on the implementation and the actual operation of the project activity, including relevant dates:

As can be checked from the table above, the earliest date of commissioning of the units was on 22nd August 2008 which is for Haridwar plant and the latest commissioning was for Bawal plant which was 02nd Dec 2013. All units have been in continuous operation since its commissioning. Therefore,the consideration of crediting period for the project is justified as 01 Jan 2013.

All these plants are in continuous operation, though plant operating parameters are different and load factors are different. Therefore, overall implementation status is considered to be valid, without any design change and without any discontinuation of the operations.

In order to present an ex-ante estimated value in this Project Concept Note for all future reference, adetailed calculation has been done. Based on the primary data collected during the project design and based on all methodological parameters, the estimated annual average emission reductions are about 16,780 tCO_2e, whereas actual emission reductions accounted during the first CoU period has been estimated as 22,329 tCO_2e as annual average; is being submitted under this report as a part of first monitoring and verification.

B) For the description of the installed technology(is), technical process and equipment, include diagrams, where appropriate>>

PROCESS FLOW DIAGRAM

Connector Symbols

Operation Decision

Inspection Storage

Transfer

S No	Process & Description	Connector SYMBOLS (Opr. / Insp. / Deci. / Trans / Store)
10	Raw Material weighing / unloading	
20	Sampling and Inspection	
30	Sorting	
40	Weighment/ material feeding on furnace	
50	Charging	
60	Melting	
70	Drossing and Iron removal	
80	Casting Sampling for testing of raw material composition	
90	Alloying	
100	Final Sampling for testing of required customer specification	
110	Metal Pouring in ladle from furnace	
120	Ladle transfer from furnace to degassing m/c and start degasing	
130	Vacuum sample for porosity testing, K value test,density test	
140	Weighment	
150	Delivery	

B.2 Do no harm or Impact test of the project activity>>

The project does not have any negative impact on the environment or in the region, rather it has positive attributes. There are several positive impacts of a metal recycling project that focuses on recycling molten aluminium compared to solid ingots:

Energy savings: Recycling molten aluminium requires significantly less energy than producing aluminium from virgin ore. According to the Aluminium Association, recycling aluminium saves about 95% of the energy needed to produce primary aluminium from bauxite ore. This results in significant reductions in greenhouse gas emissions and other air pollutants.

Resource conservation: Recycling aluminium conserves natural resources like bauxite ore and reduces the need for mining, which can cause environmental damage.

Waste reduction: Recycling molten aluminium produces less waste than producing solid ingots from virgin ore. Recycling aluminium also helps to reduce landfill waste and associated environmental issues.

Cost savings: Recycling aluminium is often less expensive than producing aluminium from virgin ore, especially as the cost of energy continues to rise.

Job creation: Metal recycling projects can create new jobs in recycling, collection, and processing of aluminium scrap.

Improved sustainability: By recycling aluminium, we can move towards a more sustainable and circular economy, where resources are used more efficiently and waste is minimized. This can lead to a more sustainable future for both the environment and the economy.

Therefore, if we summarize the positive impacts as mentioned above, the overall we could mention that recycling molten aluminium can have a significant positive impact on the following broad categories:

- **Environmental**
- **Social**
- **Economical.**

The project units are already operational and all these positive attributes are achieved by the project units. Thus this project is contributing to various sustainable benefits which can be realized both in direct and indirect forms and positive impacts are realizable across the operational lifetime of the project. However, CMR is currently not claiming impacts of such SD benefits, hence specific monitoring of such indicators are not established. Whereas, some of the regular CSR activities are reported under the Appendix 2.

Additional Information on Do No Harm Assessment:

A DO NO HARM assessment is an evaluation of the potential impacts of a project on human rights, labour standards, environmental conditions, and community development. Here is an assessment of the metal recycling project that focuses on recycling molten aluminium compared to solid ingots:

1. **Human Rights:** The project is not experiencing any direct negative impacts on human rights. Generally, workers in the metal recycling industry have risks such as exposure to hazardous materials and heavy machinery. However, at CMR plants the best possible proper safety measures are taken to ensure worker safety. Hence no negative impact.

2. **Labour Standards:** The project complies with labour laws and standards, including those related to working hours, wages, and worker safety. Workers are provided with appropriate protective gear and training to minimize risks. Moreover, CMR is already

3. certified as "Great Place to Work", which certainly confirms the compliance of all labour laws as well as qualitative employment across the organization.

4. **Environmental Conditions:** Recycling molten aluminium is generally more environmentally friendly than producing solid ingots from virgin ore. While achieving this climate friendly action, CMR group also implemented appropriate environmental management practices across the plants and offices to ensure that any environmental hazards or probable risks are minimized. Moreover, the required environmental clearances and consent to operate from Pollution Control Board received in all the units, hence it ensures no direct or indirect impacts to air and water pollution, waste generation/disposal methods etc.

5. **Community Development:** The project units are already having positive impacts on the community as new jobs and local economic opportunities have been created. Also, CMR group conducts various CSR (Corporate Social Responsibility) activities for community with the active participation and involvement of the local community to ensure that their needs and concerns are considered.

Overall, the metal recycling project that focuses on recycling molten aluminium compared to solid ingots has the potential to have positive impacts on the environment, the economy, and society. However, it is important to ensure that appropriate measures are in place to mitigate any potential negative impacts on human rights, labour standards, environmental conditions, and community development. The project proponent "CMR Group" has been successfully addressing to all these areas that ensures that no negative impact or No Harm to the community and the region.

B.3. Baseline Emissions>>

Baseline is determined for the proposed project activity in accordance with paragraph 4 - applicability condition (c) of the Small-Scale Methodology AMS III.BD, Version 01.0 titled "GHG emission reduction due to supply of metal instead of ingots for Aluminium castings".

The project activity of the CMR four units result in reduction of anthropogenic emissions of GHG by sources below those that would have occurred in the absence of the project activity under UCR. The project units aim to achieve fuel and metal saving at casting units by supplying molten Aluminium in place of solid ingots. Supply of molten Aluminium to the casting unit is less GHG emission intensive technology, whereas, supply of solid ingots is more GHG intensive technology.

There are no any National and/or Sectoral policies or Regulations that give comparative advantages to supply of solid ingots to casting units over supply of molten Aluminium to the casting units. Also, there is no National and/or sectoral policy or regulation that give comparative advantages to supply of molten Aluminium to the casting units over supply of solid ingots to casting units which is a more emissions-intensive technology.

Hence, the proposed project activity is voluntary in nature. The E+ and E- policies in accordance with "Clarifications on the Consideration of National and/or Sectoral Policies and Circumstances in Baseline Scenarios" published in CDM EB22/Annex 3 with regards to the local, national and sectoral policies have been taken into account while developing the baseline scenario.

Post implementation of the project activity the project proponent would directly supply molten Aluminium/Aluminium alloy, thereby eliminating **the use of fossil fuel at casting units** for melting of Aluminium ingots procured in the pre-project scenario and **avoiding the metal loss** that would have happened due to oxidation. In absence of the project scenario, proponent (PP) would continue the supply of Aluminium metal to the casting units in the form of solid ingots from its existing facility.

The input parameter used to estimate baseline emissions are as follows:

Parameter	**Choice of data**
$EF_{CO2,grid,y}$ - The emissions associated with grid electricity consumption	A "grid emission factor" refers to a CO2 emission factor (tCO2/MWh) which will be associated with each unit of electricity provided by an electricity system. The UCR recommends an emission factor of 0.9 tCO2/MWh for the 2014 - 2020 years as a conservative estimate for Indian projects not previously verified under any GHG program. Also, for the vintage 2021 & 2022, the combined margin emission factor calculated from CEA database in India results into higher emission than this UCR default value. Hence, the same emission factor has been considered to calculate the emission reduction under conservative approach.
$EF_{fossilfuel}$ - CO2 emission factor ($tonCO_2/MJ$) of the fossil fuel which would have been consumed at the casting unit to which the molten metal is being supplied.	Calculated using the "Tool to calculate Project or leakage CO2 emissions from fossil fuel combustion".

Q_y - quantity of molten Aluminium alloy supplied in the year y to the casting unit (ton).	Monitored data, which will be obtained from the plant records during the verification. For the purpose of ex-ante estimation, an annual avg. value from the plant's records considered which is more realistic.
$\eta_{furnace}$ - Efficiency of the furnace at the casting unit to which the molten metal is being supplied (fraction)	Efficiency value shall be taken as mentioned in paragraph 11 of theapplied methodology AMS III BD (Version 01.0).
T_{amb} - Ambient temperature (°C)	The ambient temperature T_{amb} = 50.6 °C is prescribed as per the appliedmethodology AMS III BD (Version 01.0). However, for the purpose of estimation the ambient temperatures recorded in the respective units areused.
β - Percentage loss of aluminium due to oxidation during the process of re-meltingof ingots.	Use of default value given in applied methodology AMS III BD (Version 01.0).
EI_{AP} - Emission factor for primary aluminium production from virgin inputs (electricity)/tonne molten aluminium	Use of conservative default value of 7.3 MWh (electricity)/tonne molten aluminium as per the guidance in paragraph 12 of the applied methodology AMS III BD (Version 01.0).

B.4. Debundling>>

This project activity is not a debundled component of a larger project activity.
Instead, the overall project is bundle of four recycling units of CMR group.

Additionally, the project comes under the type-III category as per CDM methodology. The ex-ante estimated value of annual average ERs are less than the threshold limit of 60 k tCO_2e. Hence, there is no concern related to de-bundling from the project carbon accounting as well.

SECTION C. Application of methodologies and standardized baselines

C.1. References to methodologies and standardized baselines >>

SECTORAL SCOPE:
04, Manufacturing Industries

CATEGORY:
AMS. III.BD. (Title: "GHG emission reduction due to supply of molten metal instead of ingots for aluminium castings")
Standardized Baseline: Not Applicable.

C.2. Applicability of methodologies and standardized baselines >>

In accordance with Appendix B of the simplified modalities and procedures for small-scale CDM project activities, the project category is categorized as Type – III.B D. (Version 01), Sectoral Scope: 04, "GHG emission reduction due to supply of molten metal instead of ingots for aluminium castings". The applicability of methodology is discussed below:

Applicability Criterion	Project Case
1. This methodology is applicable to existing facilities as well as new constructions (Greenfield facilities).	The four units of the project activity were newly constructed metal recycling units. Hence, applicability condition is satisfied.
2. For facilities to qualify as existing, both the recycling unit and the casting units have a history of operation for at least three years prior to the start date of project activity and it shall be demonstrated that the baseline is the continuation of the existing practice i.e. casting units solely use ingots prior to the start date of the CDM project. The baseline emissions are established from the characteristics of the existing systems using data from the immediately prior three years. If any one of the units (recycling or casting) is a new construction it shall be considered as Greenfield.	The project units are newly constructed facilities and hence, a greenfield facility.
3. For Greenfield and existing facilities, if the estimated average annual emission reductions from the project activity is greater than 600 tCO2 per installation (i.e. casting unit), then mandatory investment analysis is required for identification of the baseline and demonstration of additionality of the project. The investment analysis shall take into account all costs and benefits that result from the project activity;	The estimated emission reduction achieved fromthe project activity is about 22,329 tCO2e per year. However, demonstration of additionality is not considered to be applicable under the UCR activity. Hence, this criterion is not applicable.
4. The hot metal transport between the recycling facility and casting unit is undertaken in closed ladle all through the crediting period;	As demonstrated under the project description, the hot metal transport between the recycling facilities and

	casting units are undertaken in closed ladle only. This has been included in the monitoring parameter.
5. It is possible to directly measure and record the output of the recycling facility i.e. the quantity of molten aluminium metal or alloy supplied to the casting units;	Molten Aluminium produced by the recycling facility is measured at plants and the values are recorded for every trip of molten metal transfer to the casting units.
6. In order to avoid double counting of emission reductions, a contractual agreement between the recycling facility and casting unit shall indicate that only one of them will claim emission reductions;	This condition is already established as the project has required contractual agreements in place. The required declaration shall be submitted during the verification process.
7. Production outputs in baseline and project scenario remain homogenous and within a range of ±10% with no change in installed capacity. The methodology is not applicable to project activities for retrofit of an existing facility to increase production outputs	Production output both in baseline and project case would remain homogenous, as composition of the production output is dependent on the requirement from die-casting facility. And this requirement would remain same irrespective of the physical state in which it is supplied.
8. It shall be demonstrated that the use of hot metal in the casting unit will not increase auxiliary consumptions. Any transportation related emissions is included as project emissions	It is evident from the process description included under the section A that use of hot metal in the casting unit does not lead to any increase in auxiliary energy consumption, except for the energy consumption during transporting the hot metal from the recycling facility to the casting facility. All transportation related energy consumption has been accounted in the project emissions.
9. Measures are limited to those that result in aggregate emission reductions of less than or equalto 60 kt CO2 annually	The actual estimate shows that the annual average estimated ER is 22,329; hence well below the prescribed limit.

The project activity thus meets all the applicability criteria set out under the selected small-scale methodology (i.e. AMS-III.BD / Version 01.0) and hence the methodology is applicable to this project activity.

C.3 Applicability of double counting emission reductions >>

There is no double accounting of emission reductions in the project activity due to the followingreasons:

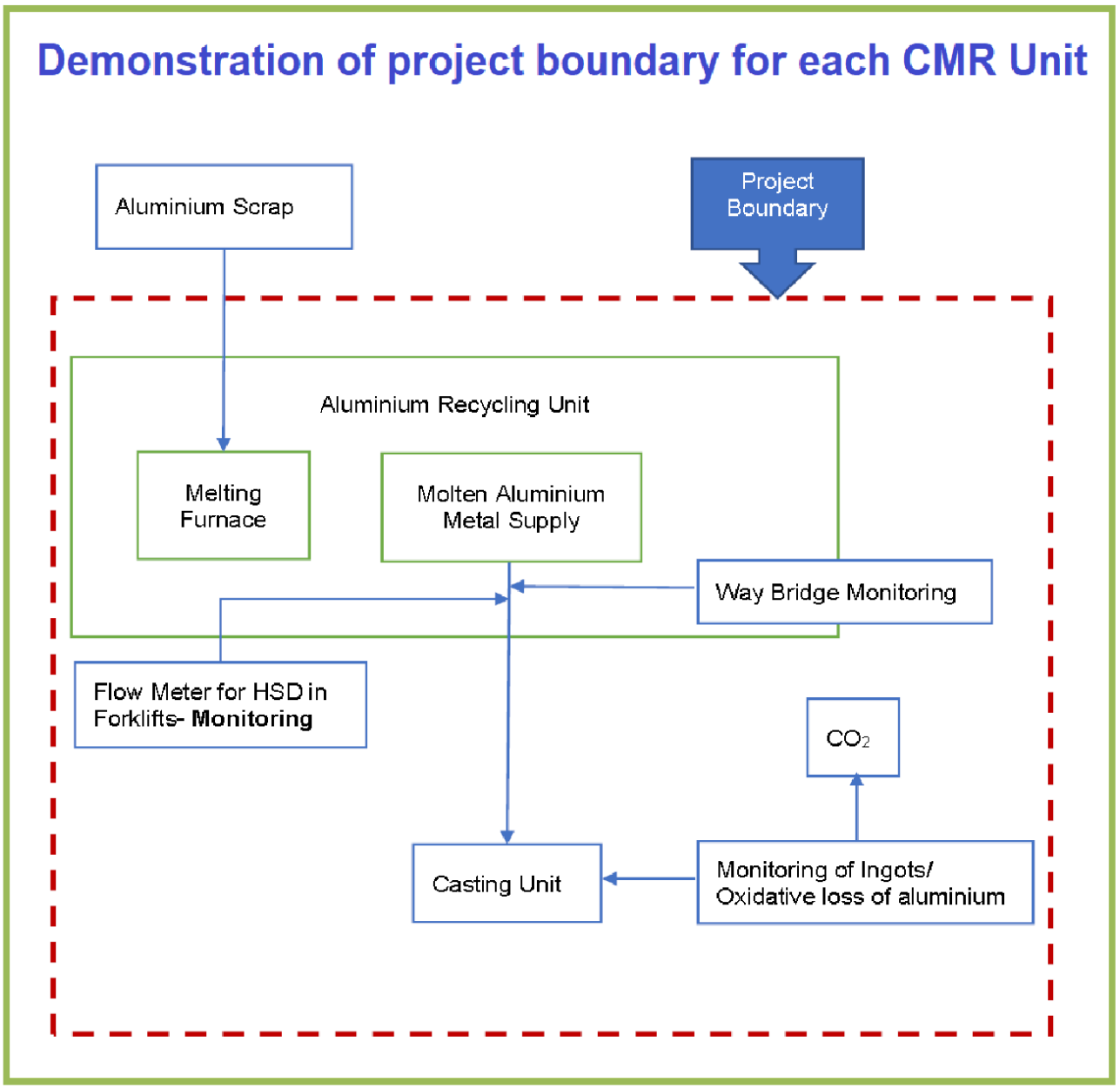
- Project is uniquely identifiable based on its location coordinates,
- Project has dedicated commissioning certificate of the production unit,
- Project is associated with energy meters and other measuring devices for the key parameterswhich are uniquely identifiable for the carbon project.

Additionally, there is no accounting of any green attributes or any form of such benefits claimed by the consumers of molten metal (i.e. clients of CMR respective plants); neither CMR group has surrendered the carbon credits to or exchanged any communication with their clients related to green attributes; hence there is no double accounting of emission reduction claims in this entire project activity.

In this regard, PP has submitted the details of all the clients associated with the CMR entities across these four plants to the audit team for independent review and assessment. Additionally, PP has signed the No-Double accounting statement and submitted to the audit team.

C.4. Project boundary, sources and greenhouse gases (GHGs)>>

As per applicable methodology, the project boundary would be the physical site of the CMR units located in the state of Haryana and Uttarakhand.



The table below provides an overview of the emissions sources included or excluded from the project boundary for determination of baseline and project emissions.

Source		Gas	Included?	Justification/Explanation
Baseline	Grid connected fossil fuel-based electricity generation	**CO_2**	**Yes**	**Main emission source, associated with virgin Aluminium production.**
		CH_4	No	Minor emission source
		N_2O	No	Minor emission source
		Other	No	No other GHG emissions were emitted from the Project

Source		Gas	Included?	Justification/Explanation
Project	Fuel used in furnaces (Thermal energy)	**CO_2**	**Yes**	An important emission source due to the combustion of FO
		CH_4	No	Minor emission source
		N_2O	No	Minor emission source
		Other	No	No other GHG emissions were emitted from the Project
	Fuel used in transportation on of molten Aluminium	**CO_2**	**Yes**	An important emission source produced during Transportation
		CH_4	No	Project activity does not emit CH_4
		N_2O	No	Project activity does not emit N_2O
		Other	No	No other emissions are emitted from the project
	Electricity Requirement	CO_2	No	Not applicable
		CH_4	No	Not applicable
		N_2O	No	Not applicable
		Other	No	Not applicable

C.5. Establishment and description of baseline scenario (UCR Protocol) >>

The project activity involves supply of molten Aluminium and utilization in die-casting operation directly. Therefore, the project activity reduces the dependence on fossil fuel and avoid associated aluminium metal loss due to oxidation during re-melting of ingots which is the baseline scenario; thereby, achieving an overall reduction in GHG emissions at project level.

This section provides details of emission displacement rates/coefficients/factors established by the applicable methodology selected for the project.

Baseline is determined for the proposed project activity in accordance with paragraph 4 - applicability condition (c) of the Small-Scale Methodology AMS III.BD, Version 01.0 titled "GHG emission reduction due to supply of metal instead of ingots for Aluminium castings".

The detailed assessment of baseline scenario has been demonstrated under the previous section A.4 and A.6; the same shall be referred for baseline establishment.

Net GHG Emission Reductions and Removals:

Thus, $ER_y = BE_y – PE_y – LE_y$
Where:

ER_y = Emission reductions in year y (tCO_2/y)
BE_y = Baseline Emissions in year y ($t CO_2/y$)
PE_y = Project emissions in year y (tCO_2/y)
LE_y = Leakage emissions in year y (tCO_2/y)

Baseline Emission *(BEy)*

As per the provisions in the proposed new small-scale methodology the baseline emissions are calculated as follows:

$BE_y = BE_{fuel,y} + BE_{metal,y}$

Where,

BE_y =	Baseline emissions in the year y ($tonCO_2$-e)
$BE_{fuel,y}$ =	Baseline emission in the year y due to combustion of fossil fuel for melting of Aluminium ingots (tonCO2-e)
$BE_{metal,y}$ =	Baseline emission in the year y due to metal loss in oxidation during melting of Aluminium ingots prior to casting (tonCO2-e).

GHG associated with fuel saving ($BE_{fuel,y}$), is calculated as follows:

$$BE_{fuel,y} = Q_y * [\{1.07 * (660 - T_{amb}) + 390\} / \eta_{furnace}] * EF_{fossil\ fuel}$$

Were,

Q_y =	Quantity of molten Aluminium alloy supplied in the year y to the casting unit (tons).
660 =	Melting Temperature of Aluminium.
T_{amb} =	Ambient Temperature (°C)
1.07 =	Specific heat of solid Aluminium metal/alloy in MJ/ ton°C.
390 =	Latent heat of fusion of Aluminium (MJ/ton).
$EF_{fossil\ fuel}$	CO2 emission factor of the fossil fuel which would have been consumed at the casting unit to which the molten metal is being supplied (tonCO2/MJ),
$\eta_{furnace}$	Efficiency of the furnace at the casting unit to which the molten metal is being supplied (fraction)

GHG emission associated with Aluminium metal loss is calculated as follows:

$BE_{metal, y} = (\beta * Qy * EIAP * EF_{CO2, grid, y})/ 100$

Where,

$BE_{metal, y}$ =	Baseline GHG emission in year y due to metal loss during melting of Aluminium ingots (tonCO2-e)
Qy =	Quantity of molten Aluminium alloy supplied in year y to the casting unit (ton)
β =	Percentage loss of Aluminium due to oxidation during the process of re-melting of ingots
EI_{AP} =	Energy intensity for primary aluminium production from virgin inputs (MWh/tonne aluminium. Conservative default value of 7.3 MWh (electricity)/tonne molten aluminium alloy can be applied if the host country is net exporter of aluminium. This shall be demonstrated for each crediting year using credible official documented evidence (e.g., from government and/or from industrial association). Otherwise, the emission factor shall be discounted using baseline correction factor of 0.63.3 These values shall be updated at each renewal of the crediting period, and project participants shall use the values from the latest version of the methodology at renewal of the crediting period

Here, $EF_{CO2, grid, y}$ has been referred to the value prescribed by UCR. The reference has already been justified under the section A.6

Project emissions (PEy):

Project Emission is calculated in accordance with paragraph 19 of the applied methodology AMS III BD, version 01. Which states that The project emissions (PEy) on account of use of any fossil fuel/electricity consumption associated with transportation of molten metal between recycling facility and casting units and also any incremental auxiliary consumption for the use of the hot metal in casting unit.

Relevant tools such as the "Tool to calculate project or leakage CO2 emissions from fossil fuel combustion" have been used. In the project case, energy is consumed in transporting the molten metal from the point of melting furnaces located at the recycling facility to the point of use i.e., die-casting machines located at the casting facility. The molten metal is transported in closed ladles carried by Forklifts. One trip of forklift carrying the molten metal comprises of travel from melting furnaces to the weight dispatch centre for weighing and recording of the molten metal in the ladle, from the load dispatch centre to the casting machine at the casting facility, return form the casting facility to the load dispatch centre for weighing and recording the empty weight of the ladle and finally to the melting furnaces to start the trip again. Energy consumption in forklifts for transportation of molten metal is the only energy consumption in the project case. There is no other auxiliary energy consumption in the project activity.

To calculate the project emissions, "Tool to calculate project or leakage CO2 emissions from fossil fuel combustion" has been used as the fuel used in the forklift is Diesel. The formula used to calculate project emission using the above referenced tool is:

$PE_y = FC_{iy} * COEF_{iy}$

Where

PE_y =	Project emission in year y tonCO2-e
$COEF_{iy}$ =	Is the CO2 emission coefficient of diesel in year y (tCO2/mass or volume unit)
FC_{iy} =	Is the quantity of diesel used in forklifts during the year y (mass or volume unit/yr);
I	Type of fuel consumed in year y. Type of fuel consumed is Diesel.

The CO2 emission coefficient $CO_{EFi,y}$ can be calculated using one of the following two Options, depending on the availability of data on the fossil fuel type i, as follows:

Option A: The CO2 emission coefficient COEFi,y is calculated based on the chemical composition of the fossil fuel type i,

Option B: The CO2 emission coefficient COEFi,y is calculated based on net calorific value and CO2 emission factor of Diesel

Since chemical composition of the fossil fuel used i.e. Diesel, is not available, option B has been chosen, which requires NCV of the fuel.

Formula used for option B as per the mentioned tool is as follows:

$COEF_{iy} = NCV_{iy} * EF_{CO2\ iy}$

Where,

COEFi,y	Is the CO2 emission coefficient of diesel in year y (tCO2/mass or volume unit)
NCVi,y	Is the weighted average net calorific value of diesel in year y (GJ/mass or volume unit)
EFCO2,i,y	Is the weighted average CO2 emission factor of diesel in year y (tCO2/GJ)
I	Are the fuel types combusted in process j during the year y. Fuel is diesel.

Leakage Emissions (LEy):

If the energy generating equipment is transferred from another activity leakage is to be considered. However, there is no such transfer of equipment.

The net Emission Reductions:

The actual emission reduction achieved during the first CoU period shall be submitted as a part of first monitoring and verification. However, for the purpose of an ex-ante estimation, following calculation has been submitted:

Estimated net annual baseline emission reductions:

Thus, $ER_y = BE_y – PE_y – LE_y$

Here,

BE_y = 227,691 tCO_2e
PE_y = 4,402 tCO_2e
LE_y = 223,289 tCO_2e

Hence, ER_y = 223,289 tCO_2e (i.e, 223,289 CoUs/year)

The detailed calculations are referred in an ER excel file and the summary of the calculations are attached to the appendix 1 of this document.

Rational: This final value is conservative as all annualized ER values are rounded down and final sum is considered for reporting, which gives the most conservative result.

The vintage wise break up is given under the ER excel sheet and also included under the Appendix of this report.

C.6. Prior History>>

The project activity has not been registered under any other GHG program for generation or issuance of carbon offsets or credits for the said crediting period.

Also, project has not been applied for any other environmental crediting or certification mechanism under any regional or national or international platforms other than UCR. Hence project will not cause double accounting of carbon credits (i.e., COUs).

C.7. Monitoring period number and duration>>

Number : First Monitoring Period
Duration : 10 years, 00 months
01/01/2013 to 31/12/2022 (inclusive of both dates)

C.8. Changes to start date of crediting period >>

There is no change in the start date of crediting period; the project is applied under UCR with its first crediting period starting from 01/01/2013.

At the time of first verification the respective date of commissioning of the CMR units (for Manesar and Bawal units) and 01/01/2013 (for Haridwar and Gurgaon) has been considered for calculation and reporting.

C.9. Permanent changes from PCN monitoring plan, applied methodology or applied standardized baseline >>

Not applicable.

C.10. Monitoring plan>>

The monitoring plan for the project activity (across all the four units) has been developed in line with the guidance provided in paragraph 17 of the methodology. According to that, quantity of Aluminium alloy supplied to the casting unit is monitored. GHG emission reduction associated withfuel and metal saving due to the project activity is calculated from monitored data, fixed data and default values. The only data that needs to be monitored is the quantity of molten Aluminium supplied to the casting units. The operational and management structure that the project participant will implement in order to monitor the quantity of molten Aluminium (Qy) supplied is explained below.

All required equipment(s) are available at the plant (such as weigh bridge, fuel consumptions, fork lift operations, time requirement etc.), hence monitoring of all the required parameters are properly addressed.

The manager of the recycling unit will be responsible to prepare the daily, monthly and annual reports. These reports will be reviewed by the plant head. Quarterly this data will also be reviewed by the plant management. Since the emissions reductions mainly depend on the amount of molten metal supplied, the weigh bridge/scale becomes an important monitoring equipment. Weigh bridge shall be calibrated as per manufacturer's prescription or at least once in five years. All the monitored data and calibration certificates shall be archived and stored (electronically & hard copies) till two years beyond the crediting period.

The basic technical details and the required flow charts are included under the appendix 2, whereas all required monitoring data (both ex-ante and ex-post) are reported below:

Data and Parameters available at validation (ex-ante values):

Data / Parameter	**UCR recommended emission factor**
Data unit	tCO_2 /MWh
Description	A "grid emission factor" refers to a CO_2 emission factor (tCO_2/MWh) which will be associated with each unit of electricity provided by an electricity system. The UCR recommends an emission factor of 0.9 tCO_2/MWh for the 2014- 2020 years as a fairly conservative estimate for Indian projects not previously verified under any GHG program. Hence, the same emission factor has been considered to calculate the emission reduction under conservative approach.
Source of data	https://a23e347601d72166dcd6-16da518ed3035d35cf0439f1cdf449c9.ssl.cf2.rackcdn.com//Documents/UCRStandardNov2021updatedVer2_301121081557551620.pdf
Value applied	0.9
Measurement methodsand procedures	-
Monitoring frequency	Ex-ante fixed parameter
Purpose of Data	For the calculation of Emission Factor of the grid
Additional Comment	The combined margin emission factor as per CEA database (latest version of 2022) results into higher emission factor. Hence for 2021-22 vintage UCR default emission factor remains conservative.

Data / Parameter	**T_{amb}**
Data unit	°C
Description	Ambient Temperature at the casting unit.
Source of data	Either of the options can be followed during the verification: **Option 1:** as per the applied Small Scale methodology AMS III BD version 01. **Option 2:** Take the ambient temperature T_{amb} = 100°C as a default value.
Value applied	**Unit Reference** / **Location Reference** / **Default value** Unit 1 / Haridwar (Uttrakhand) / 54 Unit 2 / Gurugram (Haryana) / 39 Unit 3 / Manesar (Haryana) / 44 Unit 4 / Bawal (Haryana) / 54
Measurement methodsand procedures	Default value, taken from credible public sources.
Monitoring frequency	Ex-ante fixed parameter
Purpose of Data	For the calculation of baseline emissions

Additional Comment	The option 1 as per methodology has been prescribed as the ex-ante default value. However, during the verifications such values have been used such that the results are conservative. For example, the temp. default value for Bawal plant is considered to be 54 instead of 44 as referred in the PCN which is mainly due to achieve conservativeness as production data for this plant is highest amongst all other plants.

Data / Parameter	**EI_{AP}**
Data unit	MWh (electricity)/tonne molten aluminium alloy
Description	Emission factor for primary aluminium production from virgin inputs
Source of data	As per Paragraph 12 of the applied methodology AMS III BD. Conservative default value of 7.3 MWh (electricity)/tonne molten aluminium alloy can be applied if the host country is net exporter of aluminium. Here annual report 2008-09 and 2012-13 of the Ministry of Mines, Government of India has been taken to demonstrate that India has been a net exporter of primary aluminium during the year. This value shall be validated for each crediting period using credible document.
Value applied	

Unit Reference	**Location Reference**	**Default value**
Unit 1	Haridwar (Uttrakhand)	7.3
Unit 2	Gurugram (Haryana)	7.3
Unit 3	Manesar (Haryana)	7.3
Unit 4	Bawal (Haryana)	7.3

Measurement methodsand procedures	Default value given in Paragraph 12 of the applied methodology AMS III BD has been taken.
Monitoring frequency	Ex-ante fixed parameter
Purpose of Data	For the calculation of baseline emissions
Additional Comment	In case if it cannot be demonstrated for any particular crediting year that India is a net exporter of primary Aluminium, then the value of emission factor shall be discounted using baseline correction factor of 0.63 for that year.

Data / Parameter	$\eta_{furnace}$
Data unit	Fraction
Description	Efficiency of the melting furnace
Source of data	The efficiency value of the type of furnace used has been taken from the Table 1 on efficiency of furnaces given in Paragraph 10 point number (a).
Value applied	Values taken for respective units: **Unit Reference** / **Location Reference** / **Applied value** Unit 1 / Haridwar (Uttrakhand) / 100 Unit 2 / Gurugram (Haryana) / 85.14 Unit 3 / Manesar (Haryana) / 87.3 Unit 4 / Bawal (Haryana) / 80
Measurement methodsand procedures	Based on plant records
Monitoring frequency	Ex-ante fixed parameter
Purpose of Data	For the calculation of baseline emissions
Additional Comment	For conservative and reasonable estimation, value has been derived from the plant records, in line with the methodology para 10(a)

Data / Parameter	**B**
Data unit	%
Description	Percentage loss of aluminium due to oxidation during the process of re-melting of ingots
Source of data	Based on the methodology default value, as per Para 13 (a)
Value applied	4
Measurement methodsand procedures	Default value as per methodological choice.
Monitoring frequency	Ex-ante fixed parameter
Purpose of Data	For the calculation of baseline emissions
Additional Comment	The selected default value shall be used for the crediting period and updated at renewal of crediting period

Data and Parameters to be monitored (ex-post monitoring values):

<table>
<tr><td>Data / Parameter</td><td>Q_y</td></tr>
<tr><td>Data unit</td><td>Tons</td></tr>
<tr><td>Description</td><td>Quantity of molten Aluminium supplied to the casting unit in year y.</td></tr>
<tr><td>Source of data</td><td>Plant records</td></tr>
<tr><td>Measurement procedures (if any):</td><td>Primary records maintained at the plant or copy of invoice of supply of molten Aluminium alloy, and the MIS records etc.</td></tr>
<tr><td>Measurement Frequency:</td><td>On a continuous basis.</td></tr>
<tr><td>Value applied:</td><td>Annual avg. value from eachplant records considered, as follows:
<table>
<tr><th>Unit Reference</th><th>Location Reference</th><th>Applied value in tons</th></tr>
<tr><td>Unit 1</td><td>Haridwar (Uttrakhand)</td><td>17,741</td></tr>
<tr><td>Unit 2</td><td>Gurugram (Haryana)</td><td>14,146</td></tr>
<tr><td>Unit 3</td><td>Manesar (Haryana)</td><td>12,924</td></tr>
<tr><td>Unit 4</td><td>Bawal (Haryana)</td><td>22,424</td></tr>
</table></td></tr>
<tr><td>QA/QC procedures applied:</td><td>Not applicable, primary records are considered which are available and be cross checked from the plant records (i.e. supply invoices).</td></tr>
<tr><td>Purpose of data:</td><td>The Data/Parameter is required to calculate the baseline emission.</td></tr>
<tr><td>Any comment:</td><td>Total quantity applied under the current monitoring period across the plants are as follows:
<table>
<tr><th>Unit Reference</th><th>Location Reference</th><th>Applied value (in tons)</th></tr>
<tr><td>Unit 1</td><td>Haridwar (Uttrakhand)</td><td>201,922</td></tr>
<tr><td>Unit 2</td><td>Gurugram (Haryana)</td><td>141,458</td></tr>
<tr><td>Unit 3</td><td>Manesar (Haryana)</td><td>117,006</td></tr>
<tr><td>Unit 4</td><td>Bawal (Haryana)</td><td>177,407</td></tr>
</table></td></tr>
</table>

Data / Parameter	**$EF_{fossil\ fuel}$**
Data unit	tCO2/MJ
Description	Weighted average CO2 emission factor of FO in year y CO2 emission factor (tonCO2/MJ) of the fossil fuel which would have been consumed at the casting unit to which the molten metal is being supplied. For the purpose of determining the fuel, it is to be considered that the fuel used at the recycling facility and the casting unit is the same. The fossil used in recycling facility is FO. As per the applied methodology AMS III BD, paragraph 9, for the purpose of determining the fuel, it is to be considered that the fuel used at the recycling facility and the casting unit is the same. Fuel used at the recycling facility is FO. Hence, the fuel used in the baseline is FO.

Source of data	IPCC default value of emission factor for FO at the upper limit of uncertainty at a 95 % confidence interval as provided in table 1.4 of chapter 1 of Vol. 2 (Energy) of the 2006 IPCC guidelines on National Greenhouse Gas inventories. This option is applicable as option B has been applied since, emission factor value of FO is not provided by the fuel supplier in the fuel supply invoices.
Measurement procedures (if any):	Not applicable as IPCC default value is being taken
Measurement Frequency:	Not applicable
Value applied:	78.8 x 10^-3
Monitoring equipment	Not applicable
QA/QC procedures applied:	Not applicable
Purpose of data:	The Data/Parameter is required to calculate the baseline emission.
Any comment:	This value shall be fixed for the entire crediting period. However, in case of any future revision of the IPCC, the value shall be taken into account based on conservativeness.

Data / Parameter	**FC_{iy}**
Data unit	m^3/yr
Description	Quantity of High Speed Diesel (HSD) combusted in fork lifts to transport molten Aluminium during the year y
Source of data	Onsite Measurements
Measurement procedures (if any):	Diesel used in forklifts is measured and recorded and filled in the forklifts on a daily basis. Daily records are maintained for the consumption of Diesel in the forklifts.
Measurement Frequency:	Continuous
Value applied:	Diesel consumption valuefrom each plant records considered, as follows, whereas actual avg calculated values are reported below in Comment section:

Unit Reference	Location Reference	Applied value
Unit 1	Haridwar (Uttrakhand)	2.25 l/hr
Unit 2	Gurugram (Haryana)	2.5 l/hr
Unit 3	Manesar (Haryana)	2.5 l/hr
Unit 4	Bawal (Haryana)	3 l/hr

Monitoring equipment	Not applicable
QA/QC procedures applied:	Average consumption of diesel in the forklifts can be cross checked with the mileage as rated by the forklift manufacturer.
Purpose of data:	The Data/Parameter is required to calculate the project emission.
Any comment:	For the purpose of annual value which can be used for calculation, other parameters shall be considered such as total number of trip by the fork lift, time required, density, NCV etc.

	The final values considered during verification process are:

Unit Reference	Location Reference	Applied value (in tons)
Unit 1	Haridwar (Uttrakhand)	23
Unit 2	Gurugram (Haryana)	15
Unit 3	Manesar (Haryana)	31
Unit 4	Bawal (Haryana)	67

Data / Parameter	**$NCV_{k,y}$**
Data unit	GJ/mass or volume unit
Description	Weighted average net calorific value of diesel used in the forklifts in year y
Source of data	The fossil fuel used in running forklifts to transport molten metal is diesel. IPCC default value for NCV of diesel at the upper limit of uncertainty at a 95 % confident interval as provided in table 1.2 of chapter 1 of Vol. 2 (Energy) of the 2006 IPCC guidelines on National Greenhouse Gas inventories. This option is applicable as option B has been applied as carbon fraction of diesel is not available in fuelinvoices.
Measurement methods and procedures	Plant level records
Frequency of monitoring/recording	Sample basis
Value applied	44.3
Measurement methods and procedures	Not applicable as IPCC default value is being taken.
Purpose of Data	The Data/Parameter is required to calculate the project emission.
Comments	Applicable since option B is applied. This value shall be fixed for the entire crediting period. However, in case of any future revision of the IPCC, the value shall be taken into account based on conservativeness.

Data / Parameter	**EFCO2iy**
Data unit	tCO2/MJ
Description	Weighted average CO2 emission factor of diesel in year y
Source of data	The fossil used for running forklifts to transport molten metal is diesel. IPCC default value of emission factor for diesel at the upper limit of uncertainty at a 95 % confidence interval as provided in table 1.4 of chapter 1 of Vol. 2 (Energy) of the 2006 IPCC guidelines on National Greenhouse Gas inventories. This option is applicable as option B has been applied as emission factor value of diesel is not available in the fuel supply invoices.
Measurement procedures (if any):	Not applicable as IPCC default value is being taken
Measurement Frequency:	Not applicable
Value applied:	74.8 x 10^-3
Monitoring equipment	Not applicable

QA/QC procedures applied:	Not applicable
Purpose of data:	The Data/Parameter is required to calculate the baseline emission.
Any comment:	This value shall be fixed for the entire crediting period. However, in case of any future revision of the IPCC, the value shall be taken into account based on conservativeness.

Thus, monitoring plan includes recording of all required parameters in line with the methodology. However, PCN has kept the provision that any amendment, addition, deletion of data/parameters required to establish the actual monitoring practices of the project units shall be reported during the first verification and required changes to the monitoring plan shall be proposed under deviations.

Currently, there was no such deviations applied. However, values were considered and treated into the equations to achieve the most conservative results. The summary of the overall emission reductions achieved during the entire monitoring period, as follows:

	Yr2013	Yr2014	Yr2015	Yr2016	Yr2017	Yr2018	Yr2019	Yr2020	Yr2021	Yr2022	Total
Plant-1 - CMR Bawal	16	4702	6326	8047	9034	10381	9188	7734	9192	6921	**71541**
Plant-2 - CMR Gurgaon	4884	6295	6534	6686	5165	5869	4917	4186	3513	2430	**50479**
Plant-3- CMR Manesar	181	3657	4065	3308	3650	5392	5054	5332	4727	5483	**40849**
Plant-4 - CMR Haridwar	6170	5447	6196	6130	6632	7256	6293	5639	5494	5163	**60420**
Total	**11251**	**20101**	**23121**	**24171**	**24481**	**28898**	**25452**	**22891**	**22926**	**19997**	**223289**
										Average:	22,329

Appendix 1:

Technical specification/key technical parameters of the project plants are as follows:

References:	Unit - CMR Manesar	Unit - CMR Gurgaon	Unit - CMR Haridwar	Unit - CMR Bawal
Projecty Type:	Recycling of Aluminum scrap	Recycling of Aluminum scrap	Scrap Recyling Aluminum Base (non feross)	Ferrous and Non - ferrous metal extraction involving different furnaces through melting, refining, -processing, casting and alloy re making
Main Project equipment:	Melting & Holding Furnace,Bag house,Utility equipment	Melting & Holding Furnace,Bag house,Utility equipment	Melting 6MT ton 2 no`s ,Melting 10 MT 2 no`s & Holding 15 MT Furnace, 1 No`s 8MT , D.G SET 250 KVA ,380 KVA Rotary sieve Tumbler m/c furnace charger MTS degassing caster machine ,Air screw compressor ,air dryer, ACB Panel transfarmer 1000 KVA	Melting Furnace,Holding Furnace,DG Set, Bag House,Caster, degassing Machine,Cooling tower & Rotory Sieve
Main Product & sub-products:	Aluminum alloy (liquid)	ss	Aluminum Alloy (Liquid+solid)	Aluminium Alloy (Molten & Solid Ingot)
Installed capacity as per commissioned documents:				
(I) Input Raw material capacity per day:	*100*	72 MT	110 mt/ Per Day	124.5 MT
(II) Product output against the input raw material, per day:	95% of input	95% of input	90.0%	95 % of Raw Material
Any change (addition / decrease/ increase) in original capacity:	No	no	No	No
Technical specifications:	3 Melting furnace and 3 Holding furnace 220 Kw bag house	Melting & Holding furnace	5 Melting 10 MT 2 no`s,6MT 3 no`s 4 Holding Furnaces 15MT,8MT,5MT 2 no`s	Regenerative melting furnace, Bag house for emission control, Holding furnace Metal holding and maintaing Temperature of molten aluminum Rotory Sieve for Scrap handling & caster for Solid ingot
Raw material required per kg output of the main product?	105%	105%	1.1 kg	105% of Output Material

PROCESS FLOW DIAGRAM

Connector Symbols

Operation — Decision

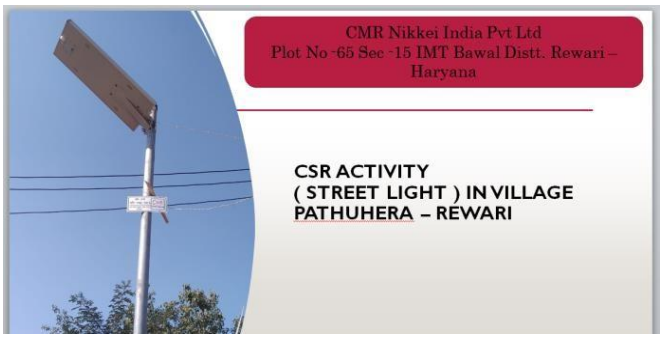
Inspection — Storage

Transfer

S No	Process & Description	SYMBOLS (Connector / Opr. / Insp. / Decis. / Trans. / Store)
10	Raw Material weighing / unloading	
20	Sampling and Inspection	
30	Sorting	
40	Weighment/ material feeding on furnace	
50	Charging	
60	Melting	
70	Drossing and Iron removal	
80	Casting Sampling for testing of raw material composition	
90	Alloying	
100	Final Sampling for testing of required customer specification	
110	Metal Pouring in ladle from furnace	
120	Ladle transfer from furnace to degassing m/c and start degasing	
130	Vacuum sample for porosity testing, K value test,density test	
140	Weighment	
150	Delivery	

Appendix 2:

Some glimpses of the CSR related activities of CMR Group are presented below:



टीबी मरीजों को बांटे गए पोषाहार

हरिद्वार। सामुदायिक स्वास्थ्य केंद्र बहादराबाद में सीएमआर ग्रीन टैक्निक्स लिमिटेड कंपनी सिडकुल रोशनाबाद ने प्रधानमंत्री टीबी मुक्त भारत अभियान से 21 टीबी मरीजों को गोद लिया है। जिन्हें बुधवार को कंपनी प्रबंधन की ओर से निक्षय मित्र बनकर पोषण आहार वितरण किया गया। चिकित्सा अधिकारी डॉ. तरुण मिश्रा, डॉ. हेमंत आर्य, प्रेरणा, सुधीर, दिनेश पंत, कंपनी प्लांट हेड महेश त्यागी रहे। संवाद

मूर्ति को न्य, ानंद नन्द

ललिताम्बा के साथ राष्ट्रव्यापी आन्दोलन चलाया उनके आन्दोलन ने तत्कालीन सरकार को झुकाने का काम किया था। गौरक्षा आन्दोलन हेतु उन्होंने जेलयात्रा भी की।

हरिद्वार व बद्रीनाथ धाम में श्री मानव कल्याण आश्रम के माध्यम से सेवा प्रकल्पों का निरन्तर संचालन कर रहा है।

स्वामी कल्याणानन्द सरस्वती जी महाराज की छठी पुण्यतिथि के अवसर पर देवी ट्रस्ट की कोषाध्यक्ष रेणुका बेन एल. ठक्कर, स्वामी कमलानन्द, स्वामी प्रसादानन्द, हंसानन्द सरस्वती, सुरेन्द्र मिश्रा, ब्रह्मजीत समेत अनेक गणमान्यजन उपस्थित रहे।

र सीएमआर कंपनी ने अपने सीसीआर के तहत वृद्ध आश्रम रावली महदूद में प्रदान की गीजर

-सुखदेव सिंह

बहादराबाद, 12 जनवरी। सिडकुल स्थित सीएमआर ग्रीन टेक्नोलेजेस लिमिटेड कम्पनी ने अपने सीएसआर फंड से रावली महदूद स्थित आश्रय गृह वृद्धाश्रम को सोलर वाटर हीटर प्रदान किया।इस अवसर पर कम्पनी के प्लांट हैड महेश त्यागी व एचआर हैड ऋषि तिवारी मौजूद रहे।कम्पनी के एचआर हैड ऋषि तिवारी ने बताया कि कम्पनी द्वारा समय समय पर जरूरतमंद संस्थाओं को आवश्यक वस्तुएं देती रही है। उन्होंने बताया कि कम्पनी द्वारा औरंगाबाद गांव के प्राथमिक स्कूलों व स्वास्थ्य संस्थानों को भी आवश्यक वस्तुएं उपलब्ध कराती रही है और आगे भी इसी प्रकार कराई रहेगी। इस अवसर पर रामराज ग्रामोद्योग संस्थान के प्रोजेक्ट को ऑर्डिनेटर चंद्रप्रकाश शर्मा ने बताया कि वर्तमान में संस्थान में 25 वृद्ध निवास कर रहे हैं जिनकी समूची देखभाल संस्थान की ओर से की जाती है।उन्होंने बताया कि सीएमआर ग्रीन कम्पनी द्वारा पूर्व में भी संस्थान को बेड, कूलर व अन्य आवश्यक सामग्री दी जाती रही है उन्होंने संस्थान की ओर से कम्पनी का धन्यवाद किया। इस अवसर पर संस्थान के प्रबंधक राजेन्द्र शर्मा,नेहा,भगवानदास आदि लोग उपस्थित थे।

खा द्वारा बहुत साफ र से देनी

ड़ा पहुंचकर लेमनग्रास की खेती का जायजा

हुये वहां के निदेशक ने बताया कि पहले यहां पर पथरीली जमीन थी, जिस पर काफी मेहनत करने के पश्चात, यहां पर ये पॉली हाउस स्थापित किये गये हैं। मुख्य विकास विकास अधिकारी यहां सबसे पहले सीड लैस खीरा उत्पादित करने वाले पॉली हाउस में पहुंचे, जहां एक निश्चित तापमान पर इस मौसम में भी सीडलैस खीरे की खेती की जा रही है। इसके बाद वे

सूचना
नाम परिवर्तन

सर्वसाधारण को सूचित किया जाता

Appendix 3:

Summary of final net emission reductions of each plant during the current monitoring period:

(CoUs from 01/01/2013 to 31/12/2022)

	Total	Unit
Plant-1 -CMR Bawal	**71,541**	CoUs
Plant-2 -CMR Gurgaon	**50,479**	
Plant-3-CMR Manesar	**40,849**	
Plant-4 -CMR Haridwar	**60,420**	
Total	**223,289**	

	Total (tCO2e)		
	Baseline	Project	Net
Plant-1 -CMR Bawal	73,754	2,213	**71,541**
Plant-2 -CMR Gurgaon	50,976	497	**50,479**
Plant-3-CMR Manesar	41,826	977	**40,849**
Plant-4 -CMR Haridwar	61,135	715	**60,420**
Total	227,691	4,402	**223,289**

Appendix 4:

Plant wise yearly breakup:
(Commercially sensitive information are stroked-out due to confidentiality)

CMR – Bawal Unit

TABLE 2:

BASELINE EMISSION (CMR Bawal)

$BE_{fuel,y}$

	Plant - Bawal										
	Year 2013	**Year 2014**	**Year 2015**	**Year 2016**	**Year 2017**	**Year 2018**	**Year 2019**	**Year 2020**	**Year 2021**	**Year 2022**	***Units***
Q_y	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	*tons*
T_{amb}	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	*^oC*
$\eta_{furnace}$	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	*Fraction*
β	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	*%*
EI_{AP}	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	*CAMS III BD (Version 01)*
$EF_{CO2, grid,y}$	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	*UCR Database*
$EF_{fossil\ fuel}$	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	*$t\ CO_2/TJ$*
Equations applied for $BE_{fuel,y}$ & $BE_{metal,y}$:											
$BE_{fuel,y}$	11	1410	1864	2258	2595	2980	2650	2239	2665	2022	*$t\ CO_2$*
$BE_{metal,y}$ =	27	3568	4739	5802	6666	7655	6810	5753	6848	5195	*$t\ CO_2$*
Basline Emission BE_y	**38**	**4978**	**6602**	**8060**	**9261**	**10634**	**9460**	**7992**	**9513**	**7216**	***$t\ CO_2$***

$$BE_{fuel,y} = Q_y * [\{1.07 * (660 - T_{amb}) + 390\} / \eta_{furnace}] * EF_{fossil\ fuel}$$

$$BE_{metal,y} = (\beta * Qy * EIAP * EF_{CO2,\ grid,\ y}) / 100$$

Total BEy	**73754**	tCO2e

TABLE 3:

Project Emission PE (CMR Bawal)

$PE_{FC,y}$

$$PE_y = FC_{iy} * COEF_{iy}$$

$$COEF_{iy} = NCV\ i_y * EF_{CO2\ iy}$$

	Year 2013	Year 2014	Year 2015	Year 2016	Year 2017	Year 2018	Year 2019	Year 2020	Year 2021	Year 2022	*Units*
FC_y	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	*t*
NCV_y	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	*GJ/t*
$EF_{co2,y}$	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	*tCO_2/TJ*
$COEF_y$	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	*tCO_2/t*
Project Emission $PE_{FC,y}$	**22**	**276**	**276**	**13**	**227**	**253**	**272**	**258**	**321**	**295**	***tCO2***

Total PEy	**2213**	tCO2e

	Year 2013	Year 2014	Year 2015	Year 2016	Year 2017	Year 2018	Year 2019	Year 2020	Year 2021	Year 2022	
Net ERs tCO2e =	**16**	**4702**	**6326**	**8047**	**9034**	**10381**	**9188**	**7734**	**9192**	**6921**	tCO2e

Net Emission reductions tCO2e =	**71541**	**tCO2**

Note: (shaded cell) = considered ex-ante value as conservative approach in absence of actual measured data

CMR – Gurgaon Unit

TABLE 2:

BASELINE EMISSION (CMR Gurgaon)

$BE_{fuel,y}$

	Plant - Gurgaon										
	Year 2013	**Year 2014**	**Year 2015**	**Year 2016**	**Year 2017**	**Year 2018**	**Year 2019**	**Year 2020**	**Year 2021**	**Year 2022**	***Units***
Q_y	[redacted]										*tons*
T_{amb}	[redacted]										*°C*
$\eta_{furnace}$	[redacted]										*Fraction*
β	[redacted]										*%*
EI_{AP}	[redacted]										*CAMS III BD (Version 01)*
$EF_{CO2, grid,y}$	[redacted]										*UCR Database*
$EF_{fossil\ fuel}$	[redacted]										*t CO_2/TJ*
Equations applied for $BE_{fuel,y}$ & $BE_{metal,y}$:	$BE_{fuel,y} = Q_y * [\{1.07 * (660 - T_{amb}) + 390\} / \eta_{furnace}] * EF_{fossil\ fuel}$				$BE_{metal,y} = (\beta * Qy * EIAP * EF_{CO2, grid, y}) / 100$						
$BE_{fuel,y}$	1349	1731	1796	1813	1409	1602	1343	1143	959	660	*t CO_2*
$BE_{metal,y}$ =	3633	4662	4837	4881	3795	4314	3615	3077	2583	1778	*t CO_2*
Basline Emission BE_y	**4982**	**6393**	**6632**	**6693**	**5203**	**5916**	**4957**	**4220**	**3542**	**2438**	***t CO_2***

Total BEy	**50976**	tCO2e

TABLE 3:

Project Emission PE (CMR Gurgaon)

$PE_y = FC_{iy} * COEF_{iy}$

$COEF_{iy} = NCV\ i_y * EF_{CO2\ iy}$

$PE_{FC,y}$

	Year 2013	**Year 2014**	**Year 2015**	**Year 2016**	**Year 2017**	**Year 2018**	**Year 2019**	**Year 2020**	**Year 2021**	**Year 2022**	***Units***
FC_y	[redacted]										*t*
NCV_y	[redacted]										*GJ/t*
$EF_{CO2,y}$	[redacted]										*tCO_2 /TJ*
$COEF_y$	[redacted]										*tCO_2 /t*
Project Emission $PE_{FC,y}$	**98**	**98**	**98**	**7**	**38**	**47**	**40**	**34**	**29**	**8**	***tCO2***

Total PEy	**497**	tCO2e

Net ERs tCO2e =	**4884**	**6295**	**6534**	**6686**	**5165**	**5869**	**4917**	**4186**	**3513**	**2430**	tCO2e

Net Emission reductions tCO2e =	**50479**	tCO2

Note:		= considered ex-ante value as conservative approach in absence of actual measured data

TABLE 2:

BASELINE EMISSION (CMR Manesar)

$BE_{fuel,y}$

	Plant -Manesar										
	Year 2013	**Year 2014**	**Year 2015**	**Year 2016**	**Year 2017**	**Year 2018**	**Year 2019**	**Year 2020**	**Year 2021**	**Year 2022**	***Units***
Q_y	694	10683	11826	9336	10493	15436	14486	15178	13473	15089	*tons*
T_{amb}	44	44	44	44	44	44	44	44	44	44	*°C*
$\eta_{furnace}$	0.8730	0.8730	0.8730	0.8730	0.8730	0.8730	0.8730	0.8730	0.8730	0.8730	*Fraction*
β	1	1	1	1	1	1	1	1	1	1	*%*
EI_{AP}	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	*CAMS III BD (Version 01)*
$EF_{CO2, grid,y}$	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	*UCR Database*
$EF_{fossil\ fuel}$	74.8	74.8	74.8	74.8	74.8	74.8	74.8	74.8	74.8	74.8	*t CO_2/TJ*
Equations applied for $BE_{fuel,y}$ & $BE_{metal,y}$:	$BE_{fuel,y} = Q_y * [\{1.07 * (660 - T_{amb}) + 390\} / \eta_{furnace}] * EF_{fossil\ fuel}$				$BE_{metal,y} = (\beta * Qy * EIAP * EF_{CO2, grid, y})/ 100$						
$BE_{fuel,y}$	66	1012	1120	884	985	1461	1364	1437	1274	1478	*t CO_2*
$BE_{metal,y}$ =	182	2807	3108	2454	2734	4054	3786	3987	3535	4102	*t CO_2*
Basline Emission BE_y	**248**	**3819**	**4227**	**3337**	**3719**	**5514**	**5150**	**5423**	**4809**	**5580**	***t CO_2***

Total BEy **41826** tCO2e

TABLE 3:

Project Emission PE (CMR Manesar)

$PE_{FC,y}$

$PE_y = FC_{iy} * COEF_{iy}$ $COEF_{iy} = NCV\ i_y * EF_{CO2\ iy}$

	Year 2013	Year 2014	Year 2015	Year 2016	Year 2017	Year 2018	Year 2019	Year 2020	Year 2021	Year 2022	*Units*
FC_y	28	43	43	33	37	57	53	57	50	59	*t*
NCV_y	43.3	43.3	43.3	44.8	44.8	44.8	44.8	44.8	44.8	44.8	*GJ/t*
$EF_{CO2,y}$	74.8	74.8	74.8	74.8	74.8	74.8	74.8	74.8	74.8	74.8	*tCO $_2$ /TJ*
$COEF_y$	3.24	3.24	3.24	3.34	3.34	3.34	3.34	3.34	3.34	3.34	*tCO $_2$ /t*
Project Emission $PE_{FC,y}$	**67**	**162**	**162**	**29**	**69**	**122**	**96**	**91**	**82**	**97**	***tCO2***

Total PEy **977** tCO2e

Net ERs tCO2e =	**181**	**3657**	**4065**	**3308**	**3650**	**5392**	**5054**	**5332**	**4727**	**5483**	tCO2e

Net Emission reductions tCO2e = **40849** **tCO2**

Note: = considered ex-ante value as conservative approach in absence of actual measured data

TABLE 2:

BASELINE EMISSION (CMR Haridwar)

$BE_{fuel,y}$

	Plant - Haridwar										
	Year 2013	Year 2014	Year 2015	Year 2016	Year 2017	Year 2018	Year 2019	Year 2020	Year 2021	Year 2022	Units
Q_y	17930	15952	18126	17873	19446	21409	18539	16626	16186	15204	*tons*
T_{amb}	34	34	34	34	34	34	34	34	34	34	*°C*
$\eta_{furnace}$	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	*Fraction*
β	4	4	4	4	4	4	4	4	4	4	*%*
EI_{AP}	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	*CAMS III BD (Version 01)*
$EF_{CO2, grid,y}$	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	*UCR Database*
$EF_{fossil\ fuel}$	73.0	73.0	73.0	73.0	73.0	73.0	73.0	73.0	73.0	73.0	*t CO_2/TJ*
Equations applied for $BE_{fuel,y}$ & $BE_{metal,y}$:	$BE_{fuel,y} = Q_y * [\{1.07 * (660 - T_{amb}) + 390\} / \eta_{furnace}] * EF_{fossil\ fuel}$					$BE_{metal,y} = (\beta * Qy * EIAP * EF_{CO2, grid, y})/ 100$					
$BE_{fuel,y}$	1472	1305	1483	1463	1591	1752	1517	1361	1324	1249	*t CO_2*
$BE_{metal,y}$ =	4728	4192	4764	4697	5110	5626	4872	4370	4252	4011	*t CO_2*
Basline Emission BE_y	**6199**	**5497**	**6246**	**6159**	**6701**	**7378**	**6389**	**5730**	**5576**	**5260**	***t CO_2***

Total BEy **61135** tCO2e

TABLE 3:

Project Emission PE (CMR Haridwar)

$PE_{FC,y}$

$PE_y = FC_{iy} * COEF_{iy}$ $COEF_{iy} = NCV_{iy} * EF_{CO2\ iy}$

	Year 2013	Year 2014	Year 2015	Year 2016	Year 2017	Year 2018	Year 2019	Year 2020	Year 2021	Year 2022	Units
FC_y	9	15	15	9	21	37	29	27	25	29	*t*
NCV_y	44.3	44.3	44.3	44.3	44.3	44.3	44.3	44.3	44.3	44.3	*GJ/t*
$EF_{CO2,y}$	74.8	74.8	74.8	74.8	74.8	74.8	74.8	74.8	74.8	74.8	*tCO_2 /TJ*
$COEF_y$	3.31	3.31	3.31	3.31	3.31	3.31	3.31	3.31	3.31	3.31	*tCO_2 /t*
Project Emission $PE_{FC,y}$	**29**	**50**	**50**	**29**	**69**	**122**	**96**	**91**	**82**	**97**	***tCO2***

Total PEy **715** tCO2e

Net ERs tCO2e =	**6170**	**5447**	**6196**	**6130**	**6632**	**7256**	**6293**	**5639**	**5494**	**5163**	tCO2e

Net Emission reductions tCO2e = **60420** **tCO2**

Note: = considered ex-ante value as conservative approach in absence of actual measured data