Monitoring Report

CARBON OFFSET UNIT (CoU) PROJECT

Title: Title: Biomass Based Thermal Energy Generation

By Dr. Reddy's Laboratories Limited, at FTO-07, Duvvada, Visakhapatnam, AP

Version 01
Date 10/09/2023
First CoU Issuance Period: 01 years, 02 months
Monitoring Period: 26/11/2021 to 31/12/2022

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

Monitoring Report	
Title of the project activity	**Biomass Based Thermal Energy Generation** By Dr. Reddy's Laboratories Limited, at FTO-07, VSEZ-Duvvada, Visakhapatnam, AP
UCR Project Registration Number	359
Version	01
Completion date of the MR	10/09/2023
Monitoring period number and duration of this monitoring period	Monitoring Period Number: 01 Duration of this monitoring Period: first and last days included (26/11/2021 to 31/12/2022)
Project participants	**Project Proponent:** Dr Reddy's Laboratories Ltd. (FTO -HO) Survey No. 42,45,46 & 54, Bachupally, Qutubullapur Mandal, Ranga Reddy District, Telengana,500100. **Aggregator:** Dr Reddy's Laboratories Ltd. (FTO -HO) Survey No. 42,45,46 & 54, Bachupally, Qutubullapur Mandal, Ranga Reddy District, Telengana,500100. Email: albinsonvtenny@drreddys.com **Consultant:** Energy Advisory Services Pvt. Ltd. Mumbai, Maharashtra Email: yogesh@easpl.co.in
Host Party	INDIA
Applied methodologies and standardized baselines	**Applied Methodology:** AMS-I.C.: Thermal energy production with or without electricity --- Version 22.0 UCR Standard for emission factor
Sectoral scopes	01 Energy industries (Renewable/Non-Renewable Sources)
Project commissioning date	26.11.2021
Estimated amount of GHG emission reductions for this monitoring period in the registered PCN	2021: 597.82 CoUs (597.82 tCO2eq)
	2022: 6266.05 CoUs (6266.05 tCO2eq)
Total:	**6863.87 CoUs (6863.87 tCO2eq)**

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 **Biomass Based Thermal Energy Generation** is located at FTO-07, Dr. Reddy's Laboratories Limited, VSEZ, in Village Duvvada, Tehsil Duvvada, District Visakhapatnam, State Andhra Pradesh, Country INDIA.

The details of the registered project are as follows:

Purpose of the project activity:

Dr. Reddy's Laboratories (DRL), a leading multinational pharmaceutical company based in India and overseas, committed to providing affordable and innovative medicines.

Dr. Reddy's Laboratories started in 1984 with a modest investment and a bold vision. Today, with research and development centres, manufacturing facilities and commercial presence across the globe, we serve over half a billion patients worldwide. Dr. Reddy's Laboratories aspire to triple our reach and touch over 1.5 billion patients by 2030

The UCR project activity consists of the generation of thermal energy by utilizing renewable biomass process boilers of total installed capacity of 4.5 TPH at the Formulation Tech-Ops-07 (FTO-07), owned and operated by the PP. The project activity involves the installation of one (01) Biomass Briquette/Rice Husk fired steam boilers with a steam output capacity of 4.5 TPH (at F & A 100^0C. This project activity uses renewable biomass briquettes and/or rice husk as fuel and supplies the process steam throughout the plant for an important process of manufacturing, sterilization and clean steam, within the project boundary at FTO-07 VSEZ, Duvvada, Visakhapatnam.

Conventionally, steam required for the processes in FTO-07 was met through a 4 nos of furnace oil fired boilers (1*3 TPH, 1*2 TPH and 2*4 TPH) which were operating inside the plant premises. Fossil fuel (furnace oil) combustion produces greenhouse gases (GHGs). This project activity displaces/avoids the use of fossil fuel (furnace oil) with briquette (renewable biomass) which is a clean and carbon neutral energy source. Also, the new boiler is more efficient than the old furnace oil fired boilers. Thus, the project activity helps in reduction of GHG emissions.

The briquettes, used in the boiler within the project activity, are composed of mainly agro-based residues and crop residues based on their availability from the surrounding region outside the project boundary (the PP is not the producer of the processed solid biomass fuel as specified in the requirements of the UCR CoU Standard for inclusion in the updated eligibility conditions specified in the UCR biomass program).

The project activity consumes about 6,500 tonnes (estimated) of briquette/biomass per year.

The estimated yearly average emission reductions due to the project activity are 10,100 tCO_2e.

In the pre-project scenario, the process demand of steam has been met by a fossil fuel (furnace oil) fired boiler. The project activity is thus the thermal energy production unit using renewable energy sources that displaces fossil fuel (furnace oil) use and avoids GHG emissions (CO_2). The project results in reductions of CO_2 emissions that are real, measurable and give long-term benefits to the mitigation of climate change.

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

The boiler installed is a "horizontal multi-tubular shell type boiler with membrane assembly" types that ensure 100% firing of biomass briquettes/rice husk, through intelligent combustion manager.

The primary technology for the project activity involves installation of 1*4.5 TPH biomass fired boilers. The direct combustion of biomass in the boiler is converted into thermal energy, which is utilized for steam generation. The boiler in the project activity was commissioned on **26.11.2021**.

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

	UCR Project ID or Date of Authorization:	
	Start Date of Crediting Period:	26/11/2021
	Project Commissioned:	26/11/2021

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	26/11/2021
Carbon credits claimed up to	31/12/2022
Total ERs generated (tCO_{2eq})	6938.87 tCO2eq
Project Activity Emissions	75.00 tCO2eq
Leakage Emissions	0.00 tCO2eq
Net Emissions	**6863.87 tCO2eq**

e) Baseline Scenario>>

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

- Energy generation (thermal heat and / or electricity) by more carbon-intensive technologies based on fossil fuel. In case of retrofits or capacity addition, operation of existing renewable power units without retrofit and capacity addition.

BASELINE SCENARIO

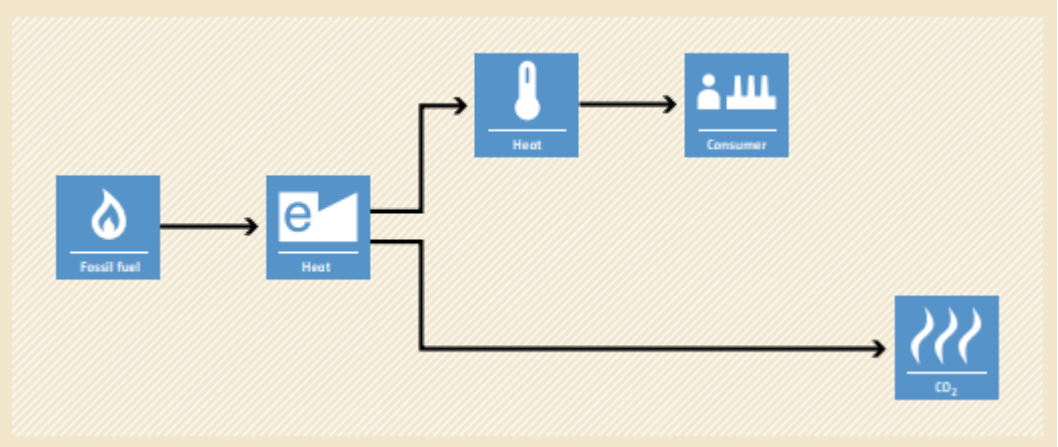


Figure 1-Baseline scenario

A.2. Location of project activity>>

Country:	INDIA
Village:	Duvvada
Tehsil:	Duvvada
District:	Visakhapatnam
State:	Andhra Pradesh
Pin code	530046
Coordinates	17^0 43’ 14.04” N 83^0 10’ 12.72” E

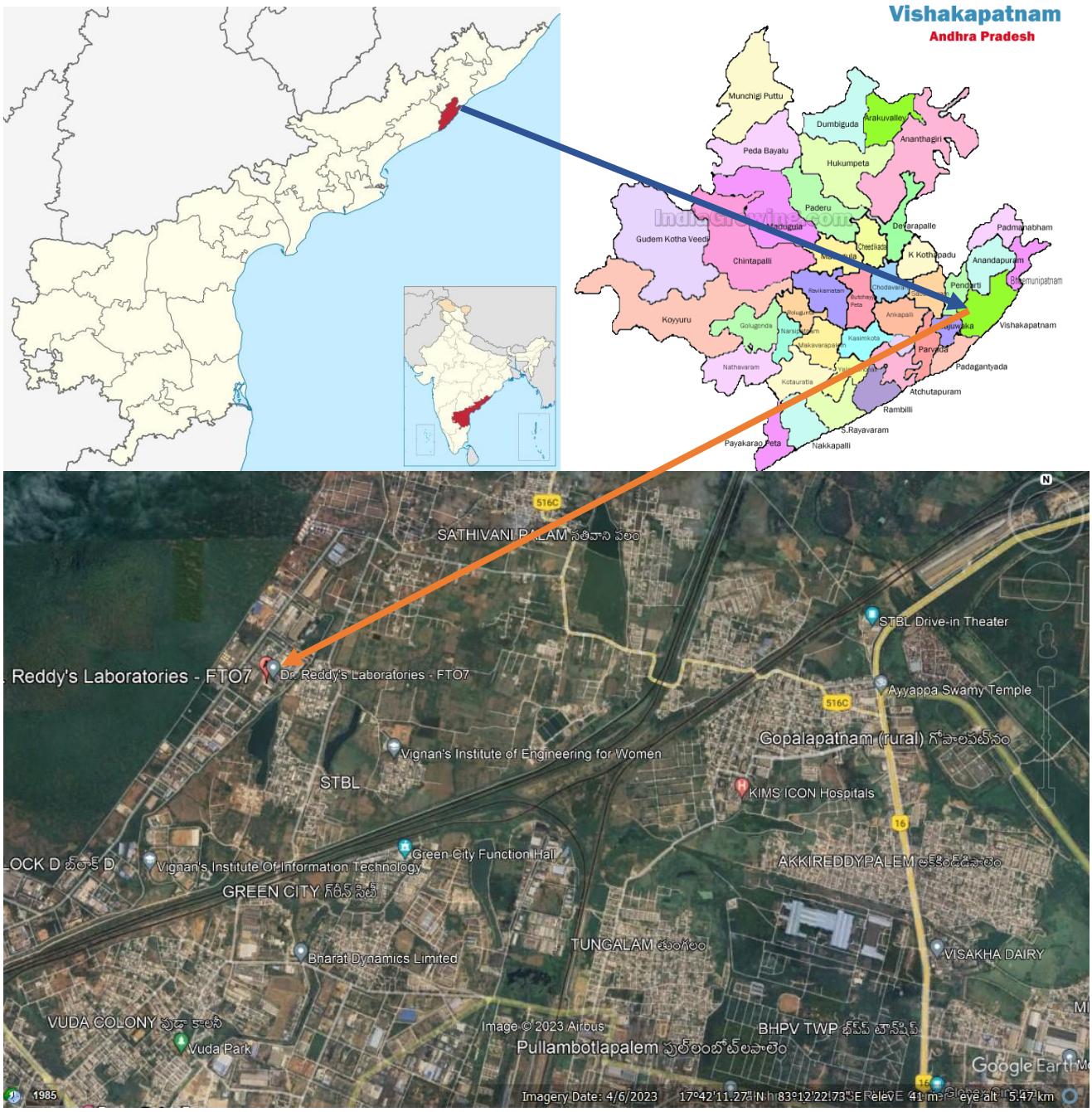


Figure 2- Location with co-ordinates

A.3. Parties and project participants >>

Party (Host)	Participants
INDIA	**Project Proponent:** Dr Reddy's Laboratories Ltd. (FTO -HO) Survey No. 42,45,46 & 54, Bachupally, Qutubullapur Mandal, Ranga Reddy District, Telengana,500100. **Plant Location:** Formulation Tech-Ops-07 (FTO-07), M/s Dr. Reddy's Laboratories Limited, VSEZ, Duvvada, Visakhapatnam, AP **Aggregator:** Dr Reddy's Laboratories Ltd. (FTO -HO) Survey No. 42,45,46 & 54, Bachupally, Qutubullapur Mandal, Ranga Reddy District, Telengana,500100. Email: albinsonvtenny@drreddys.com **Consultant:** Energy Advisory Services Pvt. Ltd. Mumbai, Maharashtra Email: yogesh@easpl.co.in

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

SECTORAL SCOPE	01, Energy industries (Renewable/Non-renewable sources)
TYPE	I – Renewable Energy Projects
CATEGORY	AMS-I.C.: Thermal energy production with or without electricity --- Version 22.0

The project activity is thermal energy generation project using a biomass briquette to generate steam in the boiler that displaces equivalent amount of thermal energy that would have been generated by a fossil fuel-based boiler. Since the project activity utilises biomass for the generation of thermal energy by displacing fossil fuel, it meets the primary applicability criteria of the methodology.

The thermal generation capacity of project activity is currently 13.5 MWthermal which is less than the threshold of 45 MWthermal as per the applied methodology. The capacity limits specified in the methodologies apply to both existing and additional units within the project activity. In the present case of the project activity, a 4.5 TPH boiler is installed (greenfield)

A.5. Crediting period of project activity >>

Length of the crediting period corresponding to this monitoring period: 01 years 02 months, included 26/11/2021 to 31/12/2022 (first and last days)

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

Name	Nikhil Vedprakash
Contact No	+91 7303201778
E-Mail	nikhil@easpl.co.in

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>>

The boiler installed is a "horizontal multi-tubular shell type boiler with membrane assembly" types that ensure 100% firing of biomass briquettes/rice husk, through intelligent combustion manager.

The boiler offers progressive combustion with distinct combustion zones making it the ideal solution for biomass combustion with higher moisture. This grate (dynamic step grate) offers the fuel flexibility and can burn complex agricultural biomass fuels like forest wastes, empty fruit bunches, spice waste, soya stock, and many other biomasses.

Table 1: Technical specification of the boiler

Technical Specification and Performance parameter of the Boiler		
Type of boiler		Water + Smoke Tube Type
Model		**EAZO-DSG**
Design Code		IBR 1950 with latest amendment
Type of grate		**Dynamic Step Grate (DSG)**
Combustion Control		**Through Intelligent Combustion Manager**
Peak Steam generation capacity (F & A 100 Deg C)	Kg/hr	4500
Avg Feed water Temp	Deg C	70
Boiler design Pressure	Kg/cm^2	10.54
Steam Pressure		
Safety valve Set Pressure	Kg/cm^2	10.2/ 10.5
Feeding Cut Off pressure switch setting	Kg/cm^2	8
Modulating pressure control range	Kg/cm^2	9-9.5
Net pressure available at the outlet of MSSV	Kg/cm^2	9
Primary Fuel Used		Briquette
Fuel Ultimate Analysis		Typical
Carbon		41.1
Hydrogen		6.1
Sulphur		0.17
Nitrogen		2.27
Oxygen		31.4
Moisture		12.75
Ash		6.22
Ash Fusion Temp. ^0C		> 1000 deg.C

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

COMBUSTION SYSTEM USED IN THE BOILER

The **combustion system** is the heart of the **energy plant**. Already since the mid 80's VYNCKE has been using its DWS, Dynamic Air-cooled Step-grate. This step-grate was designed and developed specifically for combustion of dry and solid fuels. This technology also proved very suitable for dealing with poor quality fuels that have high slagging and sintering properties.

The combustion chamber, DSG Grate is placed under and the furnace of the boiler. Moving cast iron grates which are Hydraulically driven are mounted in the air-cooled zones. These moving grates ensure uniform bed height and progression of the fuel on the grate.

The grate area is designed to cater each combustion parameter (residence time of fuel, speed & frequency of grate movement, quantity of air) can is regulated for respective fuels. Thus, the combustion process can be optimized easily during commissioning and ever after. Quantity of unburned fuel particles falling through the grate is minimised due to regulated fuel movement on the grate.

The Boiler is designed by VYNCKE designs and builds the entire energy plant from fuel storage to chimney, including the combustion and boiler technology, flue gas cleaning, power generation, and control and automation of the total plant.

Figure 2 Boiler's dynamically air-cooled grate

ADVANTAGES & FEATURES

a. Reliable, world class design

Combustion Engineering based on rich experience of over 100 years from Vyncke & Pressure part design based on IBR 1950.

b. Optimum combustion and maximum heat transfer by radiation

The spacious furnace allows a complete burn-out of fuel without having contact with the cold wall. The large heating surface of the furnace implies heat transfer by radiation. This ensures the temperature of the flue gas is already reduced considerably before entering the fire tubes. The system is designed to minimize slagging by avoiding localized heating.

c. Highest possible heat extraction

Radiation & Convection Heat Zones are designed for maximum recovery of heat limiting the outlet temperatures from the boiler.

d. Quiet combustion

Since the fuel is given sufficient time in each zone to burn completely, few unburned particles are carried along with the flue gases.

e. Independent Regulation of Fuel & Combustion Air

Separate regulation of the quantity of supplied fuel and combustion air is provided. The fact that the fuel and oxygen supply can be adjusted separately is essential to obtain optimal combustion.

f. Steady combustion & High Tolerance of Fuel Size in a given band

Due to the computer aided fuel feeding, the slow heating of the fuel and the combustion above the fuel bed, the quality of the combustion is hardly affected when the characteristics of the fuel (moisture content, granular size, density) are partly changed.

g. Automatic re-ignition without using an additional fuel

Ignition Vault and post combustion vault provide auto-ignition feature even after a standstill for a relatively long time. The fuel bed burns very slowly downwards and insulates itself with a thin layer of ash, which keeps the fuel mass glowing for automatic re-ignition.

h. Compact Design

The boiler is extremely compact in size and hence reduction in overall floor space and civil cost.

i. Safety aspect at its best

- Subject to very strict quality controls
- Single element type water level control provided
- Safety controls and interlocks provided through PLC based Automation

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

This project is a steam generation plant utilising biomass briquet as an energy source, where a fossil fuel-based steam generation plant is the baseline.

The Government of India has stipulated following indicators for sustainable development in the interim approval guidelines for such projects which are contributing to GHG mitigations. The Ministry of Environment, Forests & Climate Change, has stipulated economic, social, environment and technological well-being as the four indicators of sustainable development. It has been envisaged that the project shall contribute to sustainable development using the following ways:

There are social, environmental, economic and technological benefits which contribute to sustainable development.

- **Social benefits:**
  - The project activity helped to alleviate poverty in the area by creating employment opportunities for the local people during the construction, operation and maintenance phases and also through handling of biomass material to the project plant.
  - The project activity contributed to employment generation in the local area for both skilled & unskilled people for operation and maintenance of the plant.
  - It has created steady higher value jobs and skilled workers at the facility. The project activity is contributing to the national energy security by reducing consumption of fossil fuels.
  - The technology being used in the project is proven and safe for steam generation. An increase in such kind of projects shall enable all the technology suppliers to continuously innovate and modernize on the technology front.
  - The local people will know the technological advancement and will help in capacity building.
  - By discouraging use of coal and thereby mining of coal, the project activity reduces the exposure of coal miners to dangerous working conditions and toxic work environments.

Environmental benefits:

- The project activity is a renewable energy project, which utilizes biomass as a fuel for steam generation, a move that is voluntary and not mandated under current environmental laws of India.
- Since this project activity generates steam from green energy (biomass), it has positively contributed towards the reduction in (demand) use of finite natural resources like coal and furnace oil, minimizing depletion of these resources and in turn increasing its availability to other important purposes of the Indian economy and energy security. Therefore, this project activity helps to environment sustainability by avoiding GHG emissions in the atmosphere.
- Avoids global and local environmental pollution, leading to reduction of GHG emissions.
- The biomass from agricultural industrial mills in the vicinity are generally in excess and hence get disposed in unplanned ways including dumping into nearby rivers. As a result of such disposal and due to natural decay, in the absence of the project activity, the agricultural waste used in the project would otherwise have emitted methane in an uncontrolled open landfill site.

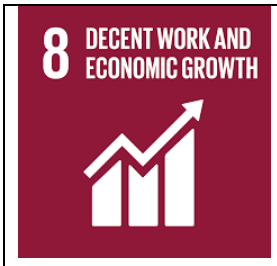
- **Economic benefits:**
  - The project is a clean technology investment decided based on carbon revenue support, which signifies flows of clean energy investments into the host country.
  - The project activity requires temporary and permanent, skilled and semi-skilled manpower at the project location; this will create additional employment opportunities in the region.
  - Success of these kind of project will provide new opportunities for industries and economic activities to be setup in the area. Apart from getting better employment opportunities, the local people will get better prices for their land, thereby resulting in overall economic development.
  - The project activity helps in conservation of fast depleting natural resources like coal and oil thereby contributing to the economic wellbeing of country as a whole.
  - The increase in demand of biomass exerted by the project activity has had a local effect on its price and generates additional revenue for the agricultural millers, which in turn benefits the local farmers in the area.
  - Reduction in energy cost
  - Lower operation cost of the plant

- **Technological benefits:**
  - The successful operation of project activity would lead to promotion of biomass energy-based steam generation and would encourage other entrepreneurs to participate in similar projects.
  - Increased interest in low grade waste energy projects will further push R&D efforts by technology providers to develop more efficient and better machinery in future.
  - The project activity leads to the promotion and demonstrates the success of waste energy-based projects in the region which further motivate more investors to invest in such power projects.

The project activity also contributes to the following sustainable development goals (SDGs):

Table 2: Contribution to the SDGs

SDG Goals	Description
	• The project activity will generate clean energy, which with increased share will increase the affordability at a cheaper rate to end user. • The project activity will utilize biomass energy to generate steam. The project activity will increase the share of renewable energy resource-based steam generation to global mix of energy consumption • Improvement in energy efficiency

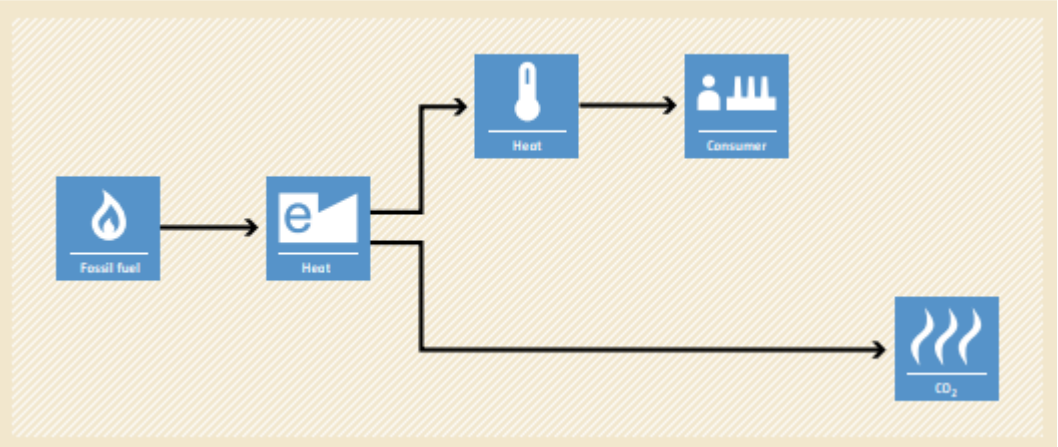
	• Decent work and economic growth. • This project activity generates additional employment for skilled and unskilled, also the project situated in remote area will provide employment opportunities to unskilled people from villages. • The training on various aspect including safety, operational issues and developing skill set will also be provided to employees • This project will achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value
	• Support domestic technology development, research and innovation in developing countries, including by ensuring a conducive policy environment for, inter alia, industrial diversification and value addition to commodities • Enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries • upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes.
	• Biomass is used in the project activity, unless otherwise channelized into projects like the one discussed in this document, do not find any major use elsewhere- and hence become waste products. • Using renewable (biomass) energy helps in repurposing of waste and contributes to the share of energy efficiency and reduction in GHG emissions.
	• Biomass based steam generation systems reduce the GHG emissions. • This project is expected to reduce CO2e emission 10,100 ton per year. • This project meets the SDG 13 goal by saving fossil fuel and produce clean energy.
	• Submission of this document in a global GHG reduction / removal standard (UCR), involving multiple agencies and partners across the globe (independent third-party auditors), for bringing in sustainable financing through the sale of carbon credits that can be generated from the project activity stands testimony to SDG 17.

B.3. Baseline Emissions>>

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

- Energy generation (thermal heat and / or electricity) by more carbon-intensive technologies based on fossil fuel. In case of retrofits or capacity addition, operation of existing renewable power units without retrofit and capacity addition.

BASELINE SCENARIO
Steam supplied to the plant is supplied by a more-GHG-intensive means.



PROJECT SCENARIO
Steam is generated and supplied to the plant using renewable energy technologies.

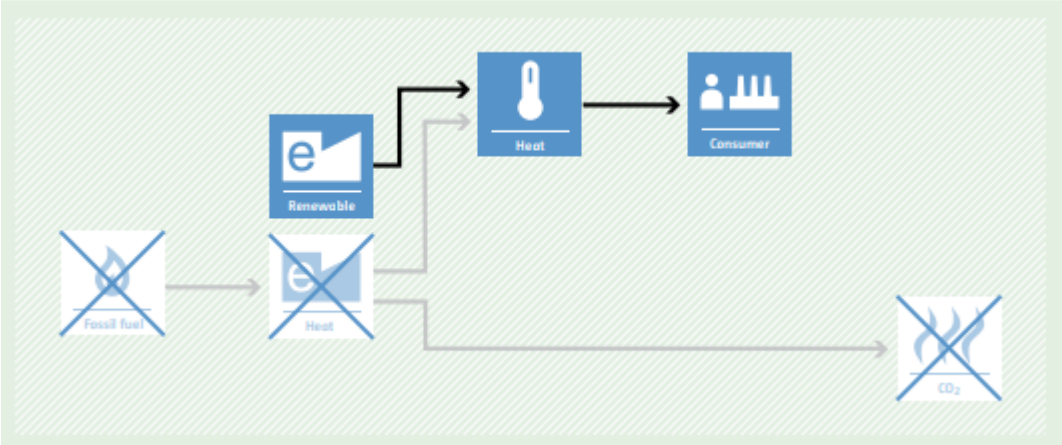


Figure 3 -Baseline and project scenarios

Thus, this project activity was a voluntary investment that replaced an equivalent amount of fossil fuel used to generate the steam for the plant. The project proponent was not bound to incur this investment as it was not mandatory by national and sectoral policies. Thus, the continued operation of the project activity would continue to replace fossil fuel-based steam generation and fight against the impacts of climate change. The Project Proponent hopes that carbon revenues from carbon credits will help repay the loans and help in the continued maintenance of this project activity.

The Project Proponent hopes that carbon revenues from 2022-2026 accumulated as a result of carbon credits generated will help repay the loans and in the continued maintenance of this project activity.

B.4. De-bundling>>

This project activity is not a bundled component of a larger project activity.

SECTION C. Application of methodologies and standardized baselines

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

SECTORAL SCOPE	01, Energy industries (Renewable/Non-renewable sources)
TYPE	I – Renewable Energy Projects
CATEGORY	AMS-I.C.: Thermal energy production with or without electricity --- Version 22.0

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

The project activity is thermal energy generation project using a biomass briquette-based steam generation boiler that displaces equivalent amount of thermal energy that would have been generated by a fossil fuel-based boiler. Since the project activity utilises biomass for the generation of thermal energy by displacing fossil fuel it meets the primary applicability criteria of the methodology.
The thermal generation capacity of project activity is currently 13.5 MWthermal which is less than the threshold of 45 MWthermal as per the applied methodology. The capacity limits specified in the methodologies apply to both existing and additional units within the project activity. In the present case of the project activity, a 4.5 TPH boiler is installed (greenfield)
The biomass used by the project plant is not stored for more than one year.
The project activity does not involve recovery and utilization of biogas for power/heat production.
The project activity is neither a co-generation nor co-firing system, therefore this condition is not applicable in the case of current project activity.
Steam generated using the biomass, is used for captive use. The steam produced in the project activity is utilized in the process of DRL. It is not delivered to any third party.
The project activity does not involve the use of any refrigerant within its boundaries and hence the given applicability clause in the methodology is not fulfilled here.
The PP is not the producer of the processed solid biomass fuel. The PP has a contract with the biomass briquette supplier for the supply of the same which will ensure that there is no double counting of emission reductions by the supplier.
Thermal energy generation capacity is determined by taking the difference between enthalpy of total output leaving the project equipment and the total enthalpy of input entering the project equipment.
The installed biomass boiler generates steam to meet the demand of steam recipient plant and displace fully the use of fossil fuel-based boilers. The project technology utilizes appropriate treatment systems to ensure exhaust gas and discharged water in compliance with national environmental regulations. Note that fossil fuel (i.e. furnace oil, coal, gas, etc) cannot be used for biomass fired boilers due to its specialized design of combustion chamber. The service level (e.g. temperature, pressure) of supplied steam in case of utilizing different types of renewable biomass residues is ensured by qualified boiler operators and is monitored by steam flow meter at recipient plant. The project activity will thus reduce Greenhouse gas (GHG) emissions associated with the combustion of fuel oil in baseline boilers.

The project activity claims emission reduction for the thermal energy production by renewable energy technologies (biomass boilers) that displace the use of fossil fuel-based boilers. This is in line with the applied methodology AMS I.C requirements.

C.3 Applicability of double counting emission reductions >>

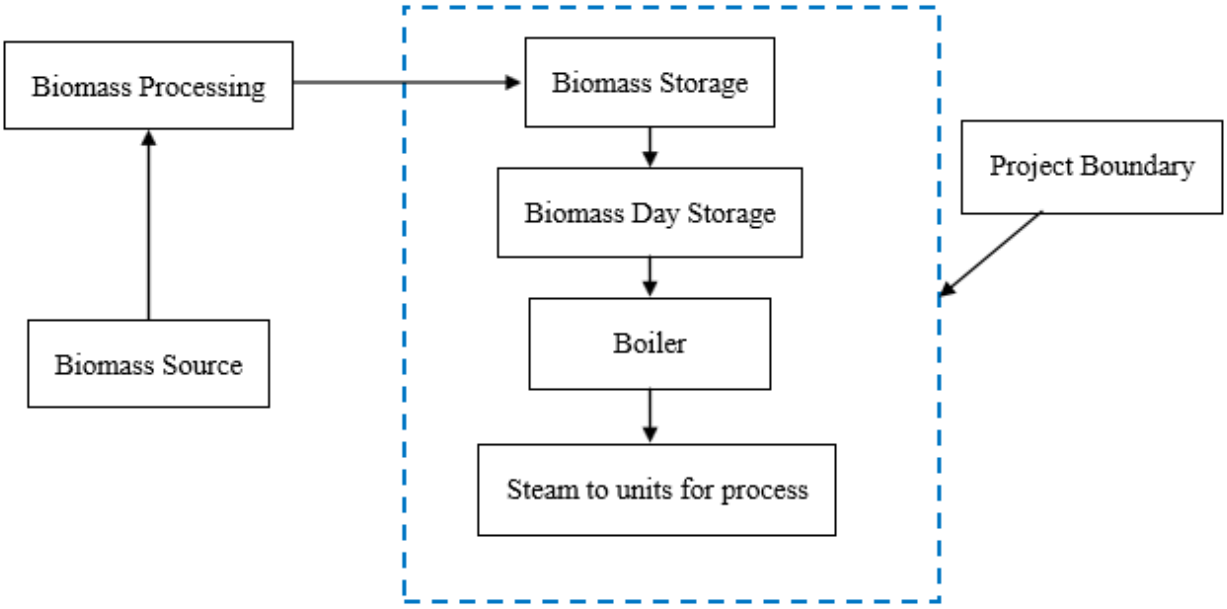
The project was not applied under any other GHG mechanism. Hence project will not cause double accounting of carbon credits (i.e., COUs), due to the following reasons:

- Project is uniquely identifiable based on its location coordinates,
- Project has a dedicated commissioning certificate and connection point,
- Project is associated with steam meters which are dedicated to the consumption point for the project developer.

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

The project boundary includes the physical, geographical site(s) of:

- Site of the renewable energy generation.
- Biomass based boiler, which starts from the biomass storage to the point of steam supply
- Biomass briquet storage facility



Leakage Emissions is not applicable as the project activity does not use technology or equipment transferred from another activity.

There is no registered or an application to register another small-scale carbon project activity with the same project participants in the same project category **within 10 km of the project boundary**, hence the project activity is not a de-bundled component of a large-scale project.

By using locally sourced GHG-neutral biomass briquet, the PP is successfully able to avoid the fossil fuel emissions and thereby GHG emissions due to in-house cogeneration energy requirements and vehicular emissions avoiding sourcing of biomass fuel from a large distance.

	Source	GHG	Included?	Justification/Explanation
Baseline	Emissions from burning non-renewable wood Emissions from animal manure stored on site	CO_2	Included	Major source of emission
		CH_4	Included	Major source of emission
		N_2O	Excluded	Excluded for simplification. This is conservative
Project Activity	Emissions from on-site steam use Emissions from residue from anaerobic digester composting	CO_2	Excluded	Steam is generated using biomass briquette to generate steam, hence these emissions are not accounted for. CO_2 emissions from the decomposition of organic waste are not accounted
		CH_4	Excluded	Excluded for simplification. This is conservative
		N_2O	Excluded	Excluded for simplification. This is conservative

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

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

- Renewable energy technologies that displace technologies using fossil fuels, wherein the simplified baseline is the fuel consumption of the technologies that would have been used in the absence of the project activity, times an emission factor for the fossil fuel displaced.

- In the case of an existing baseline cogeneration or trigeneration plant, the efficiency shall be calculated as the total annual energy produced over the last three years using the historical data as prescribed in paragraph 26 "of AMS-I.C. Small-scale Methodology: Thermal energy production with or without electricity Version 22.0 Sectoral scope(s): 01"

Emission Reductions (ERy) The emission reduction due to the project activity is calculated as the difference between the baseline emissions and the sum of the project emissions and the leakage:

ERy = BEy- (PEy+ LEy)

BEy= Baseline emissions in year y (t CO_2e)

As mentioned in the methodology AMS I.C, *"Small-scale Methodology: Thermal energy production with or without electricity Version 22.0 Sectoral scope(s): 01"*

The baseline emissions for steam produced using fossil fuels *are calculated as follows:*

$$BEy = (HGy * EFCO_2) / \eta_{th}$$

Where:

HGy = The net quantity of heat supplied by the project activity during the year in TJ. It is calculated as product of quantity of steam generated and net enthalpy of steam. The net enthalpy of steam is calculated as difference of enthalpy of steam and enthalpy of feedwater.
The enthalpy of steam is calculated from steam pressure and steam temperature.

$EFCO_2$ = The CO_2 emission factor per unit of energy of the fuel that would have been used in the baseline plant in (tCO_2/TJ), obtained from reliable local or national data if available, otherwise, IPCC default emission factors are used.

η_{th} – The efficiency of the boiler using fossil fuel that would have been used in the absence of the project activity (TOOL09 - Methodological tool Determining the baseline efficiency of thermal or electric energy generation systems). For new coal fired boiler -0.85

PEy = Project activity emissions. The GHG emissions due to the combustion of biomass is neutralized by the sequestration done during the growth of the biomass, thereby making it a carbon neutral fuel. Further the rice husk and bagasse contain negligible quantities of nitrogen and sulphur, the other greenhouse gas from the combustion of biomass can be considered as negligible. Therefore, essentially there would not be any GHG emissions due to the project activity within the project boundary.

However, as per paragraph 31 under Section 5.2 of "TOOL16 Methodological tool: Project and leakage emissions from biomass Version 05.0", - "*For microscale and small-scale project activities, apply a default emission factor of 0.0142 tCO_2/tonne of biomass".*

Project Emission PEy

Project emissions calculated as given below
Sample calculation for the month of December 2022

Description	Quantity
Quantity of dry biomass consumed in the month December 2022	468.02 t
Default emission factor	0.0142 tCO2 / tonne of biomass
PEy for the month of Dec 2022	6.65 tCO2/y

Leakage Emission LEy

LEy = Leakage emissions. Leakages is to be considered if the energy generating equipment is transferred from another activity or if the existing is transferred to another activity. There is no transfer of energy generating equipment or existing equipment to another activity. Since biomass residues are not procured from (transported) over a distance of more than 200 kilometres due to the implementation of the project activity, leakage can be neglected.

Hence **LEy = 0**

Baseline Emission BEy
Sample calculation for the month of December 2022

Description		Quantity
Enthalpy of steam	=	2793.5 kJ/kg (at 08.0 kg/cm2 and 180.0 ^{0}C)
Steam production in the month of Dec-2022	=	2,037 t
Enthalpy of feed water	=	314.8 kJ/kg (@11.0 kg/cm^2 and 75 ^{0}C)
HGy, the net quantity of heat supplied by the project activity during the year in TJ.	=	2,037*(2793.5-314.8)/10^6 = 5.05 TJ
EF$_{CO2}$ The CO_2 emission factor	=	96.1 tCO2/TJ IPCC 2006 guidelines for National Greenhouse Gas inventories got stationary combustion
Boiler Efficiency	=	0.85% *(TOOL09-Methodological tool: Determining the baseline efficiency of thermal or electric energy generation systems, Version 03.0)*
BEy Baseline Emission	=	5.055*96.1/0.85 = 570.84 t CO_2e

Estimated Emission Reduction ERy for the month of December 2022

ERy = BEy- (PEy+ LEy)

= 570.84 – (6.65+0) = 564.19 CoUs

Year	Net Export (Acutual)	Baseline emissions	Project emissions	Leakage		Emission reductions
	t of steam/year	(t CO_2e)	(t CO2e)	(t CO_2e)		(t CO_2e)
26/11/2021 to 31/12/2021	2,155.03	603.92	6.10	0.00		597.82
01/01/2022 to 31/12/2022	22,605.53	6,334.95	68.90	0.00		6,266.05
Total	**24,761**	6,938.87	75.00	0		**6,863.87**

C.6. Prior History>>

The project activity has not applied to any other GHG program for generation or issuance of carbon offsets or credits for the said crediting period

C.7. Monitoring period number and duration>>

First Issuance Period: 01 years, 2 months – 26/11/2021 to 31/12/2022

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

There is no change in the start date of crediting period.

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

No changes

C.10. Monitoring plan>>

USE THE FOLLOWING TABLES TO FOR PARAMETERS BEING MONITORED OR USED IN EMISSION REDUCTIONS DETERMINATION

According to the approved methodology AMS-I.C – Thermal energy production with or without electricity (Version 22), the following parameters will be monitored:

Parameters	Description
$Q_{S,y}$	Quantity of steam supplied per year measured at recipient's end
$T_{steam,y}$	Temperature of steam at the recipient's end
$P_{steam,y}$	Pressure of steam
$E_{steam,y}$	Enthalpy of the saturated steam supplied to the recipient
$T_{Feedwater,y}$	Temperature of boiler feed water
$E_{Feedwater,y}$	Enthalpy of feed water
$EG_{thermal,y}$	Net quantity of thermal energy supplied by the project activity during the year y
$B_{Biomass,y}$	Net quantity of biomass consumed in year y (on dry basis)
$MC_{biomass}$	Moisture content of the biomass

The PP and the biomass producer are bound by a contract that shall enable the PP to monitor the source of the briquette to account for any emissions associated with solid biomass fuel production. Such a contract also ensures that there is no double-counting of emission reductions. The PP is not the producer of the briquette.

The monitoring and recording of the required parameters are carried out by trained personnel who are managed by the Project Managers at DRL. All measurements will use calibrated measurement equipment that are maintained regularly and checked for its functioning which will meet the minimum requirement of the methodology. All indicators of importance for controlling and reporting of projects performance have been incorporated in the monitoring plan (Monitoring Report during verification) as well as indicated in the planned formal set of monitoring protocol and work instructions.

Data/Parameter	Date of commissioning of biomass boiler
Data unit	Date as per boiler test report.
Description	Actual date of commissioning of the project
Source of data Value(s) applied	Monitoring Report As and when commissioned
Measurement methods and procedures	The construction processes are maintained from its initiation to completion dates for the boiler unit. Thus, the start date of each of the unit installed is recorded in the monitoring report.

Monitoring frequency	As and when commissioned and fixed and recorded in the monitoring report
Purpose of data	To estimate baseline emissions

Data / Parameter:	$Q_{biomass}$
Data unit:	MT
Description:	The quantity of biomass used to generate steam in the boiler
Source of data:	Plant records and log books receipts
Measurement procedures (if any):	Monitoring: The quantity of biomass fed into the boiler is controlled. Data type: Measured
Monitoring frequency:	Daily
QA/QC procedures:	The amount of biomass used can be cross checked by the purchase orders and stock inventory for briquette/rice husk
Any comment:	-

Data / Parameter:	**Sp**
Data unit:	Kg/cm^2 boiler
Description:	Pressure of the steam at the outlet of the biomass boiler
Source of data:	Log book
Measurement procedures (if any):	The steam pressure would be measured using pressure gauge. This parameter is used to calculate the Net Enthalpy of steam. Monitoring: Log book Data type: Monitored
Monitoring frequency:	Daily/hourly
QA/QC procedures:	The parameter is monitored and logged in log sheets. Based on the logged data, a report consisting of the parameter are prepared by Shift in charge in hard copy and are forwarded to manager on monthly basis. The data used is reviewed by conducting an inter department review meeting once in 6 months.
Any comment:	-

Data / Parameter:	T_{steam}
Data unit:	^0C
Description:	The temperature of steam
Source of data:	Plant Log Sheets
Measurement procedures (if any):	Steam temperature is measured in the plant premises by using temperature gauge. This parameter is used to calculate the Net Enthalpy of steam. Monitoring: Log book Data type: Monitored
Monitoring frequency:	Daily/hourly
QA/QC procedures:	The parameter is monitored and logged in log sheets. Based on the logged data, a report consisting of the parameter are prepared by Shift in charge in hard copy and are forwarded to manager on monthly basis. The data used is reviewed by conducting an inter department review meeting once in 6 months.
Any comment:	-

Data / Parameter:	$T_{feedwater}$
Data unit:	^0C
Description:	The temperature of feed water
Source of data:	Plant Log Sheets
Measurement procedures (if any):	Feed water temperature is measured in the plant premises by using temperature gauge. This parameter is used to calculate the Net Enthalpy of feedwater. Monitoring: Log book Data type: Monitored
Monitoring frequency:	Daily/hourly
QA/QC procedures:	The parameter is monitored and logged in log sheets. Based on the logged data, a report consisting of the parameter are prepared by Shift in charge in hard copy and are forwarded to manager on monthly basis. The data used is reviewed by conducting an inter department review meeting once in 6 months.
Any comment:	-

Data / Parameter:	h_g
Data unit:	kJ/kg
Description:	The enthalpy of steam
Source of data:	Plant Log Sheets
Measurement procedures (if any):	Type: Calculated Data type: Monitored
Monitoring frequency:	Daily/hourly
QA/QC procedures:	The parameter is monitored and logged in log sheets. Based on the logged data, a report consisting of the parameter are prepared by Shift in charge in hard copy and are forwarded to manager on monthly basis. The data used is reviewed by conducting an inter department review meeting once in 6 months.
Any comment:	-

Data / Parameter:	h_f
Data unit:	kJ/kg
Description:	The enthalpy of feed water
Source of data:	Plant Log Sheets
Measurement procedures (if any):	Type: Calculated Data type: Monitored
Monitoring frequency:	Daily/hourly
QA/QC procedures:	The parameter is monitored and logged in log sheets. Based on the logged data, a report consisting of the parameter are prepared by Shift in charge in hard copy and are forwarded to manager on monthly basis. The data used is reviewed by conducting an inter department review meeting once in 6 months.
Any comment:	-