Verification Report for

Project : 36 MW Biomass Based Grid Supply Power Project by SDSSSKL, Shirol, India.

UCR Project ID : 402

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| Name of Verifier | SQAC Certification Pvt. Ltd. |
| Date of Issue | March 01, 2024 |
| Project Proponent | Shree Datta Shetkari Sahakari Sakhar Karkhana Ltd. |
| UCR Project Aggregator | Progressive Management Consultants |
| Work carried by | Mr. Santosh Nair |
| Work reviewed by | Mr. Praful Shinganapurkar |

**Summary**:

SQAC Certification Pvt. Ltd. has performed verification of the “36 MW Biomass Based Grid Supply Power Project by SDSSSKL, Shirol, India”. The purpose of the project activity is to generate electricity using renewable biomass and thereby reduce GHG emissions by displacing fossil fuel dominated grid-based electricity with biomass based renewable electricity.

The project activity meets the following UN SDG’s:

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Verification for the period**:** **01/04/2013 to 31/12/2022** (09 Years, 09 Months)

The GHG emission reductions were calculated on the basis of UCR Standard for Baseline Grid Emission Factor, CDM UNFCCC Methodology, ACM0006: Electricity and heat generation from biomass, Ver 16.0. The verification was done remotely by way of video calls / verification, phone calls and submission of documents for verification through emails.

SQAC is able to certify that the emission reductions from 36 MW Biomass Based Grid Supply Power Project by SDSSSKL, Shirol, India, (UCR ID – 402) for the period **01/04/2013 to 31/12/2022** amounts to **7,37,471 tCO2 (7,37,471 CoUs)**

**Detailed Verification Report**:

**Purpose:**

The project entails the establishment of a 36 MW renewable biomass (bagasse) electricity generation cogeneration facility by M/s. Shree Datta Shetkari Sahakari Sakhar Karkhana Ltd (SDSSSKL). Its objective is to produce electricity without fossil fuels, utilizing renewable biomass, thus mitigating greenhouse gas emissions by substituting grid-based electricity, which relies predominantly on fossil fuels, with renewable biomass-generated electricity.

The UCR project activity's operational commencement is marked by the initial commercial power supply to the grid, which commenced on 11/08/2011 (as indicated in the Power Purchase Agreement dated 21/06/2013), although grid connectivity was established earlier on 04/08/2011. During a standard sugarcane crushing season, the facility has a gross power generation capacity of 33.50 MW, which increases to 36 MW during the off-season.

In a typical sugarcane crushing season, the gross power generation capacity is 33.50 MW, and in the

off-season, it is 36 MW. Captive consumption is typically 11 MW and 3.5 MW during the on- and off-season respectively while approximately 22.50 MW and 32.50 MW are exported to the state grid, i.e. Maharashtra State Electricity Distribution Limited (MSEDL).

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**Location of project activity:**

Country : India

District : Kolhapur

Village : Shirol

Tehsil : Shirol

State : Maharashtra

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**Scope:**

The scope covers verification of emission reductions from the project - 36 MW Biomass Based Grid Supply Power Project by SDSSSKL, Shirol, India, (UCR ID – 402).

**Criteria:**

Verification criteria is as per the requirements of UCR Standard.

**Description of project:**

The UCR project activity is a grid-connected bagasse-based cogeneration power plant with a high-pressure steam turbine configuration. The UCR project activity is the electricity generation capacity and the installation of facilities for allowing captive use and export of electricity to the electricity grid. The high-pressure boilers are fired by bagasse, a byproduct from the sugar manufacturing process to generate steam, which in turn powers the steam turbine to generate power.

The UCR project activity involves the installation of a 36 MW turbo generator along with high pressure 110 kg/cm2 (g) capacity boiler.

The technology of biomass residue-based high steam pressure power generation itself is known and in use in India. The use of a high-pressure system allows for increased efficiency levels for electricity generation.

The project is a green field renewable energy power generation project connected to the grid and supplies electricity to the grid and is used for captive purposes. The project activity is generating electricity using biomass (sugar factory residues) with a 1x180 TPH single drum, Travelling Grate boiler using a 36000 KW, 8 HP turbine whose capacity will be governed at MW.

On an annual average basis, the project exports around 1077528 MWh/yr to the Indian electricity grid. Power is generated and supplied in the sugar season and off-season at 11 kV and stepped-up on-site to 132 kV before being transmitted to the nearby Jaysingpur sub-station located at Kolhapur.

**United Nations Sustainable Development Goals:**

The project activity generates electrical power using Biomass, thereby displacing non-renewable fossil resources resulting in sustainable, economic and environmental development. In the absence of the project activity an equivalent amount of power generation would have taken place through fossil fuel dominated power generating stations. Thus, the renewable energy generation from project activity will result in reduction of the greenhouse gas emissions.

Positive contribution of the project to the following Sustainable Development Goals:

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| **Development Goals Targeted** | **SDG Target** | **Indicator (SDG Indicator)** |
| **SDG 7: Affordable and Clean Energy**  A yellow sun with a power button  Description automatically generated | **7.2:** By 2030, increase substantially the share of renewable energy in the global energy mix  **Target: Renewable Power supplied to the grid in the monitored period =1077528 MWh** | **7.2.1**: Renewable energy share in the total final energy consumption |
| **SDG 8: Decent Work and Economic Growth** | **8.5** By 2030, 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. **Target:**   * Training staff annually * Employment of staff | **8.5.1**: Average hourly earnings of female and male employees, by occupation, age and persons with disabilities. |
| **SDG 09: Industries, Infrastructure and Innovation** | 9.2: Promote inclusive and sustainable industrialization and, by 2030, significantly raise industry’s share of employment and gross domestic product, in line with national circumstances, and double its share in least developed countries | The project activity provides employment to people 115 villages in the area. |
| **SDG 13: Climate Action** | 13.2: Integrate climate change measures into national policies, strategies and planning  **Target: 737471 tCO2 = Quantity of tCO2 reduced in this monitored period** | **13.2.1**: Number of countries that have communicated the establishment or operationalization of an integrated policy/ strategy |

**Technical details of the project activity**

**Boiler Details:**

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| Manufacture | IJT (Isgec John Thompson) make 180 TPH High pressure Boiler (MR/14914) |
| Type | Single- drum, water tube, Membrane wall, natural circulation, Balanced draught, Top Supported, Travelling Gate boiler |
| Net Steaming capacity at MCR (kg/hr) for Bagasse firing | 180,000 |
| Steam temperature at super heater outlet (Deg C) | 540± 5 |
| Steam Pressure at main steam stop value (kg/cm2) (g) | 109 |
| Peak Capacity of Boiler (Kg/hr) | 198,000 |
| Minimum possible duration for peak capacity/Shift (8 hrs) | 30 Minutes |

**Turbine Details:**

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| Make | 36 MW Simense Make |
| Type | Extraction cum condensing |
| Steam pressure at the TG inlet | 105 ATA |
| Steam temperature at the TG inlet | 535º C |
| Exhaust steam pressure | 0.064 ATA |
| Steam inlet quantity | 179.51 TPH |
| **Gear Box** | |
| Rated Power | 36,000 KW |
| **Energy production** | |
| Gross power | 33.50 (season); 36 MW (off – Season) |
| Auxiliary consumption | 11.00 MW (Season); 3.5 MW (off-season) |
| Net power for export after auxiliary consumption | 22.5 MW (season); 32.50 MW (off-season) |

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**Level of Assurance:**

The verification report is based on the information collected through interviews conducted over video calls / phone calls, supporting documents provided during the verification, Project Concept Note (PCN) / Monitoring Report (MR), submitted to SQAC. The verification opinion is assured provided the credibility of all the above.

Review of the following documentation was done by SQAC Verifier, Mr. Santosh Nair, who is experienced in such projects.

**Documentation Verified:**

* Project Concept Note (PCN)
* Monitoring Report (MR)
* JMR’s
* Month wise Quantity of biomass residue combusted in the project plant.
* Environmental Clearance
* Commissioning Certificate
* Calibration Certificates
* Data provided upon request of all the documents of the related project.
* MIS Report
* Power Purchase Agreement
* Invoice

**Sampling:**

Not applicable

**Person interviewed:**

Mr. Vijay Ingle – Co-generation Manager: Shree Datta Shetkari Sahakari Sakhar Karkhana Ltd.

Mr. Dheeraj Patil – Instrument Engineer: Shree Datta Shetkari Sahakari Sakhar Karkhana Ltd.

Mr. Yogesh Hulgeri – Electrical Engineer: Shree Datta Shetkari Sahakari Sakhar Karkhana Ltd.

**Corrective Action Requests (CARs)**

Corrective Action Requests (CARs) and their resolutions are listed below:

There is only 1 CAR:

***CAR 1***:

The net quantity of electricity supplied to the grid as per JMR & Invoice is not matching with the ER statement for the Jan 2013 to March 2013.

Response from Project Participant

The data pertaining to those 3 months are not available as it was dealt with a third party. The only alternative is to ignore these 3 months. The correction has been made in the MR & ER sheet and accordingly Monitoring Report (V02) has been released after revising the crediting period from 01/04/2013 to 31/12/2022 due to mismatch of figures.

Conclusion by Verification Team

Verified Monitoring Report (V02) for correction and found to be matching as per requirement. Hence Corrective Action Request CAR-1 is closed.

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**Applied methodologies and standardized baselines:**

UCR Protocol Standard Baseline

SECTORAL SCOPE - 01 Energy industries (Renewable/Non-renewable sources)

TYPE I - Renewable Energy Projects (Large Scale)

CATEGORY - ***ACM0006 Electricity and heat generation from biomass, Version 16.0***

This methodology is applicable to project activities that operate biomass

(co-) fired power and-heat plants. The project activity includes the installation of new plants at a site where currently power or heat generation occurs. The new plant replaces or is operated next to existing plants (capacity expansion projects). Project types included under this methodology are co-generation of power and heat using biomass. Typical activities include capacity expansions, as is the the current UCR project activity.

UCR CoU Standard is used to determine the baseline grid emission factor for the 2013-2022 period.

**Application of methodologies and standardized baselines**

* The project activity is a power generation project using a biomass (bagasse) and displaces CO2 emissions from electricity generation in power plants that are displaced due to the project activity. Since the project activity utilises biomass (bagasse) for the generation of power and supplies it to the local grid, it displaces fossil fuel (coal), and hence it meets the primary applicability criteria of the UCR and UNFCCC CDM methodology. The project is also included in the positive list of approved types of activities of the UCR CoU Standard.
  + The project activity is a power-and-heat plant that encompasses cogeneration plants, i.e. a power-and-heat plant in which at least one heat engine simultaneously generates both process heat and power. The total installed capacity of project activity is 36MW which is acceptable as per the applied large-scale methodology.
  + The installation of a new biomass residue fired power generation unit, which replaces existing power generation capacity fired with fossil fuel as in the project plant (power capacity expansion projects) is also included in this methodology.
  + For the purposes of this methodology, heat does not include waste heat, i.e., heat that is transferred to the environment without utilization, for example, heat in flue gas, heat transferred to cooling towers or any other heat losses.
  + The biomass used by the project plant is not stored for more than one year. The biomass used by the project plant is not processed chemically or biologically (e.g., through esterification, fermentation, hydrolysis, pyrolysis, bio or chemical degradation, etc.) prior to combustion.
  + The Project Activity uses biomass residues from a production process (e.g., production of sugar), and the implementation of the project does not result in an increase of the processing capacity of (the industrial facility generating the residues) raw input (e.g., sugar) or in other substantial changes (e.g., product change) in this process.
  + The project activity unit does not co-fire fossil fuel and/or does not exceed the limit of 25% co-firing fossil fuel criteria as per the UCR Protocol for such projects.
  + Biomass generated power is used for direct grid supply and for meeting the captive needs at the facility. The project activity involves the grid-connected bagasse-based electricity generation capacity involving the installation of facilities for allowing the export of electricity to the regional grid.
  + Biomass is not sourced from dedicated plantations. The existing installed turbogenerators are fired by bagasse, a by-product of the sugarcane processing and a biomass residue. Biomass used by the project plant is limited to biomass residue (bagasse).
  + Bagasse is burnt in boilers as generated from the sugar mill and does not require any specific technology for its preparation before combustion. No fuel preparation equipment has been installed at site for preparation of bagasse. Hence no significant energy quantities are required to prepare the biomass residues for fuel combustion.
  + The project activity also does not include any GHG emissions related to the decomposition or burning of biomass. The baseline heat emissions for the project activity are not included in the project boundary nor does it claim for emission reductions from heat.

**Applicability of double counting emission reductions**

The biomass-based boiler and turbine are constructed by the project proponent within the project boundary. The biomass-based boiler, turbine and energy meters have unique IDs, which is visible on the units. The generated electricity is measured using energy meters which also have unique serial numbers.

Additionally, the same has been stated in the undertaking provided in the Double Counting Avoidance Assurance Document (DAA) by SDSSSKL dated 23/12/2023.

**Project boundary, sources and greenhouse gases (GHGs)**

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

1. All plants generating power and/or heat located at the project site fired with biomass, fossil fuels or a combination of both;
2. All power plants connected physically to the electricity system (grid) that the project plant is connected to.

**Leakage Emissions (LEy)**

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

Hence **LEy = 0**

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|  | **Source** | **GHG** | **Included?** | **Justification/Explanation** |
| BASELINE | GHG Emissions from fossil fuel in Grid Baseline Power Generation. | CO2 | **Included** | **Major source of GHG emissions** |
| CH4 | Excluded | Excluded for simplification. This is conservative. |
| N2O | Excluded | Excluded for simplification. This is conservative. |
| Uncontrolled burning or  decay of surplus biomass residue. | CO2 | Excluded | Excluded for simplification. This is conservative. |
| CH4 | Excluded | Excluded for simplification. This is conservative. |
| N2O | Excluded | Excluded for simplification. This is conservative. |
| PROJECT ACTIVITY | Emissions from Biomass  Project Activity  On-site fossil fuel and electricity consumption  due to the project activity (stationary or mobile)  Off-site transportation  of biomass during  cultivation | CO2 | **Included** | Fossil fuel co-fired with biomass is included as a major project emission source.  Off-site transportation of biomass during cultivation using default emission factor as per the methodology. |
| Combustion of biomass residue for electricity  and / or heat generation  Storage of biomass Residue  Wastewater from the treatment of biomass. | CH4 | Excluded | No fossil fuel / electricity is consumed at the project site due to the project activity. No biomass residue from off-site will be used for the project activity.  Excluded for simplification. This is conservative.  Wastewater is treated aerobically. |
| N2O | Excluded | Excluded for simplification. This is conservative. |

**Project Emissions (PEy)**

The project emissions (PEy) under the methodology may include:

* CO2 emissions from transportation of biomass and/or biomass residue to the project site,
* CO2 emissions from on-site consumption of fossil fuels due to project activity,
* CO2 emissions from electricity consumption at the project site that is attributable to the project activity and
* CH4 emissions from combustion of biomass.

Where:

**PETy** = are the CO2 emissions during the year y due to transport of the biomass to the project plant in tons of CO2,

**PETy** = Default project emissions as per UCR notification dated 04/10/2023 has been applied following the provisions from the TOOL12,

* *For large-scale project activities, apply a net-to-gross adjustment of 10%, i.e. multiply the emission reductions determined based on the applied methodology by 0.9 to determine the final amount of emission reductions that can be claimed.*

**PEFFCO2,** y = are the CO2 emissions during the year y due to fossil fuels co-fired by the generation

facility in tons of CO2,

**PEEC,y**= are the CO2 emissions during the year y due to electricity consumption at the project site

that is attributable to the project activity in tons of CO2,

**GWPCH4** = is the Global Warming Potential for methane valid for the relevant commitment period and,

**PEBiomass,CH4,y** = are the CH4 emissions from the combustion of biomass during the year y.

*When the project activity exceeds the co-firing limit of 25% for any month during the monitored period, the emission reductions have not been considered, in keeping with the principle of conservativeness. Also the project emissions have been included for the said month on account of*

*coal usage being a major source of emissions for the same. The emission reduction calculations sheet has been updated for the same.*

The project activity also doesn’t include the CH4 emissions from the combustion of biomass.

Hence,

**PE FFCO2, y**= **PE FC,j,y**= are the CO2 emissions during the year y due to fossil fuels co-fired by the generation facility in tons of CO2, in process j during the year y (tCO2 / yr);

**𝑃𝐸 𝐹𝐶,𝑗,𝑦 = ∑ 𝐹𝐶𝑖,𝑗,𝑦 × 𝐶𝑂𝐸𝐹𝑖,y**

**𝑖**

**FC i,j,y** = the quantity of fuel type i combusted in process j during the year y (mass or volume unit / yr); **COEF i,y**= the CO2 emission coefficient of fuel type i in year y (tCO2 / mass or volume unit);

**i** = the fuel types combusted in process j during the year y.

The coefficient of emission factor of the fuel is calculated in accordance with the option ‘B’ of the “Tool to calculate project or leakage CO2 emissions from fossil fuel consumption” which states that “The CO2 emission coefficient **COEF**i,y is calculated based on net calorific value and CO2 emission factor of the fuel type i as follows:”

**COEF i,y = NCV i,y X EF CO2,i,y**

Where:

**COEF i,y**= the CO2 emission coefficient of fuel type i in year y (tCO2/ mass or volume unit);

**NCV i,y**= the weighted average net calorific value of the fuel type i in year y (GJ/ mass or volume unit);

**EF CO2,i,y**= weighted average CO2 emission factor of fuel type i in y

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| CO2 emission factor for coal | 0.09970 tCO2e/GJ | Confirmed from IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories (99,700kg/TJ) |
| Hence, the project emission  estimate on account of firing of coal fines is calculated as: | COEFi,y = NCVi,y X EFCO2,i,y | = 0.0142358 GJ/kg x 0.09970 tCO2e/GJ  = 0.001419309 tCO2e/kg |

Hence,

**PEFFCO2,y** = 0,

**PEEC, y** = 0 and,

**PE Biomass,CH4,y** = 0

**Leakage Emissions (LEy )**

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

Hence

**LEy** = Leakage emissions = 0

**Establishment and description of baseline scenario (UCR Protocol)**

The baseline scenario identified is:

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

The baseline emissions due to displacement of electricity are determined by net quantity of electricity generation as a result of the project activity (incremental to baseline generation) during the year y in MWh times the CO2 emission factor for the electricity displaced due to the project activity during the year y in tons CO2/MWh

Given that power generation for internal consumption is part of the present project activity, emission reductions are only claimed from on-site incremental power generation that is injected into the grid. Therefore, the baseline scenario is the emission of GHG from the present electricity generation mix of the electricity grid.

Direct off-site emissions in the project activity arise from the biomass residue transport. However,

the biomass is generated from the in-house processes pertaining to the sugar processing industry,

hence, biomass residue transport is only accounted if biomass residue is imported from outside the project boundary. The same type of CO2 emission occurs during transportation of coal from coalmines to thermal power plants (supplying power to state grid). The biomass is collected from the nearby sources and is transported by trucks to the project site.

Each truck laden with biomass is weighed on the electronic weighbridge and the corresponding readings are noted in the plant log books. For the current monitoring period no biomass residue was collected from outside, thus for this monitoring period, the value of this parameter is zero, however, using the UCR principles of conservativeness, transport emissions are calculated by applying a net-togross adjustment of 10%, i.e. multiply the emission reductions determined based on the applied methodology by 0.9 to determine the final amount of emission reductions. The reported values of the quantity of biomass transported can be verified against the plant records.

**Emission Reductions (ERy)** is the emission reduction due to the project activity are 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 CO2e)

As mentioned in the methodology the baseline emissions are calculated as follows:

**BEy = EGpj,y \* EF grid,y**

Where:

**EG grid,y** = Quantity of net electricity generation that is fed into the local grid as a result of the

implementation of the project activity in year y (MWh)

**EFgrid,y** = The CO2 emission factor for grid connected power generation in year y calculated using UCR Standard emission factor (0.9 tCO2/MWh).

**LEy** = Leakage emissions = 0

For this methodology, it is assumed that transmission and distribution losses in the electricity grid are not influenced significantly by the project activity and are therefore not accounted for.

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| **Year** | **GENERATION (MWh)** | **Auxiliary (MWh)** | **Net Export to Grid (MWh)** | **Coal  Consumed (Tonnes)** |
| 2013 | 56743.481 | 4329.246 | 40866.233 | 19748.31 |
| 2014 | 174747 | 14725.8 | 124413.599 | 26730.08 |
| 2015 | 174438.472 | 14126.439 | 127576.51 | 13371.923 |
| 2016 | 166834.502 | 13124.631 | 119097.826 | 13392.825 |
| 2017 | 112671.983 | 8863.5 | 78521.152 | 3943.213 |
| 2018 | 153084.525 | 10424.7965 | 110550.7219 | 2290.54 |
| 2019 | 154427.19 | 12125.3345 | 114798.3356 | 2565 |
| 2020 | 169290.48 | 13788.54 | 122602.6857 | 10655 |
| 2021 | 159057.475 | 14747.007 | 132590.3344 | 1196.463 |
| 2022 | 149870.3625 | 12342.777 | 106510.7644 | 1445.1 |
| **Total** | **1471165.471** | **118598.071** | **1077528.162** | **95338.454** |

**Emission Reductions:**



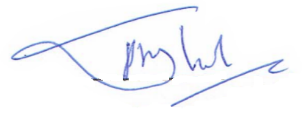
Calculated renewable power (MWh) to grid supplied = 1077528 MWh

Calculated total baseline emission reductions (Bey) = 969771 tCO2eq

**Total Emission Reductions (ERy) =** **7,37,471 CoUs (7,37,471 tCO2eq)**

**Conclusions**:

Based on the audit conducted on the basis of UCR Protocol, which draws reference from UCR Standard for Baseline Grid Emission Factor, CDM UNFCCC Methodology ACM0006: Electricity and heat generation from biomass, Ver 16.0, the documents submitted during the verification including the Data, Project Concept Note (PCN) / Monitoring Report (MR), SQAC is able to certify that the emission reductions from the project - 36 MW Biomass Based Grid Supply Power Project by SDSSSKL, Shirol, India (UCR ID – 402) for the period  **01/04/2013 to 31/12/2022** amounts to **7,37,471 tCO2 (7,37,471 CoUs)**

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Santosh Nair Praful Shinganapurkar

Lead Verifier (Signature) Senior Internal Reviewer (Signature)

Date: 01/03/2024