



**Verified Carbon
Standard**

VERIFICATION REPORT FOR RECAST ENERGY LOUISVILLE FUEL SWITCH FROM COAL TO BIOMASS FOR THERMAL ENERGY



Document Prepared

By SCS Global Services

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Summary:

The Recast Energy Louisville Fuel Switch From Coal to Biomass for Thermal Energy Project (the Project) is a thermal energy generation project fueled with locally available forestry and agricultural cellulosic residues (i.e. primary mill residues, logging residues, and crop residues), and is located at the Lubrizol Advanced Material, Inc. facility in Louisville, Kentucky (the Facility). The Project location is on land owned by one of the project customers (Lubrizol) and then subsequently leased back to the Project Proponent, Recast Energy Louisville, LLC. The Project is owned and operated by Recast Energy Louisville, LLC. Thermal energy from the biomass system displaces thermal energy generated by the coal-fired boiler system. The thermal energy generated from the biomass boiler is sold to Lubrizol and Zeon Chemicals (the project customers). The pre-project scenario consisted of the project customers receiving thermal energy that was generated by coal and supplemented with natural gas when needed. The Project achieves GHG emission reductions by displacing thermal energy that would have been generated from the Boiler #4 fossil fuel boiler. The Project's crediting period is April 1, 2013 through March 31, 2023.

The purpose of verification was to ensure the Project was implemented in accordance with the criteria stated below and meets the requirements of the Verified Carbon Standard (VCS) program.

The verification process consisted of the independent third-party assessment of the Project design implementation and emission reduction assertion against the criteria stated in the VCS Program Guide v 4.1, 20 January 2022, VCS Standard v 4.2 and Definitions v 4.1, 20 January 2022, and the approved Clean Development Mechanism (CDM) methodology AMS-I.C, "Thermal energy production with or without electricity" Version 19.

This Verification Report covers the reporting period January 1, 2021 through December 31, 2021. During the verification process, SCS Global Services issued four clarification requests and no corrective action requests – all of which were addressed sufficiently by Recast Energy, LLC.

On the basis of work conducted, SCS Global Services was able to conclude with reasonable assurance that the Recast Energy Louisville Fuel Switch From Coal to Biomass for Thermal Energy Project asserted vintage emission reductions of 52,116 tonnes of CO₂-e in calendar year 2021 were accurately stated and met all relevant VCS Standard Version 4.2 requirements and correctly

applied the VCS-approved CDM methodology AMS-I.C, "Thermal energy production with or without electricity" v 19.0.

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1 INTRODUCTION

1.1 Objective

The objective of this verification was to determine conformance with the criteria as noted below and confirm that the emission reductions reported are accurate, complete, consistent, transparent and free of material error for the Recast Energy Louisville Fuel Switch from Coal to Biomass for Thermal Energy Project (the Project), located in Louisville, Kentucky. SCS Global Services (SCS Global) conducted the verification following the criteria listed below.

1.2 Scope and Criteria

This report covers the verification of greenhouse gas (GHG) emission reductions achieved by displacing thermal energy that would have been generated from a fossil fuel boiler over the period from January 1, 2021 through December 31, 2021. The project boundary Scope consisted of the following:

Baseline Sources

- Emission reductions of CO₂ resulting from displacement of fossil fuel (coal) consumption

Project Sources

- CO₂ emissions from on-site consumption of diesel fuel in equipment used to move wood fuel within the facility
- CO₂ emissions from electricity consumption by the project activity in excess of the electricity used by the boiler prior to the activity

Leakage

- CO₂ leakage emissions from the offsite transportation and processing of biomass residue

The criteria used for this verification were:

VCS Standard v 4.2 (20 January 22) and associated updates and clarifications

VCS Program Guidelines v 4.1 (20 January 22)

CDM AMS- I.C. "Thermal energy production with or without electricity" ver. 19.0, and associated updates, and the following CDM approved methodological tools and guidance documents:

- tool to calculate the emission factor for an electricity system, Version 04.0.0;
 - tool to calculate baseline project and/or leakage emissions from electricity consumption, Version 1.0;
 - tool to calculate project or leakage CO2 emissions from fossil fuel combustion, Version 2.0;
 - General Guidelines to SCC CDM methodologies, Version 20;
 - General guidance on leakage in biomass project activities, Version 03;
 - Annex 18, Definition of Renewable Biomass
- ISO 14064:2006 Part 3, Greenhouse gases – Specification with guidance for the validation and verification of greenhouse gas assertions.

1.3 Level of Assurance

A reasonable level of assurance was attained for this verification.

1.4 Summary Description of the Project

The Project is a thermal energy generation project fueled with locally available forestry and agricultural cellulosic residues (i.e., primary mill residues, logging residues, and crop residues), and is located at the Lubrizol Advanced Material, Inc. facility in Louisville, Kentucky (the Facility). The Project location is on land owned by one of the project customers (Lubrizol) and then subsequently leased back to the Project Proponent, Recast Energy Louisville, LLC. The Project is owned and operated by Recast Energy Louisville, LLC. Thermal energy from the biomass system displaces thermal energy generated by the coal-fired former Lubrizol Boiler #4. The thermal energy generated from the biomass boiler is sold to Lubrizol and Zeon Chemicals (the project customers) adjacent to the Facility. The pre-project scenario consisted of the project customers receiving thermal energy from Lubrizol Boiler #4 generated by combustion of coal, supplemented with natural gas when needed. The Project does not combust coal or natural gas, its sole fuel being biomass with occasional startup diesel oil. The Project achieves GHG emission reductions by displacing thermal energy that would have been generated from the former Lubrizol Boiler #4 fossil fuel boiler with thermal energy produced using biofuel.

The Project's crediting period is April 1, 2013 through March 31, 2023. The project start date established as per the Validation as December 10, 2012.

2 VERIFICATION PROCESS

2.1 Method and Criteria

SCS Global conducted its verification of the reported emission reductions in accordance with ISO 14064:2006 Part 3. The following is a summary of the verification process implemented:

- Conflict of Interest review;
- Selection of Audit Team;
- Kick-off telephone meeting with Recast Energy Louisville, LLC (Recast Energy);
- Review of the VCS Project Description and Validation Report,
- Development of the verification plan and sampling plan;
- Document review and evaluation of raw data, calculations, and supporting documentation for the period under review;
- Follow-up interaction with Recast Energy for corrective action, clarification, or supplemental data as needed; and,
- Final statement and report development.
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The verification was performed in accordance with the requirements of the criteria listed above.

Prior to the beginning of this verification, SCS Global conducted an evaluation to identify any potential conflicts of interest associated with the project. No potential conflicts were found for this Project.

SCS Global utilized a qualified team of professionals to perform this verification. The lead verifier was Michael DeBusschere, P.E. and the Internal Reviewer was Tina Sentner. Both are qualified lead GHG Verifiers.

The verification audit was initiated with a kick-off conference call on April 6, 2022 between SCS Global and Recast Energy. The communication focused on confirming the verification scope, objectives, criteria, schedule, and the data required for the verification.

Site Visit

SCS Global performed a remote site visit for this report period. A site visit was previously conducted on April 5, 2019 and two subsequent video visits in 2020 and 2021 by the lead verifier when he was with a different verification body, which included a tour of the project facility including the fuel material receiving yard and location of relevant metering, Project Boiler No. 4, Ash Handling unit, and all associated ancillary equipment (i.e., metering and data recording systems), and process areas were thus verified as physically located and in operation.

The site visit for this verification was replaced with teleconference interviews with relevant site personnel and project stakeholders; review of the Project's

operations; data collection procedures, observation of the Project DCS control system screens and information management systems; as well as assessments of the Project's controls for sources of potential errors and omissions reports. Based on this review it was determined that there were no material changes in the project equipment, design, personnel or management systems from previous verifications by the lead verifier, and that reasonable assurance could be achieved without a site visit this report period.

2.2 Document Review

SCS Global performed a document review following approval of the conflict of interest review and members of the verification team. The audit team conducted a document review to inform the planning process in advance of performing verification activities. The Audit Team reviewed the Project Description (PD), the Validation Report, and documents relevant to the verification such as the Monitoring Report, emission inventories, distributive control system descriptions and screen copies, calculation methods and leakage documentation for deliveries of wood fuel as a basis for developing the verification plan.

The following documents were included in the initial document review: For Documentation of project boundaries (geographic, pollutants to be reported, and Scopes to be reported) for the assertion years, and information regarding the GHG reporting & monitoring Management Plan:

- Recast Energy Louisville Fuel Switch From Coal to Biomass Project Description, ver 2.7, 12/4/2014.
- Validation Report for Recast Energy Louisville Fuel Switch from Coal to Biomass for Thermal Energy ver 1, 12/5/2014.
- Recast Energy Louisville Fuel Switch From Coal to Biomass for Thermal Energy Monitoring Report 2021 and assertion, ver 6.3 5/26/2022

Site specific electrical and natural gas use information for the project:

- GHGOffset Lou1 2021 Final.xls, FC Diesel Tab and supporting Electrical Use Invoices 2021
- Electricity Usage Study EC 2013-2014 by piece of equipment (Engineering study used in the estimation of power consumed ECy)

Records used for fuel supply mobile source fleet emissions:

- GHGOffset Lou1 2021 Final.xls, Biomass Distance Tab & FC Diesel Tab 2021,
- Transportation Energy Book v 39, Table B-4, ORNL-5198

Updates to definitions and heat content of boiler fuels, and the emission factor used for these fuels in calculating reductions:

- Transportation Energy Book v 39 ORNL-5198,
- US Energy Information Agency CO2 Emission Factors by Fuel 2/2/16.

Default factors for wood fuels and the data used to normalize to default heat values:

- Transportation Energy Book v 39 ORNL-5198fuels

Emission source testing summaries year to year, and the air emissions operating permit and emission reports for the assertion years:

- Recast Energy Louisville, LLC Annual Emission Report 4/14/2022,
- Alliance Source Test Report for Recast Energy Louisville LLC 11/30/2021,
- Title V Air Operating Permit O-1333-19 dated 12/11/2019.

Monitoring equipment calibration and servicing documentation:

- Computer File "2021 Meter Calibrations" 1/10/2022 with Steam Meter Calibration Certificates Meters 1, 2 and 3 Dated 05/24/2021 Respectively
- Boiler 4 Steam Meter Placement Schematic m-13 rev4 11x17 2021
- Photocopy of the boiler plate showing its specifications

Steam Logs for March, July, September, November & December 2021

The following additional information was received as a result of the on-site teleconference meeting and document review conducted during the verification:

- Selected detailed spreadsheets for 2021 enthalpy production - GHGOffset Lou1 2021 Final.xls, Q Steam Tab & Steam Meters Tab 2021
- DCS data summaries for four months of the report year
- DCS Screen Shots of monthly summaries
- Attestation to the VCS that asserted emission reduction credits have not been applied for to any other crediting body.
- Discrepancies between project documentation and the verification criteria were considered material and identified for corrective action. In addition, SCS assessed the GHG emission reduction assertion and underlying monitoring data to determine if either contained material or immaterial misstatements. The results of these reviews are discussed in greater detail below.

Development of the Verification Plan and Sampling Plan

SCS Global developed and documented its verification plan as well as determined the data-sampling plan subsequent to the kick-off call. The verification plan was developed based on review of the PD and Validation Report along with a discussion of key elements of the verification process during the kick-off meeting. Recast Energy was given the opportunity to comment on key elements of the plan for verification. Based on items discussed and agreed

upon, the level of assurance, materiality threshold, and standards of evaluation and reporting for the verification were finalized. SCS Global also provided an outline of the verification process, established project steps and a tentative schedule for completion of the verification to Recast Energy. The verification plan was issued on May 5, 2022.

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2.3 Interviews

Through the course of verification activities and through telephone conferencing on May 11, 2021 SCS GLOBAL interviewed the following project personnel to inform the verification process:

- Donna Wirick, Recast Environmental Manager, Richmond, VA
- Jamie Howell, Louisville Plant Operations Manager
- Rick Vinson, Plant Operator

Interviews focused on relevant operational details with each participant. For instance, the plant operator was asked to discuss how the DCS system operated, what parameters were being monitored and how often, and how the system maintained for accuracy; what was his daily routine with respect to operation of the wood fired boiler; how often was a boiler efficiency test conducted per EPA requirements; what specifications are used for steam measurement and meter calibration and how often was there a meter calibration per OEM; boiler tube cleaning and blow down, and could we obtain screen shots of the DCS for selected days in 2021.

The Plant Manager was interviewed about what arrangements were made with steam purchases and the recordkeeping documentation, how would steam purchase records be used to compare to steam generation figures; what wood chip documentation is kept, how is it documented with trip tickets, whether calibration of the truck scale is maintained; what is the relationship among the parties involved in the Project; discuss report year project emission parameters such as diesel loader gallons combusted and electrical usages tracked; what are the qualifications of the Plant Operator and Plant Manager.

Lastly, the Recast Environmental Manager discussed how daily records are transferred to the spreadsheets used to calculate emission reductions; how were leakage emissions determined; explaining the assembly of the GHG calculation workbook; what standard factors were used such as what year of record for eGRID, wood chip vehicle emissions and thermal conversion emission factors; and environmental compliance documentation such as for permits and inspections.

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2.4 Site Inspections

A site visit was not required for this verification. However SCS conducted a remote site visit on May 11, 2022. Information and Communication Technology (ICT) was utilized to conduct the site visit virtually. Prior to conducting the site visit virtually, SCS updated the verification risk assessment to incorporate and assess risks associated with using ICT. A site visit agenda was provided to the site personnel prior to the site visit outlining the process and procedures implemented for the virtual site visit. Live video conferencing software was utilized to interview key site personnel directly responsible for project monitoring and data management processes and procedures. The virtual site visit also included review of the Project's operations; data collection procedures and information management systems; as well as assessments of the Project's controls for sources of potential errors and omissions. The site inspection included a virtual tour of the project components, including the combustion equipment, steam collection and conveyance system, and all associated metering and monitoring equipment and data management system.

The following topics were discussed with Project personnel during the remote site visit:

- The implementation status of the project activities
- Whether there were any material discrepancies between project implementation and the project description, and were there any material discrepancies between the actual monitoring system, and the Monitoring Report set out in the project description and the applied methodology
- Confirm implementation status of the Monitoring Report and the completeness of monitoring and servicing
- Discuss how the implemented monitoring system (ie, process and schedule for obtaining, recording, compiling and analyzing the monitored data and parameters) conform to the Methodology
- Review documentation the GHG emission reductions or removals generated by the project were not included in an emissions trading program or any other mechanism that includes GHG allowance trading, or submitted to another certifying body than VCS since the initial verification
- Determine whether the project has participated or been rejected under any other GHG programs since validation or previous verification.

- Identify any internal documents and protocols that set guidelines for the data collection process.

The information gathered during these discussions and review was used to assess the Project's data management systems and its controls for sources of potential errors and omissions.

2.5 Resolution of Findings

The Audit Team issued two requests for clarification and two observations during the verification process. SCS Global prepares a listing of information requests and potential nonconformances and provides the Project with opportunity to respond and/or correct the issues. Upon submittal of the additional information requested, SCS Global reviews it and determines if the information addresses the issue completely. Once conformance is determined, findings are put into a final table for inclusion into the Verification Report. Recast Energy's responses were sufficient to resolve all requests. The clarification requests and the responses provided are summarized in Appendix A.

2.5.1 Forward Action Requests

There were no forward action requests made during this verification.

2.6 Eligibility for Validation Activities

SCS Global did not conduct Validation activities during this verification.

3 VALIDATION FINDINGS

3.1 Participation under Other GHG Programs

SCS Global did not conduct Validation activities during this verification. There were no other approved GHG programs the project sought verification approval or validation from.

3.2 Methodology Deviations

The following methodology deviations were previously approved during Validation and applied in the initial verification period and in this verification period:

- Parameter: Qsteam, :

AMS-I.C, "Thermal energy production with or without electricity" ver. 19.0 Requirement: In case the project is exporting heat to other facilities, the metering shall be carried out at the recipient's end. Deviation: Measure thermal energy produced directly from the steam and feed water meters on the biomass boiler, not at the customer meters.

Justification: Steam for delivery to two separate customers is generated by one biomass boiler and up to 4 natural gas boilers. If steam is measured at the customer's meters, steam and feed water measurements will comingle mass and energy from all boilers will be used to calculate thermal energy generated by the biomass boiler alone. Recast Energy proposes simply measuring the steam and feed water only at the biomass boiler to eliminate the inaccuracy introduced by deriving the thermal energy using 12 measuring points instead of 2 direct measuring points. Accordingly, the enthalpy values, h_{steam} and $h_{\text{feedwater}}$ will be determined at the biomass boiler. This deviation will result in increased accuracy of the baseline by directly measuring the energy produced from biomass.

- Parameter: ECy,

AMS-I.C, "Thermal energy production with or without electricity" ver. 19.0 Requirement: Use "Tool to calculate baseline, project and/or leakage emissions from electricity consumption"

Deviation from Requirement: Electricity consumption is measured based on the difference in equipment (motor ratings) on Boiler #4 before and after conversion.

Justification: Reliable data is not available for electricity consumption of the boiler house prior to conversion. The converted boiler is one part of a complex boiler house system consisting of other boilers, water pumps, water treatment systems etc. that did not change with the project. A study will be prepared that identifies the changes in equipment for Boiler #4 and the maximum capacity for electricity usage before and after the project. Once per verification period, the list of equipment used to calculate the net change in electricity will be reviewed for any equipment and usage updates, and the net change in electricity recalculated for inclusion in the project emissions calculations. This deviation is conservative, as it measures the maximum potential electricity usage for Boiler #4 pre and post project, which will be larger than the actual usage of the boiler. The deviation is also more accurate, as it is very difficult to isolate the electrical usage of Boiler #4 and the boiler house in general both pre and post project.

- Parameter: EFgrid, CM,y

AMS-I.C, "Thermal energy production with or without electricity" ver. 19.0 Requirement: Use "Tool to calculate baseline, project and/or leakage emissions from electricity consumption"

Deviation: Data from the US Environmental Protection Agency eGRID tables is used in place of calculating a combined margin emission factor per the Tool.

Justification: The Emissions & Generation Resource Integrated Database (eGRID) is a comprehensive source of data on the environmental characteristics of almost all electric power generated in the United States. Emission factors are generated for the US based on the electricity generation in each sub-region. This deviation is more accurate than a default factor (Option A2) and is more accurate than using Option A1 to calculate a combined margin emission factor based on the closest power producers. The project is connected to a large power grid that will pool electricity from many sources over the project life, so a regional average will include the full range of fuels producing GHG's in the region of the project.

- Parameter: FCDiesel, loader, y

AMS-I.C, "Thermal energy production with or without electricity" ver. 19.0 Requirement: Use "Tool to calculate project or leakage CO2 emissions from fossil fuel combustion"

Deviation: Purchased fuel invoices are used to monitor the quantity of diesel fuel used to calculate the project CO2 emissions from fossil fuel.

Justification: The diesel fuel is metered into the onsite storage tank by the fuel supplier and recorded on the invoices, and this deviation assumes all fuel purchased during the monitoring period is used in the onsite fuel moving equipment. This deviation is conservative by assigning all purchased fuel at the facility to the project emissions calculations.

These deviations were approved during the Project Validation and initial Verification by the validation body and SCS concludes they remain valid for this reporting period.

3.3 Project Description Deviations

Not applicable. No new project description deviations were applied during the current reporting period. There were no project description deviations for

applicability, additionality or baseline appropriateness scenarios from the previously approved project description.

3.4 Grouped Project

Not applicable. The project is not a grouped activity and is a sole facility project.

VERIFICATION FINDINGS

4.1 Project Implementation Status

The Recast Energy Louisville Fuel Switch From Coal To Biomass For Thermal Energy Project was implemented according to the Project Description (PD). For the current verification period (CY2021), the project operated continuously supplying steam to the project customers as needed for manufacturing operations. The normal demand for steam fluctuated with operational needs primarily the result of fluctuations in demand for building heat for the manufacturing complex. SCS Global confirmed there were no changes to the project activity, proponents or other entities.

The Project start date was December 10, 2012. The 10-year project crediting period began on April 1, 2013 and ends on March 31, 2023 based on the initial report period verification. The Project's start date and crediting period were previously confirmed at validation.

The relevant parameters of the Project's Monitoring Report are described below. The quantity of steam generated by the Project (Boiler No. 4) was monitored by an ABB Vortex Flow meter FV4000. The flow meter was calibrated prior to initial installation on June 6, 2012 by the OEM in accordance with the manufacturer's specifications. The PD states that flow meters will be serviced by a qualified technician at least once every three years.

The calibration requirement was met for the current reporting period with calibrations conducted on June 7, 2021 of all three steam flow meters. The calibration certification documentation indicated the meters were performing within calibration requirements with no adjustments needed. The steam and boiler feed water enthalpies were calculated from the steam pressure and boiler feed water temperature, measured by a pressure sensor (ABB pressure transducer) and temperature sensor (ABB temperature probe) respectively. The PD states that these meters will be checked for accuracy at least once every three years. The steam pressure and temperature meters were checked for calibration accuracy also on 7 June 2021 in accordance with the manufacturer's specifications confirmed by calibration certificates, less than three years prior to the previous calibrations.

The Project utilized a Rockwell International distributive control system (DCS) to record boiler operational parameters every ten seconds, and to provide hourly summaries of select operations parameters specific to GHG reduction calculations. In particular the pounds of steam generated, hours of operation and whether the boiler is operating normally were all recorded. The Project team captured and summarized DCS data into spreadsheet performance reports, which were then used to create invoices to its two customers on a monthly basis.

Electricity consumption by the project activity was determined by comparing the electricity demand of Boiler No. 4 and the associated pollution control and ancillary equipment before and after the biomass conversion based on a study conducted at validation, evaluating the specifications and usage rate of the power consuming equipment. The study determined the difference in electricity usage for the project, related directly to the changes in equipment on the boiler and pollution control and ancillary equipment to combust biomass. There have been no substantive changes in electricity-using project equipment since the electricity use validation study.

All other electricity uses within the facility existed prior to the conversion and would have continued at the same rate had the conversion not occurred. The study was last updated in July 2021 which remains for the current reporting period. Electricity use emissions were calculated appropriately using the latest EPA eGRID factors.

Fossil fuel consumption for equipment used to move biomass within the project facility was determined by fuel supplier invoices during the monitoring period.

Leakage emissions from off-site consumption of diesel fuel during the collecting and processing of biomass residues are determined from biomass delivery records. Calculation of LE is : $Q \text{ biomass} * \text{EFF diesel} * \text{Coef.}$ LE is zero because no crop residue Q was combusted by the Project.

Off-site consumption of diesel fuel due to transporting of biomass residues were applicable if from more than 200 km to the project site per CDM AMS-I.C, "Thermal energy production with or without electricity" v 19.0 .The net biomass delivered to the facility with each load was measured by a truck scale. Delivery tickets recorded the net weight and the origin of the load and identified the distance travelled for delivery. Quality assurance and control procedures include calibration of the facility truck scale (Weigh Tronix E1310) at least annually, in accordance with manufacturer recommendation. The scale was calibrated quarterly during 2021, documented by calibration certificates, even though the weight of biomass was not required by the Methodology to determine emission reductions. Delivery tickets were reviewed and signed by a project employee upon receipt from the truck driver, reviewed during invoice matching, and then archived. SCS Global reviewed a sample of 2021 biomass delivery tickets from records submitted for document review to confirm that

transportation distances were correctly accounted for although leakage emissions were immaterial.

The Project used Google Earth to document distances travelled and assumed equidistant round-trip segmentation for deliveries of 200 km or more for input into leakage calculation of fuel transportation, and for each disposal/end use destination according to the ash delivery tickets generated during the monitoring period. Emissions from off-site consumption of diesel fuel due to transportation of ash (combustion residuals) from the Project to final disposal or beneficial use outlets were determined according to the round-trip distance to the disposal site.

No data and/or variables presented in the Monitoring Report differ from those stated in the PD, except where noted in Section 3.2 above or as described below. Similarly, the data collection and recordkeeping procedures were found to be consistent with those outlined in the monitoring report and as described by the PD, and meet the requirements of AMS-I.C, "Thermal energy production with or without electricity" v 19.0, SCS Global also verified the Project management and operational systems, with respect to monitoring and reporting, and found they were conformant with the verification criteria through the review of project documentation.

Lastly, SCS Global confirmed with Project management that GHG emission reduction credits had not been registered under another GHG program.

Additionally, Recast Energy provided an attestation for the current reporting period in its Monitoring Report indicating that GHG emission reduction credits for the current verification period will be registered only with VCS and not under any other GHG program. As per the validated PD, no other environmental credits are generated by the Project.

SCS Global confirmed there were no issues from validations. No Project Description deviations were implemented for the Project during the reporting period compared to validation. See section 3.2 above for previously validated methodology deviations.

Based on this review, SCS Global concluded with reasonable assurance the project was implemented as described in the Project Description and the Project Monitoring remained effective during the verification period.

4.2 Safeguards

4.2.1 No Net Harm

No net harm effects were demonstrated for the Project in the Monitoring Report during the verification report period January 1, 2021 through December 31, 2021.

4.2.2 Local Stakeholder Consultation

No public input or hearings, comments or complaints have been conducted or received during the reporting period January 1, 2021 through December 31, 2021. In addition, the project is not an AFOLU project.

4.3 AFOLU-Specific Safeguards

Not applicable. This is a non-AFOLU project and therefore this section is not required.

4.4 Accuracy of GHG Emission Reduction and Removal Calculations

Emission reduction calculations for the reporting period were reviewed to ensure conformance in the formulas used and accuracy of the raw data used as inputs. The emission reduction calculation formulas were found to be conformant with Equation 2 described in AMS-I.C, "Thermal energy production with or without electricity" ver. 19.0 Methodology and the validated PD. The methodology requires only CO₂ to be determined for reductions, project emissions and leakage.

Baseline emissions were calculated as the consumption of coal fuel that would have been used in the absence of the project activity multiplied by the emission factor for the fossil fuel displaced. Coal consumption was determined as the net quantity of heat divided by the efficiency of the boiler that would have been used in the baseline scenario. The net energy is the result of the enthalpy gain reached in the boiler multiplied by the steam volume generated. The net quantity of steam/heat supplied by the Project (EG thermal, y) was determined by multiplying the difference between steam pressure enthalpy (h steam) and boiler feed water temperature enthalpy (h feedwater), the quantity of steam generated by the project activity (Q steam, y), which is conformant with the methodology deviation approved at validation, measured at the output of biomass Boiler No. 4. Enthalpy of steam and boiler feed water were determined according to steam and water thermodynamic properties tables.

Project emissions occurred from on-site fossil fuel consumption by equipment used to move biomass within the project facility and indirectly from electricity consumption attributed to the project activity. Emissions from electricity consumption (ECy) were calculated by multiplying Project electricity usage determined as described in the previous section by the appropriate eGRID emission factor in tCO₂//MWh. The Project used the 2020 default US EPA eGRID emission factors for the SRTV sub-region, which were the latest available. Project emissions from fossil fuel consumption by the biomass loader (FCdiesel, loader, y) was calculated by multiplying the fuel usage determined as described in the previous section by the diesel fuel emission factor in expressed in tCO₂e/GJ. Project leakage emissions from biomass processing, biomass transportation, and transportation of ash combustion residues are accounted for in accordance

with AMS-I.C, "Thermal energy production with or without electricity" v 19.0 .Leakage emissions due to competing uses for the biomass that might have occurred in the absence of the project were evaluated at validation and excluded.

As described in the previous section, the emissions from off-site consumption of diesel fuel during the collecting and processing of biomass residues into a transport-ready fuel format were excluded for this monitoring period. The emissions from biomass transportation were determined as the emissions from off-site combustion of diesel fuel due to transporting of biomass residues from more than 200 km to the project site (DAFbiomass delivery). For delivery distances greater than 200 km, the emissions were calculated by multiplying the roundtrip distance by the appropriate fossil fuel emission factor and the fuel efficiency of a typical tractor, based on US DOT data, updated each monitoring period. Delivery distances were recorded on the biomass delivery tickets during receipt of biomass deliveries ($Q_{biomass, j, y}$). Emissions from off-site combustion of diesel fuel due to transportation of ash (combustion residuals) from the Project to final disposal or beneficial use outlets are determined according to the roundtrip distance (DAFash delivery) to the disposal site multiplied by the emission factor for diesel fuel and the fuel efficiency of a typical tractor, based on US DOT data, updated each monitoring period.

Finally, total emission reductions for the monitoring period are determined by subtracting the project and leakage emission from baseline emissions per Equation 2 of the Methodology. In the table below, Equation 2 of the Methodology has $EG_{thermal,y}$ as $Q_{steam} \times (h_{steam} - h_{feedwater}) \times \text{Conversion Factor}$. SGS Global has checked the Project's calculations and found them to conform to the Methodology. TDL_y was also reviewed and found to be correctly consistent with EPA's eGRID documentation for the SERC Tennessee Valley grid.

Data Unit/Parameter	Description	Value Monitored as Verified	Source of data verified
$EG_{thermal,y}$	The net quantity of steam/heat supplied by the project activity during the year y	For 2021: 500.55 TJ	GHGOffset Lou1 2021 Final.xls, Q Steam Tab & Steam Meters Tab 2021
$EF_{grid, CM,,y}$	Combined margin emission factor for the grid in year y	For 2021: 0.381 tCO ₂ e/MWh	2020 EPA's eGRID documentation for the SERC Tennessee Valley grid
TDL_y	Average technical transmission and distribution losses for	For 2021: 0.053	2020 EPA's eGRID documentation for the

	providing electricity to the project in year y		SERC Tennessee Valley grid
$Q_{\text{steam},y}$	The quantity of steam generated by the project activity (Boiler #4) in year y	For 2021: 476,941,878 lbs	GHGOffset Lou1 2021 Final.xls, Q Steam Tab & Steam Meters Tab 2021
h_{steam}	The enthalpy of steam as it leaves the biomass boiler.	For 2021: 1197.53 BTU/lb	GHGOffset Lou1 2021 Final.xls, Q Steam Tab & Steam Meters Tab 2021
$h_{\text{feedwater}}$	The enthalpy of boiler feed water as it enters the biomass boiler (Boiler #4).	For 2021: 202.7 BTU/lb	GHGOffset Lou1 2021 Final.xls, Q Steam Tab & Steam Meters Tab 2021
$FC_{\text{Diesel, loader, } y}$	Quantity of diesel fuel used by the front-end loader and any other on-site fuel moving equipment	For 2021: 10,577 gal	GHGOffset Lou1 2021 Final.xls, Biomass Distance Tab & FC Diesel Tab 2021, Transportation Energy Book v 39, Table B-4, ORNL-5198
EC_y	Power consumed by the project activity	1,957 MWh in 2021	GHGOffset Lou1 2021 Final.xls, and supporting Electrical Use Invoices 2021
$DAF_{\text{biomass delivery}}$	Estimated round-trip delivery distance	$[\Sigma(DAF)]$ Biomass: For 2021: 46,561 km	GHGOffset Lou1 2021 Final.xls, Biomass Distance Tab & FC Diesel Tab 2021, Transportation Energy Book v 39, Table B-4, ORNL-5198
$DAF_{\text{ash delivery}}$	Estimated round-trip ash delivery distance	$[\Sigma(DAF)]$ Ash: For 2021: 0 km	GHGOffset Lou1 2021 Final.xls, Biomass Distance Tab & FC Diesel Tab 2021, Transportation Energy Book v 39, Table B-4, ORNL-5198

EFF_{tt,y}	Fuel efficiency for tractor trailers	9.66 km/gal is the value For 2021 and are the latest available values (published 2019)	TRANSPORTATION ENERGY DATA BOOK: EDITION 39 —2021, Table 5.2, 2019 Data
Q_{biomass,j,y}	Quantity of biomass residues of type j delivered to the project activity, as received.	2021 All Biomass Delivered: 75,485 tons Biomass Not Processed for Project: 75,485 tons Biomass Processed for Project: 0 tons	<i>biomass delivery tickets</i> GHGOffset Lou1 2021 Final.xls, Biomass

The Audit Team performed an independent recalculation of the emission reductions from the verification period using the available raw boiler feed enthalpy flow, steam produced, steam sold, electricity used, and diesel fuel consumption data. Material misstatements were identified for correction by the Project as described in Section 2.5. No material misstatements were observed in the final GHG assertion. Overall, the GHG emission reductions were quantified correctly in accordance with the VCS PD and AMS-I.C, "Thermal energy production with or without electricity" v 19.0.

4.5 Quality of Evidence to Determine GHG Emission Reductions and Removals

Recast Energy provided all requested documentation for emission reduction calculations including baseline emissions, project emissions and leakage emissions, as well as documentation of the Project data collection and summarization processes. SCS Global was provided the reporting period's Monitoring Report prepared in accordance with the latest VCS program template, 2021 calendar year calculation spreadsheets, calibration records, and electronic data associated with steam generation, steam pressure, and steam temperature readings. SCS Global's lead verifier observed operation of the Project monitoring equipment while video conferencing for this verification and while physically on site during previous verifications with another verifying body, and obtained screen shots of the operating system as it was operating in real time. Measurements of required operational parameters for the Project's boiler are performed every ten seconds and retained by a Rockwell distributive control system (DCS). The project reduces raw ten second readings to daily

averages for steam produced, feed water enthalpy, net steam delivered, steam pressure & temperature and other factors in addition to boiler operating hours and performance. Raw data was reviewed from its source of generation to confirm the accuracy of the daily DCS information flow. SCS Global reviewed and compared the daily raw data summaries to total report period steam production, and recalculated emission reductions. Project calculations and raw data matched. The evidence provided was sufficient for verification of the Project and consistent with the requirements of "Thermal energy production with or without electricity" v 19.0 VCS Standard v 4.2 (20 January 2022), and the validated PD. SCS Global concluded the Project monitoring and supplemental data were appropriate and meets generally accepted evidentiary standards for best practice in GHG accounting to sufficiently quantify the GHG emission reductions.

4.6 Non-Permanence Risk Analysis

Not applicable. The Project generates emission reductions that are permanent and cannot be retrieved, since they are based on combustion of biomass, which once created, cannot be undone. Therefore the non-permanence risk score was judged to be zero for project non-permanence rationale, non-permanence assumptions, non-permanence justifications, and the quality of non-permanence documentation and data.

5 VERIFICATION CONCLUSION

On the basis of the work performed and review of the Project Monitoring Report, Validated Project Description and the necessary evidence requested during the verification process, SCS Global has concluded that the Recast Energy Louisville Fuel Switch From Coal to Biomass for Thermal Energy Project has been compiled in a transparent manner, the data was found to be accurate within reasonable assurance and the Project was implemented in accordance with the requirements of the VCS Standard v 4.2 dated 20 January 2022, the VCS Program Guide v 4.1 20 January 2022 and the CDM AMS I.C. "Thermal energy production with or without electricity" v 19.0 June 17, 2011. The verification team confirms that all verification activities required by the criteria listed were performed as described in this report.

SCS Global Services has verified emission reductions reported by the Recast Energy Louisville Fuel Switch From Coal to Biomass for Thermal Energy of 52,116 tonnes of CO₂-e in calendar year 2021.

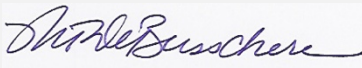
Verification period: From January 01, 2021 to December 31, 2021

Verified GHG emission reductions and removals in the above verification period (number rounded for simplicity):

Year	Baseline emissions or removals (tCO ₂ e)	Project emissions or removals (tCO ₂ e)	Leakage emissions (tCO ₂ e)	Net GHG emission reductions or removals (tCO ₂ e)
2021	53,058.5	893.3	49.0	52,116.2
Total	53,058.5	893.3	49.0	52,116.2

Verification Conclusion Summary:

Project Proponent	Recast Energy Louisville, LLC
Project Location	Louisville, Kentucky, USA
Project Type	Renewable Energy
Project Periods:	January 1, 2021 - December 31, 2021
Nature of Data Verified	Historical
Protocol/Methodology	- VCS Standard v 4.2, dated 20 January 2022 - VCS Program Guide v 4.1, 20 January 2022 - CDM AMS I.C. "Thermal energy production with or without electricity" v 19.0, dated 17 June 2011, and associated clarifications and methodological tools.
Emission Reductions/Removals Verified	Vintage 2021: 52,116.2 metric tons of CO ₂ -equivalent
Verification Conclusion, with Reasonable Assurance	Based upon the verification activities described above, SCS Global has concluded that the vintage CO ₂ e emission reductions in all material respects, fairly stated.
Representation	SCS Global represents that the Emission Reductions verified in this report have occurred in accordance with the applicable VCS Rules.

Lead Verifier	 Michael DeBusschere, May 28, 2022, revised 2023-02-11
Internal Reviewer	 Tina Sentner, May 28, 2022, revised 2023-02-11

APPENDIX: FINDINGS

Audit Information

Project Name	VCS1386– Recast Energy Louisville Fuel Switch From Coal to Biomass for
Type of Audit	Verification
Standards Body	Verified Carbon Standard (VCS)
Reporting Period	01 January 2021 to 31 Dec 2021

Type	Number	Status	Title	Standard Reference	Document Reference	Finding	Project Response	Auditor Response
OBS	1	Closed	Electrical Study	VCS Section 3.19.2.1	Approved deviation #1	The electrical study used in the approved deviation for project electrical usage was stated to be last updated in 2018. Has there been a more recent review & update?	The electrical study was reviewed and confirmed again in 2021.	Inquiry Closed.
OBS	2	Closed	Monitoring report leakage	VCS Section 3.14.1	Monitoring Report vs GHG Offset-Emission Calcs LOU1 workbook DAF Biomass Tab.	There is an immaterial discrepancy between the workbook's total wood delivered of 75,485 tons and the Monitoring Report's total of 73,769 tons.	The figure in the GHG calculation workbook is correct. The Monitoring Report wood combustion total was from an earlier unfinal total. Wood combustion is not used to calculate ERCs and the difference in the two totals was immaterial.	Inquiry closed.
NIR	3	Closed	Wood scale calibrations	VCS 3.15.5	Project measurement equipment must be calibrated	The Reference documents provided by the Project did not include wood biomass weigh scale calibrations.	Calibrations for the Lubrizol wood scale used by the Project were provided for 2021.	Issue closed.
NIR	4	Closed	Project design information	VCS 3.11.1	Monitoring equipment positioning	Project design information identifies three steam flow meters and two steam pressure meters but not the positioning of these meters. Please provide a simple schematic to define how positioning meets monitoring purpose & requirements.	The requested schematic was provided showing proper positioning of steam flow monitors.	Issue closed.