BALL STATE UNIVERSITY CAMPUS-WIDE CLEAN ENERGY & EFFICIENCY MONITORING REPORT

Document Prepared By:
Center for Energy research/Education/Service
(CERES)

Project Title	Ball State University Campus-Wide Clean Energy and Efficiency Project
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Prepared By	Robert J. Koester AIA LEED AP
Contact	2000 University Avenue AB 018 Muncie Indiana 47306-0170 765.285.1135 rkoester@bsu.edu www.bsu.edu/sustainability

This document format and the referenced resources and tools were developed initially with the financial support of Chevrolet to help campuses assess whether to pursue VCS certification of their GHG reductions. These referenced resources and tools are offered for assistance only and if a campus uses these, it does so at its sole expense and discretion. Alternatively, campuses are free to develop their own tools to generate the necessary information to give to VCS for possible certification. Use of these resources and tools does not guarantee certification by VCS.

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Project Details

This Monitoring Report (MR) has been prepared and submitted by Ball State University ("Applicant") using data prepared and compiled by Applicant and reflects its best judgment. It includes the campus CNBN excel template, supplied separately to validators/verifiers, which contains all of the information and calculations the Applicant believes are needed to support validators/verifiers in performing their evaluation of the campus' project candidacy for certification. It is the Applicant's judgment that this MR and the excel template accurately set forth all relevant data and parameters, on a reproducible basis, necessary to establish the project's performance in these regards, indexing clearly to the numbered equations applicable in VMD0038.

Campus name/location: Ball State University
Muncie, IN USA

By submitting this MR and accompanying materials, does the above named University/College intend to affirm its agreement with the above statement? ☒ Yes ☐ No

1.1 Summary Description of the Implementation Status of the Project

This campus' activities include:

Behavior Change Campaign/Communications	☒ Yes	☐ No
CoGen & Fuel switching	☐ Yes	☒ No
Lighting Retrofits	☒ Yes	☐ No
On-Site Renewables	☐ Yes	☒ No
Boiler Retrofits/Central Heating/Cooling Upgrades	☒ Yes	☐ No
Building System Retro-Commissioning & Upgrades Including Automation	☒ Yes	☐ No
Weatherization Improvements	☒ Yes	☐ No
LEED Certification/Green Buildings	☒ Yes	☐ No
Innovative Strategies	☒ Yes	☐ No

Describe specifics of at least two of the measures undertaken:

Measure 1)

District-Scale Geothermal (Closed-Loop, Ground-Source) Heat Pump Chiller Heating and Cooling System; as above

Measure 2)

Weatherization of envelopes:

The university routinely upgrades insulation levels in roof decks when replacing worn-out roof surfaces with new systems; specifically rock-ballasted built-up roofing is replaced with cool-roof EPDM continuous membranes and/or green roofs. In addition, window replacement with high performance glazing and thermal-brake framing has been adopted as an operational standard.

Additional Measures as applicable

For detailed description of the full breadth of sustainability-related and energy conservation practices at Ball State University, see Appendix D in Project Description Document.

However in sum, the following describe more fully the line items checked above:

Behavioral change campaign/communications.

The university facilitates month-long energy conservation competitions within the nine residence hall complexes and among all academic buildings. These competitions occur in the fall and spring semesters and are promoted with campus-wide email exchange and web-based reporting of week-to-week performance.

Lighting retrofits.

The university has aggressively switched-out T12, halogen, incandescent, and high-pressure sodium lamps as part of its on-going maintenance and rehabilitation programs. In addition, for new construction and substantial facility renovation, specifications mandate the use of high-efficiency lamps, fixtures, and lighting controls.

Boiler retrofit/central heating/cooling upgrades.

This comprises the core activity by which the university is dialing-down its greenhouse gas emissions; eliminating four coal-fired boilers, three centrifugal heat-pump-chillers, and five water-based cooling towers.

Building system retro-commissioning and upgrades including automation.

The university routinely switches-out dated equipment; installing variable-speed pumps and fan motors, CO_2 return-air sensors, sub-zoning of air-handling equipment where feasible, and use of digital sensors to control systems operation.

LEED Certification/LEED Buildings.

In both the 2007-12 and 2012-17 Strategic Plans, the university has adopted LEED Silver as the standard for all new construction and renovations/upgrades. In some instances, the university has achieved LEED Gold ratings for some of its newer buildings.

Innovative Strategies.

The university has engaged in long-range planning for the future use of alternative energy sources on campus and on outlying properties owned by Ball State; including building-integrated photovoltaics, stand-alone-armature photovoltaics and wind energy conversion. In addition the university has expanded the involvement of students in immersive learning opportunities on campus (e.g. LEED Lab) wherein students under the mentorship of faculty evaluate building energy performance and provide actionable reports.

For stat 1 reduction projects, describe the stationary 1 facilities being backed down

Four Coal-Fired Chain-Grate Boilers Taken Off Line

Do any of these activities differ from those already described during validation or during a prior monitoring period? ☐ Yes ☒ No

If so, consistent with the new activities described in section 2.1, please provide brief implementation timelines for these new activities: N/A

Credits are sought in:

Stationary 1 combustion reductions	☒ Yes	☐ No
Scope 2 electricity based reductions	☐ Yes	☒ No

First project year implementation date 07-01-2011, (FY 2012)

The baseline scenario as prescribed in VMD0038 is the campus' historical emissions (as further described in sections 2.4 and 3.1).Since CACP (now SiMap) periodically updates its calculator and the most applicable, contemporaneous version is to be used to calculate each year's GHG inventory, as of this submission uses SiMap.

Per equations 12 or 23: [BE Per equations 12 or 23 tCO2e/year]

Average baseline emissions = BE

For	FY 2012	66,241 tCO2e	using	CACP	v 9.9
For	FY 2013	65,380 tCO2e	using	CACP	v 9.9
For	FY 2014	64,530 tCO2e	using	CACP	v 9.0
For	CY 2015	63,691 tCO2e	using	CACP	v 9.0
For	CY 2016	62,863 tCO2e	using	CACP	v 9.0
For	CY 2017	62,046 tCO2e	using	SiMAP	v 1.0

As an example for the project emissions/reductions profile for project year 1:
Project emissions for year 1 45,960 [PE_1 For year 1, per Eq 14 or 25 tCO2e/yr]

Do applied EE technologies require PE Emissions Adjustments?
☒ Yes ☐ No
If yes, PE Adjustment test applied f [Enter applied test name a) – j) from 8.1.3 / 8.2.3]
Resulting PE Adjustment, $PE\Delta_y$: 5,293 [$PE\Delta_1$ For year 1, per Eq15-22, 26-8 tCO2e/year]
Thus, year 1 emission reductions: 14,988 [ER_1 For year 1, per Eq 29 tCO2e/year]

Total emission reductions for the project's current monitoring period: CY 2017 = 32,952
[Summing for 5th year ER_y per Eq 29 tCO2e/year] Consistent with tables in sections 4.4

Do campus sq footage variances apply during project period such that SFΔy is not equal to 1 for some project year y? ☐ Yes ☒ No

1.2 Sectoral Scope and Project Type

Sector scope
☒ 1 Energy industries (renewable / non-renewable sources)
☒ 3 Energy demand

1.3 Project Proponent

Organization name	Ball State University
Contact person	Jim Lowe, PE
Title	Associate Vice President for Facilities Planning and Management
Address	2000 University Avenue Muncie IN 47306
Telephone	765.285.2805
Email	jlowe@bsu.edu

Organization name	Ball State University
Role in the project	Secretariat
Contact person	Robert J. Koester, AIA LEED AP
Title	Professor and Director
Address	2000 University Avenue Muncie IN 47306
Telephone	765.285.1135
Email	rkoester@bsu.edu

1.4 Other Entities Involved in the Project

Not Applicable

1.5 Project Start Date

Project start date: 07/1/2011

1.6 Project Crediting Period

Project Crediting Period Start Date: 07/1/2011
Project Crediting Period End Date: 07/1/2021
Project Crediting Period: 10 years

1.7 Project Location

2000 University Avenue Muncie, IN [See Appendix A for Campus Map]
40.1933^0 N
85.3881^0 W

1.8 Title and Reference of Methodology

Campus Clean Energy and Energy Efficiency Methodology VM0025: v 1.0
Campus Clean Energy and Energy Efficiency Module VMD0038: v 1.0
For current version, see
http://www.v-c-s.org/methodologies/campus-clean-energy-and-energy-efficiency-methodology/

1.9 Other Programs

Include the following information, as applicable:

- Emission Trading Programs and Other Binding Limits:
  Is there an applicable carbon cap or binding limit in the campus region?
  ☐ Yes ☒ No
- Other Forms of Environmental Credit:
  Is there an applicable GHG reporting system under which the campus is publicly reporting its emissions? ☒ Yes ☐ No
  Please indicate which one:
  ☒ ACUPCC
  ☒ STARS
  ☒ GRI
  Has or will the campus ensure(d) that project reductions have not been double reported to this entity for project years in which reductions have been sold?
  ☒ Yes ☐ No
- Participation under Other GHG Programs:
  Is there an applicable GHG program under which the campus is registering its credits?
  ☐ Yes ☒ No

1.10 Sustainable Development

This project contributes to the sustainable development of the United States and specifically to the UN Sustainable Development Goals 7) Affordable and Clean Energy, 9) Industry, Innovation, and Infrastructure, 11) Sustainable Cities and Communities, and 13) Climate Action.

Through research and investments in clean energy on campus, this project drives progress towards affordable and clean energy for the students, faculty, and staff at Ball State University. Student engagement on campus also drives innovation, and the University's leadership creates a model for clean energy infrastructure.

Ball State University is a signatory of the Presidents Climate Commitment, which commits the school to increasing climate resilience with the local community and achieving carbon neutrality on campus. In this way the University is driving action on climate change, both in terms of mitigation and preparedness with its community.

2 IMPLEMENTATION STATUS

2.1 Implementation Status of the Project Activity

For performance methodologies, updates on the overall project performance is required and provided below.

Years for which verification is sought during this reporting cycle:

Project Year 1	FY 2012	☐ Yes	☒ No
Project Year 2	FY 2013	☐ Yes	☒ No
Project Year 3	FY 2014	☐ Yes	☒ No
Project Year 4	CY 2015	☐ Yes	☒ No
Project Year 5	CY 2016	☐ Yes	☒ No
Project Year 6	CY 2017	☒ Yes (last ½ FY 17)	☐ No
Project Year 7	CY 2018	☒ Yes (First ½ FY 18)	☐ No
Project Year 8	CY 2019	☐ Yes	☒ No
Project Year 9	CY 2020	☐ Yes	☒ No
Project Year 10	CY 2021	☐ Yes	☒ No

On an annual reporting basis (adopted last cycle) of: ☐ Fiscal ☒ Calendar

If fiscal, does fiscal year commence July 1? ☐ Yes ☐ *No* ☒ N/A

Campus square footage for years where verification is sought

(CY 2017 … Last ½ FY 2017 & First ½ FY 2018) = 7,166,210 sq. ft.

Are sq. ft. figures consistent with ACUPCC/STARS/ public GHG reporting? ☒ Yes ☐ No

Per equation 8/9 (for stationary 1 credits) and/or 10/11 (for scope 2 electricity credits), which evaluate whether the GHG emissions in project year 1 and y respectively were below the permissible threshold per Test 4a/b-S and/or Test a/b-E:

Equation 8:
$$\sum_i \frac{F_{b=1,i} - F_{p=1,i}}{F_{p=1,i}} \geq PBS_c * SCAP$$

Equation 9:
$$\sum_i \frac{F_{b=1,i}}{F_{p=y,i}} \geq (PBS_c * SCAP + 1) * \frac{SF_{p=1}}{SF_{p=y}}$$

Equation 10:
$$\frac{E_{b=1} - E_{p=1}}{E_{p=1}} \geq PBE_c * E2AP$$

Equation 11:
$$\frac{E_{b=1}}{E_{p=y}} \geq (PBE_c * E2AP + 1) * \frac{SF_{p=1}}{SF_{p=y}}$$

<u>For stationary 1 credits</u>:

Has Test 4a/b-S been met:

i.e. Did the project achieve or exceed the annual average percentage reduction rate specified in the methodology as the performance benchmark (PBS) appropriate to the campus' Carnegie classification given the scope of GHG's (for stationary 1) for which credits are here sought?

For project year 1:

Indicate whether the principle PBS % reduction threshold for project eligibility has therefore been met (that is the campus reduction rate exceeded the PBS required minimum):

☒ *Yes* ☐ *No*

Such that the principle % reduction threshold for project eligibility has been met in year 1:

Indicate the PBS required reduction rate 5.86 % per annum

Indicate the campus project's actual annual average percentage reduction rate achieved in stationary 1 emissions between the first year of the additionality eligibility period and project year 1 19.27 % per annum

For project year y, the stationary 1 emissions may not exceed the threshold value of GHG emissions from project year 1 required to pass test 4 in equation 8 above, (once adjusted, on a square foot adjusted basis, to reflect the new size of the campus). This value of adjusted GHG emissions each year serves as the applicable maximum threshold for project year y stationary 1 emissions whose compliance is assessed in equation 9

For project year y:
Such that the maximum threshold has not been exceeded for stat 1 emissions in subsequent years – since emissions may not exceed this threshold if credits are to be issued in that specific year
(CHECK ONLY THOSE YEARS WHICH HAVE PASSED BASED ON ACTUAL GHG REPORTED DATA FOR YEARS INCLUDED IN THIS MONITORING PERIOD)
CY Basis ☐ *2* ☐ *3* ☐ *4* ☐ *5* ☒ *6* ☒ *7* ☐ *8* ☐ *9* ☐ *10*

Were simple weather adjusted factors applied in Eq 8 and 9? ☐ Yes ☒ No
(using weather adjusted emissions per equations 6 and 7)

Note: when BSU previously sought emission reductions for a half year period (FY2015), it took the step voluntarily to pressure test its additionality testing for that FY, to ensure that the results were conservative and more accurate. BSU therefore applied measurement and monitoring refinements to take into account any potential seasonal variances arising from energy consumption averages in the first vs. second half of that calendar year. Those refinements were designed to ensure more accurate and conservative monitoring of the metered data for that half year period when applied to the additionality project year y testing given seasonal variances that could arise. The same additionality equation for project year y was applied (namely equation 9).

Specifically, to examine potential seasonal variations, BSU evaluated, based on historical data, the extent to which the first six months of energy consumption/GHG emissions might vary compared to the last six months; and refined the half year's PE GHG emission estimates (normalizing for any such seasonal variance) which was then entered as the foundation for that project year y additionality testing. Again using equation 9, the project passed project year y additionality testing readily using both metered and the seasonally adjusted measurement basis.

For scope 2 electricity credits: N/A
For both credit scopes:
Were the campus-wide energy efficiency and clean energy measures undertaken as described in section 1.1 prior to or during this period? ☒ Yes ☐ No

Were there any unexpected events that impacted GHG emission reductions removals or monitoring? ☐ Yes ☒ No
Leakage is set at zero per the VMD0038 module.
Are there any other changes to report? ☒ Yes ☐ No

With the filing of this MR, we again cite the decimal percentages of steam sold to the regional hospital on the edge of campus. This provides a more exacting alignment of our internal record keeping with our public reporting. Every file (utility summary, CNBN excel templates, CACP (now SiMap) Calculator in the 6.9, 7.0, 8.0 and 9.0 versions accordingly) were updated (in SiMap) with those numbers shown in the prior and in this current MR. As a result the PBSc has changed from 18.75% to 19.20% thus reinforcing even more strongly the project's original additionality validation decision.
Similarly, compared to the validation reporting, the results herein for actual BEy, PEy and ERy were refined and updated to be more accurate (reflecting now the use of decimal percentages in the parsing of steam values supplied to the hospital).

Since validation for FY 13, the accurate incremental electricity consumption due to the geothermal installation again has been confirmed and the values now used to replace the earlier estimates submitted for validation. As a result, $\Delta Ep=y$ for FY 13 was confirmed as 11,212 rather than 9,237.

In addition, as noted in our previous MR submissions, we used a very detailed kWh tracking and documentation; assembling a 5-year baseline profile of electrical consumption for the south chiller plant from metered data as shown in the supplied spreadsheets. That data was accumulated on a monthly basis and we were able to gather those readings for every month of the 5 years except for 2 in FY 2011. For those 2 months we were able to generate a proportional estimate of the likely consumption.
Then with the start of the geothermal project, the existing south chiller plant was maintained in service as the geothermal was brought on line. Specifically, of the 5 chillers in place, 3 were taken offline and 2 were continued in use as a back-up to the district scale geothermal system. During this transitional time, we were able to gather meter readings for FY 2012 and FY 2013.

However, with the final switch-out of equipment, including removal of the old cooling towers, the re-routing and replacing of some electrical circuitry in anticipation of the new (geothermal) District Energy Station South (DESS), there was a period of 1-1/2 years during which the meters were not usable for documenting electrical flow. In fact, there were several months when the chillers were simply turned off because they had to be disconnected to rework the electrical system.

Thus for FY 2013, FY 2014 and FY 2015 (first half), we developed estimated profiles of consumption for the south chillers (old chiller plant) as follows: since the District Energy Station North (DESN) heat pump chillers do not even function unless they run at a minimum 50% load, we used that 50% assignable DESN value to pro-rate an electrical split for the south chiller plant.

And although there were days and even weeks when the DESN equipment was running near full capacity, we chose to be very conservative in our estimates by using the 50% base as the cut-off for splitting electrical supply between the north district energy station and the south chiller plant.

To corroborate the reasonableness of these pro-rata estimates in prior reporting, we also used the same form of analysis to backload calculations for the baseline years to determine if the figures were close to the metered readings for the south chill plant; they were. Thus we had a high level of confidence in our pro-rata proportioning and remain comfortable with the fact that we were/are willing to accept such a conservative split of electrical supply.

The difference between Validation and Verification reporting arose as follows:

During validation, Ball State was still using a proxy estimate for the electricity consumption from the geothermal system for year FY2013. This electricity consumption was/is fully monitored via sub-meters. And so during verification the accurate meter readings were provided for FY 2013 alongside new readings for FY2014/15 (first half).

> (Note: the FY2013 estimated kWh consumption was 25,000,000 kWh; thus the actual meter reading figure applied in verification is 28,082,866 kWh).

During the transition to geothermal for both heating and cooling purposes, some of BSU's older chill plant facilities were continued in use with the expectation that, as the geothermal system was mainstreamed, they would ultimately be streamlined, backed down and even eliminated in the same way that the geothermal had replaced the coal energy inputs/boilers for heating purposes. As a result, when estimating the incremental electricity due to geothermal stationary 1 combustion adjustment technologies' incremental electricity consumption in prior reporting, BSU not only included the electricity increase required to run the geothermal system itself but also the incremental electricity needed to run those chillers.

This second source of incremental electricity consumption was estimated (as allowed per VMD0038 PE Adj route f) by: 1) tracking the electricity consumption of the chillers in each project year; and 2) subtracting out the 5-year baseline period average electricity consumption the chillers used in the same baseline period that BSU used for its GHG VCS project baseline (FY2007-11).

In keeping with BSU's more complete reporting on decimal percentages, we had re-examined internal record keeping and brought BSU's public reporting in line with those internal data sources.

Following this diligence, BSU's previous and now this MR and excel template rely upon this in-depth due diligence which: 1) refined the chiller kWh consumption in FY2012/FY2013; and 2) very slightly refined its chiller kWh consumption average over the baseline period; and 3) established the chiller kWh consumption figures for FY2014/15 first half, when the systems were gradually being phased out.

From an operational standpoint, the old chill plant had five chillers which continued to be used in FY2011/12 until the geothermal brought cooling on line in FY2012 (since the geothermal system was brought on line in stages and required calibration during commissioning). As the geothermal cooling services mainstreamed, BSU kept two chillers in place for any operational backup as/if needed. In summer 2014 these back up chillers were used to cover some of the cooling loads as we continued to commission the geothermal system. Thus from an operational standpoint, the incremental electricity consumption, over that consumed by the chiller plant prior to geothermal systems' implementation during the FY2007-11 project baseline period, was a reasonable and conservative approach to ensure that all incremental electricity consumption loads were captured in BSU's PE Adj calculations (alongside the electricity obviously needed to power the geothermal system itself).

> NOTE:
> As of last reporting cycle, these 2 chillers remain on line as part of the District Energy Station South (DESS) and the measured electricity consumption values for the DESS now integrate the new Heat Pump Chillers and the 2 remaining 'old' chillers as integral equipment.

Since we do not export chilled water to the regional hospital, the total consumption and percentage split of electrical energy is entirely internal to the campus.

As a result, from both an operational and accounting due diligence perspective, BSU considers the PE Adj estimates put forward with the previous and now this MR template to be well founded.

Are there any further activities/measures EE/clean energy undertaken beyond those described in 1.1? ☐ Yes ☒ No

If yes, please describe:

2.2 Deviations

2.2.1 Methodology Deviations

Were any deviations from the methodology applied? ☒ Yes ☐ No

Re half year monitoring basis:

Ball State University's previous application of a half year rather than a full year monitoring basis was consistent with the VMD0038 since the ERy is calculated using actual energy/GHG data from the applicable project/monitoring period and is also consistent with VCS's common practice of accrediting ERy on a half year basis.

In terms of the specifics for our campus-wide project(s), the ERy crediting for the half year period was based upon actual energy consumption and the resulting GHG emissions for the first half of FY2016 (Last half of CY 2015). It was not based upon PE estimates for the full year but upon actual energy/GHG emissions for the first half only of FY2016 itself. In practice, we entered the actual half year energy consumption figures into the CACP(now SiMap) calculator (INPUTS tab), from which the actual half year GHG emissions for PE half year result (ACUPCC REPORTING tab; now the SiMAP Reporting display pages). In the previous MR, this previous reporting the actual

PE half year GHG figure was used to determine the ER for FY2015 first half, by deducting it from the half year baseline value determined for FY2016 per VMD0038 (after the required baseline discounting). Actual energy/GHG figures for the first half of FY2016 were therefore used to determine the FY2016 first half year credits ERy. We followed the same practice this cycle; using the half-year FY data from FY 2018 and FY 2017 to assemble full-year 2017 CY data.

As reported last cycle: the excel template sheet is used for two purposes: a) to review the results of the additionality project year y test (equation 9 for stationary 1 credits; and b) to estimate ERy.

For a), since the threshold maximum allowable limit, which the PE emissions need to remain below in project year y, is based on full year baseline emission figures (see B305), to be conservative the previously-submitted excel template sheet doubled the half year actual FY2016 PE figure when entering it into the excel template (line 25 for FY2016) in order to assess the results of the additionality project year y results.

For b), the excel template was used to run a further set of calculations based upon on the actual *half year* BE, PE and ER results in column C for FY2017, confirming the results for ERy for the first half of FY2016 as described in the first paragraph above.

Ball State University is making public in this CY2016 report the half year PE emissions figure.

> Specifically:
> The credits for this monitoring period [CY2016] include the second half of the FY 2016; thus the full year's FY2016 ERy is calculated and then those credits sold already from the first half of FY 2016 are subtracted from the full FY 2016's ERy to yield the net ERy available to sell for the second half of FY2016 [as part of the CY2016 reporting]. In this way, there is no discrepancy between the full year's FY2016 ERy results and the sum of the first-half-year and second-half-year credits sold.

This approach is consistent with the VMD0038 since the ERy is calculated using actual energy/GHG data from the applicable project/monitoring period. It is also consistent with VCS's common practice of accrediting ERy on a half year basis.

Supplemental measurement basis for a seasonally adjusted PE to apply in the additionality project y test:

When Ball State University previously sought emission reductions for a half year period (FY2015), we took the step voluntarily to provide a supplementary analysis in which we refined our PE measurements for the first half year of FY2015 to adjust for any potential seasonal variances (between first and second half fiscal year energy consumption differences) so that the results of our Eq 9 additionality testing were determined using measurements which are both more accurate and conservative. Ball State University therefore applied PE measurement and monitoring refinements to take into account any potential seasonal variances arising from energy consumption between the first-half vs. second-half of the year. These refinements were designed to ensure more comprehensive, accurate and conservative monitoring of the PE data (on both a regular and seasonally-adjusted basis) for the half-year period but only when applied to the additionality project year y testing given that seasonal variances could arise. The same additionality equation for project year y was applied (namely equation 9) per the requirements of VDM0038.

Ball State University therefore originally sought to ensure that the measurements made for PE emissions for FY2015 half year, applied in eq 9, were accurate and conservative. Ball State University recognizes that there can be seasonal variances between the energy consumed in

first/second half of a project year. So we included a previously-reported supplemental analysis that provided refinements in the PE measurements for the FY2015 half year period which was designed to take account of any such seasonal fluctuations and ensured that the Eq 9 test also was still passed using the most accurate seasonally-adjusted data. The same additionality equation for project year y were applied (namely eq 9) from VMD0038 without any changes to the algorithm when conducting those tests. Ball State University passed that test on both a regular measurement and seasonally-adjusted basis: the application of Eq 9 by Ball State University, using both bases, was therefore conducted on a more accurate and conservative measurement basis since it required that Eq 9 be passed using both a regular and seasonally-adjusted measurement basis.

The voluntary supplemental step taken by Ball State University to take the Eq 9 test TWICE (on a regular and seasonally adjusted basis) was therefore justified as a methodology deviation since a) no changes in the VDM0038 equations were made; and b) only refinements in the measurement basis for the relevant parameters were made.

In terms of the specific measurement refinements made, to examine potential seasonal variations, Ball State University evaluated, based on historical data, the extent to which the first six months of actual energy consumption/GHG emissions might vary compared to the last six months; we then refined the half year's PE GHG emissions value which was normalized for any such seasonal variance and then applied to the project year y additionality testing. Again using equation 9, the Ball State University's project passed project year y additionality testing readily using both regular measurement and the seasonally adjusted measurement bases.

Since Ball State University was only making conservative and more accurate measurement refinements for PE in the FY2015 half year – and did not change the VMD0038 equations which are applied – that voluntary supplemental analysis was justified for inclusion as a Methodology Deviation.

It should again be noted (as reviewed in Q1 above) that ERy for the FY2015 half year was based on actual PE figures only -- not seasonally adjusted measurements: this was consistent with VMD0038's requirements. The seasonally adjusted PE measurements were only applied as a second voluntary test to ensure that the Ball State University passed the project year y additionality testing per Eq 9 on both regular and seasonally adjusted bases for the half year crediting period to be more accurate and conservative.

Ball State University also understood at that time that if a subsequent (catastrophic) event were to lead our energy consumption to 'spiral' unexpectedly during the second half of the FY2015, such that we might later fail the project year y Eq 9 additionality test when applied to the full FY2015, the crediting for the first half of the year would remain accredited, as included in this previous project monitoring period, since we legitimately and readily met the additionality project year y testing during this first half year of the FY2015 period.

2.2.2 Project Description Deviations

Are any project description deviations sought? ☐ Yes ☒ No

2.3 Grouped Project

Grouped project: ☐ Yes ☒ No

2.4 *Safeguards*

2.4.1 No Net Harm

There are no known negative environmental or socio-economic impacts of this project.

2.4.2 Local Stakeholder Consultation

Not Applicable to this Project

3 DATA AND PARAMETERS

3.1 Data and Parameters Available at Validation

As described in sections 9.1 and 9.2 of the Campus-wide Clean Energy & Energy Efficiency Module:

Have all parameters for validation (as now applied for project monitoring/verification purposes) been adopted from and applied as described in these sections? ☒ *Yes* ☐ *No*

Check all applicable parameters used in the pdd for validation purposes (see methodology for definitions):

At validation		
	Confirm	
PBS_c	☒ Yes	☐ No
PBE_c	☐ Yes	☒ No
B	☒ Yes	☐ No
$HDD_{p=y}$	☐ Yes	☒ No
$CDD_{p=y}$	☐ Yes	☒ No
SCAP	☒ Yes	☐ No
E2AP	☐ Yes	☒ No

For source of parameter definitions, see:
http://www.v-c-s.org/methodologies/campus-clean-energy-and-energy-efficiency/

For completeness sake, all the methodology definitions for the parameters applicable to this project validation are found below:

Data Unit / Parameter	PBS_c
Data unit	Percent
Description	Stationary combustion additionality performance benchmark for Carnegie class c. The level of the additionality benchmark is set at the annual percent reduction in campus-wide stationary combustion emissions achieved by campuses of equivalent Carnegie class which also achieve annual average reductions in total energy-based emissions.
Equations	8 and 9, VMD00038
Source of data	ACUPCC (now The Climate Leadership Carbon Commitment)
Value applied	5.68%
Justification of choice of data or description of measurement methods and procedures applied	Justification for the benchmark is provided in Appendix 1 VMD00038
Purpose of data	Determination of additionality
Comment	

Data Unit / Parameter	B
Data unit	Number
Description	Baseline period
Equations	2, 12 and 23, VMD00038
Source of data	Determined based on emissions data reported to third party GHG reporting program.
Value applied	5
Justification of choice of data or description of measurement methods and procedures applied	The baseline period must meet the following conditions: I. The baseline period must include project year 0 and three to five consecutive years prior to the project start date. II. For at least one of the baseline years, data must be publicly-available through ACUPCC (now Climate Leadership Carbon Commitment) or a third-party GHG reporting program. The baseline period must be justified relative to the data that most accurately reflects historical emissions that are comparable to the campus conditions during project crediting period (e.g., similar square footage and attendance). The baseline period must be calculated by subtracting the calendar year for the first year of the baseline period from the calendar year of project year 1.
Purpose of data	Calculation of baseline emissions
Any comment	

Data Unit / Parameter	SCAP
Data unit	Number
Description	Stationary combustion additionality eligibility period
Equations	8 and 9, VMD00038
Source of data	
Value applied	2
Justification of choice of data or description of measurement methods and procedures applied	This period must include project year 0 and one to five consecutive years prior to the project start date. This period must be calculated by subtracting the calendar year for the additionality testing year, used for stationary combustion additionality benchmark testing, from the calendar year for project year 1.
Purpose of data	Determination of additionality
Comment	In some cases, the additionality eligibility period is not the same as the baseline period or the scope 2 electricity additionality eligibility period.

3.2 Data and Parameters Monitored

As described in section 9.1 and 9.2 of the Campus-wide Clean Energy and Energy Efficiency Module.
Have all parameters for verification/monitoring been adopted from and applied as described in these sections? ☒ Yes ☐ No

Which applicable public GHG reporting system has the campus used for this applicable monitoring period (including baseline and current project years)?

Please indicate which one:
☒ ACUPCC (now Climate Leadership CC)
☒ STARS
☒ GRI

Are the GHG emissions and square foot data applied to this project in this monitoring period consistent with these public reports?
☒ Yes ☐ No

Has the CACP (now SiMap) calculator been used to develop these GHG emissions?
☒ Yes ☐ No
If not, explain how the GHG calculation approach used is consistent with the CACP (now SiMap) calculator

Check all applicable parameters used in this monitoring report for verification purposes (see methodology for definitions):

Monitored	
	Confirm Y or N
$SF_{b=x}$	☒ Yes ☐ No
$SF_{p=y}$	☒ Yes ☐ No
$F_{b=x,\,i}$	☒ Yes ☐ No
$F_{p=y,\,i}$	☒ Yes ☐ No
$E_{b=x}$	☒ Yes ☐ No
$E_{p=y}$	☒ Yes ☐ No
y	☒ Yes ☐ No
ΔEy	☒ Yes ☐ No
$AT_{y,i}$	☐ Yes ☒ No
$PSH_{b=x}$	☐ Yes ☐ No
$PSH_{p=y}$	☐ Yes ☐ No
$PC_{b=x}$	☐ Yes ☐ No
$PC_{p=y}$	☐ Yes ☐ No
$\Delta F_{y,i}$	☐ Yes ☒ No

NOTE:
BSU does not purchase steam heat or cooling and so the PSH and PC parameters are not checked.

For source of parameter definitions, see:
http://www.v-c-s.org/methodologies/campus-clean-energy-and-energy-efficiency/

For completeness sake, all the methodology definitions for the parameters applicable to this project verification are found below:

Data Unit / Parameter	$SF_{b=x}$, $SF_{p=y}$
Data unit	ft^2
Description	Total campus-wide square footage in the applicable year
Equations	1, 2, 3, 4, 9, 11, 30 and 31, VD00038
Source of data	The campus' historical GHG inventory reporting to relevant third-party GHG reporting program (e.g., ACUPCC; now CLCC). Primary data from internal financial and facilities operational reviews.
Description of measurement methods and procedures to be applied	Measured according to the reporting framework of the relevant third-party GHG reporting program.
Frequency of monitoring/recording	Annual
QA/QC procedures to be applied	The primary data is checked during internal financial and facilities operational reviews. The primary data is used to calculate the project and ACUPCC (now CLCC) reports and is checked during the calculation review and report preparations.
Purpose of data	Determination of additionality Calculation of baseline emissions Calculation of project emissions
Comment	Campus square footage data is typically reported to ACUPCC (now Climate Leadership Carbon Commitment)
Value monitored	The values for each year are provided in section 2.1 above
Calculation method	Follows the protocols set out in the relevant third party reporting program
Monitoring Equipment	The data is calculated using common area calculations

Data Unit / Parameter	$F_{b=x,i}$, $F_{p=y,i}$
Data unit	tCO_2e
Description	Stationary combustion emissions in the applicable year from fuel type i, in the applicable year
Equations	3, 5, 6, 8, 9, 12, 14 and 28, VMD00038
Source of data	GHG reports submitted to third-party GHG reporting programs such as ACUPCC (now Climate Leadership Carbon Commitment), as generated through credible GHG reporting tools such as the CAPC calculator or The Climate Registry reporting protocols. Primary data from internal financial and facilities operational reviews.

Description of measurement methods and procedures to be applied	GHG emissions must be calculated by multiplying the quantity of fuel type i used campus-wide by the appropriate emissions factor for fuel type i, for the applicable year. Emissions factors for fuels must be consistent with those permitted under the third-party GHG reporting program.
Frequency of monitoring/recording	Annual
QA/QC procedures to be applied	The primary data is checked during internal financial and facilities operational reviews. The primary data is used to calculate the project and ACUPCC (now CLCC) reports and is checked during the calculation review and report preparations.
Purpose of data	Determination of additionality Calculation of baseline emissions Calculation of project emissions
Comment	The parameter $F_{b=1,i}$ is referenced in both Section 7, VMD00038 where it applies to the additionality testing year and Section 8, VMD00038, where it applies to the first year of the baseline period. In some cases, the additionality testing year is not the same as the first year of the baseline period.
Value monitored:	The values for each year are provided in section 4 below
Calculation method	Follows the protocols set out in the relevant third party reporting program
Monitoring Equipment	The underlying primary data for fuel consumption is measured using standard industrial measures and equipment. The natural gas, for example, is measured using an industrial standardized dry gas meter provided by the utility.

Data Unit / Parameter	$E_{b=x}$ or $E_{p=y}$
Data unit	tCO_2e
Description	Scope 2 electricity emissions in the applicable year
Equations	4, 5, 7, 19, 11, 29, 23 and 25, VMD00038
Source of data	GHG reports submitted to third-party GHG reporting programs such as ACUPCC (now Climate Leadership Carbon Commitment), or generated through credible GHG reporting tools such as the CAPC calculator or The Climate Registry reporting protocols. Primary data from internal financial and facilities operational reviews.

Description of measurement methods and procedures to be applied	$E_{b=1}$ must be calculated by multiplying the total electricity consumed campus-wide by the appropriate grid emissions factor, for the applicable baseline year. Emission factors must be consistent with those permitted under the third-party GHG reporting program, preferably consistent with those permitted under the CACP (now SiMap) calculator. The default emissions factor is the regional eGRID combined margin. Other GHG emission factors should only be used if justification is provided that they are reasonable and conservative (eg, factors tailored to the specific utilities from which campuses' electricity is sourced). In such cases, the factors must have been published by the utilities in year y or, if published previously, must be used for no more than three years of emission reductions (i.e., years y, y+1 and y+2, where y can be either a project year or a baseline year).
Frequency of monitoring/recording	Annual
QA/QC procedures to be applied	The primary data is checked during internal financial and facilities operational reviews. The primary data is used to calculate the project and ACUPCC reports and is checked during the calculation review and report preparations.
Purpose of data	Determination of additionality Calculation of baseline emissions Calculation of project emissions
Comment	The parameter $E_{b=1}$ is referenced in both Section 7 VMD00038 where it applies to the additionality testing year and Section 8 VMD0038 where it applies to the first year of the baseline period. In some cases, the additionality testing year is not the same as the first year of the baseline period.
Value monitored	The $E_{p=y}$ values (tons CO2e) were applied to calculate PE Adjustment only: they were: $E_{p=1}$ 75,109 $E_{p=5}$ 75,731 $E_{p=2}$ 81,448 $E_{p=6}$ 74,857 $E_{p=3}$ 78,557 $E_{p=7}$ 40,747 **(1/2 year)** $E_{p=4}$ 76,710
Calculation method	Follows the protocols set out in the relevant third party reporting program
Monitoring Equipment	The underlying primary data for fuel consumption is measured using standard industrial measures and equipment. Electricity, for example, is measured using a standard electric meter measuring current (kWh) provided by the utility.

Data Unit / Parameter	y
Data unit	number
Description	Project year
Equations	13 and 24, VMD00038
Source of data	Primary data from internal financial and facilities operational reviews.
Description of measurement methods and procedures to be applied	y is the project year determined by counting the number of years since the project start date (i.e., the first project year = 1, the second project year = 2, etc.)
Frequency of monitoring/recording	Annually
QA/QC procedures to be applied	Project year y takes values 1,2,3,4 in this verification. Consistency between ACUPCC (now CLCC) annual reporting periods and project annual reports periods were assured (e.g. fiscal or calendar years applied consistently throughout)
Purpose of data	Calculation of baseline emissions
Comments	
Value monitored	CY 2017 … Last ½ FY 2017 & First ½ FY 2018
Calculation method	Follows the protocols set out in the relevant third party reporting program
Monitoring Equipment	Calendar

Data Unit / Parameter	ΔE_y
Data unit	tCO_2e
Description	Incremental scope 2 electricity emissions and scope 2 heat emissions, scope 2 cooling emissions and/or scope 2 steam emissions in project year y due to stationary combustion adjustment technologies
Equations	15, 16, and 22, VMD00038
Source of data	GHG reports submitted to third-party GHG reporting programs such as ACUPCC (now CLCC), or generated through credible GHG reporting tools such as the CAPC calculator or The Climate Registry reporting protocols. Primary data from internal financial and facilities operational reviews, from which this parameter is calculated.
Description of measurement methods and procedures to be applied	Credible estimation approaches are allowed and sub-metering is not required. ΔE_y must be calculated consistent with calculations above for $E_{p=y}$

	ΔE_y must be calculated by multiplying the incremental electricity consumed due to stationary combustion adjustment technologies in project year y by the appropriate grid emissions factor in project year y, then adding the incremental units of purchased heat, cooling and/or steam consumed due to stationary combustion adjustment technologies in project year y multiplied by an appropriate emissions factor. Emission factors must be consistent with those permitted under the third-party GHG reporting program, preferably consistent with those permitted under the CACP (now SiMap) calculator. The default emissions factor is the regional eGRID combined margin. Other GHG emission factors should only be used if justification is provided that they are reasonable and conservative (e.g., factors tailored to the specific utilities from which campuses' electricity is sourced). In such cases, the factors must have been published by the utilities in year y or, if published previously, must be used for no more than three years of emission reductions (i.e., years y, y+1 and y+2, where y can be either a project year or a baseline year). Emissions factors for fuels must be consistent with those permitted under the third-party GHG reporting program.
Frequency of monitoring/recording	Annually
QA/QC procedures to be applied	The primary data is checked during internal financial and facilities operational reviews. The primary data is used to calculate the project and ACUPCC reports and is checked during the calculation review and report preparations.
Purpose of data	Calculation of project emissions
Comment	
Value monitored:	The values for each year are provided in the calculations of $PE\Delta_y$ found in section 4.2 below and whose calculation basis is detailed in the excel project template.
Calculation method	Follows the protocols set out in VMD0038
Monitoring Equipment	Calculated value derived from E_y consistent with estimations and sub-metering allowed under VMD0038. See excel template.
Data Unit / Parameter	$PSH_{b=x,}$ $PSH_{p=y}$
Data unit	tCO_2e
Description	Scope 2 emissions from purchased steam and/or heat emissions in the applicable year
Equations	16, 17 and 27, VMD00038

Source of data	GHG reports submitted to third-party GHG reporting programs such as ACUPCC (now CLCC), or generated through credible GHG reporting tools such as the CAPC calculator or The Climate Registry reporting protocols. Primary data from financial and facilities operational reviews.
Description of measurement methods and procedures to be applied	$PSH_{b=x}$ or $PSH_{p=y}$ must be calculated by multiplying scope 2 emissions from purchased steam and/or heat in the relevant year by an appropriate grid emissions factor or emission factor for fuels used. Emission factors must be consistent with those permitted under the third-party GHG reporting program, preferably consistent with those permitted under the CACP (now SiMap) calculator.
Frequency of monitoring/recording	Once per project crediting period
QA/QC procedures to be applied	The primary data is checked during financial and facilities operational reviews. The primary data is used to calculate the project and ACUPCC reports and is checked during the calculation review and report preparations.
Purpose of data	Calculation of project emissions
Comment	
Value monitored:	The values for each year are provided in the calculations of $PE\Delta y$ found in section 4.2 below and whose calculation basis is detailed in the excel project template. BSU purchased no heat/steam during this monitoring period so values $PSH_{b=x,}$ $PSH_{p=y}$ are also zero.
Calculation method	Follows the protocols set out in the relevant third party reporting program
Monitoring Equipment	The underlying primary data for purchased heat and/or steam consumption is measured using standard industrial measures and equipment applied at the source of generation (offsite) consistent with supplied and invoiced energy services.

Data Unit / Parameter	$PC_{b=x,}$ $PC_{p=y}$
Data unit	tCO_2e

Description	Scope 2 emissions from purchased cooling in the applicable year
Equations	16, 18 and 27, VMD00038
Source of data	GHG reports submitted to third-party GHG reporting programs such as ACUPCC (now CLCC), or generated through credible GHG reporting tools such as the CAPC calculator or The Climate Registry reporting protocols. Primary data from financial and facilities operational reviews.
Description of measurement methods and procedures to be applied	$PC_{b=x,}$ or $PC_{p=y}$ must be calculated by multiplying scope 2 emissions from purchased cooling in the relevant year by an appropriate grid emissions factor. Emission factors must be consistent with those permitted under the third-party GHG reporting program, preferably consistent with those permitted under the CACP (now SiMap) calculator.
Frequency of monitoring/recording	Once per project crediting period
QA/QC procedures to be applied	The primary data is checked during internal financial and facilities operational reviews. The primary data is used to calculate the project and ACUPCC (now CLCC) reports and is checked during the calculation review and report preparations.
Purpose of data	Calculation of project emissions
Comment	
Value monitored:	The values for each year are provided in the calculations of $PE\Delta y$ found in section 4.2 below and whose calculation basis is detailed in the excel project template BSU purchased no cooling during this monitoring period so values $PC_{b=x,}$ $PC_{p=y}$ are also zero.
Calculation method	Follows the protocols set out in the relevant third party reporting program
Monitoring Equipment	The underlying primary data for purchased cooling consumption is measured using standard industrial measures and equipment applied at the source of generation (offsite) consistent with supplied and invoiced energy services.

3.3 Monitoring Plan

I. QC/QA STRUCTURE:

Business Affairs Oversight
As Associate Vice President for Facilities Planning and Management, Mr. Jim Lowe, PE is the responsible party for operations of the entire campus infrastructure including the High Voltage Electrical Substations, the Boiler Plant, the District Energy Stations, the Utility Distribution Systems and the import of Combustible Fuels and Grid-based Electricity.

Reporting to Mr. Lowe was a position titled Utility Engineer. That individual and Mr. Lowe are licensed professional engineers in Indiana. The Utility Engineer is responsible for the management of the supervisors of the Boiler Plant and Energy Stations noted above. Prior to the March 2014 shut down of the steam-producing coal-fired boilers, the Boiler Plant combusted coal and natural gas; and only on an emergency basis fuel oil. The supervisor of the Boiler Plant routinely provides day-to-day reports on fuel use in each and every boiler.

In addition, Mr. Lowe has a group of three engineers, two of whom are licensed professional engineers in Indiana. This group is responsible for maintaining the main electrical meters at each substation, maintaining the (47) individual building electrical meters, and providing the weekly, monthly and annual reports on electricity consumption.

In addition Mr. Lowe has a staff person who receives invoices from our utility providers, I&M Electric, Vectren Energy, and Peabody Energy. This individual compares the invoices to the data in the monthly energy reports compiled by the engineering group. *This checks-and-balances practice enables us to flag and resolve erroneous meter readings.*

Academic Affairs Oversight:
As Director of the Center for Energy Research, Education, Service, Mr. Robert J. Koester, AIA, LEED AP is a registered architect and the institutional liaison charged with filing of public reports on university sustainability activities with the American College and University Presidents Climate Commitment (ACUPCC) – *[newly rebranded as the Climate Leadership Commitment]* and the Sustainability Tracking Assessment Rating System (STARS) as well as the Carbon Credit Transaction Reporting to Second Nature as agent for the transaction of our carbon reductions in the Voluntary Carbon Market.

This latter protocol involves production of an initial Project Description Document and annual Monitoring Reports.

II. GREENHOUSE GAS/PROJECT DATA MANAGEMENT/MONITORING PROCESSES

Electricity:
We measure electrical use by kilowatt-hour in each major building on campus, and at each of the two incoming high voltage substations which BSU owns and operates. This information allows us to aggregate building metered data and the main substation metered data for comparison to that invoiced by our provider, I&M. *This checks-and-balances practice enables us to flag and resolve erroneous meter readings.*

Coal:
When we burned coal we received a load sheet from the trucking company for each and every load. Each truck would be weighed by a scale calibrated by the Indiana Division of Weights and Measures. The coal delivered was measured in pounds, or short tons. Once we received the load sheets, we totaled them.

Originally, in the Boiler Plant our four-boiler coal loader, referred to as a weigh lorry, contained a scale that allowed us to record every pound of coal that was dumped into each respective boiler. The boiler coal loader scale was calibrated annually. This information was used in total form for comparison with load sheets. *This checks-and-balances practice enabled us to flag and resolve erroneous meter readings.*

The coal loader scale data was totalized and reported to the Indiana Department of Environmental Management (IDEM) for use along with an average analysis of the components in our delivered coal to determine the Title V operating permit fees.

Gas:
We receive natural gas through what is referred to as a rate 260 purchase. This was due to the large volumes purchased. The purchase is measured in dekatherms. A dekatherm is equal to 1,000,000 BTUs or 1,000 cubic feet. [We adjust this later using the 1.028 multiplier]

We buy natural gas through a broker much like one would buy stock. The natural gas was in fact priced through the NYMEX. Our natural gas comes from the Henry Hub and was delivered to the city gate which was owned by Vectren. Our broker was Constellation; formerly named ProLiance Energy.

The natural gas was received at one metered located prior to entering the boiler plant pipe lines. Vectren meters and accumulates this information electronically. We meter the natural gas use at each of our three natural-gas-fired boilers, totalize and use the information to compare to Vectren's metered data. *This checks-and-balances practice enables us to flag and resolve erroneous meter readings.*

Determining Project Boundary:
In determining the boundary of application of Greenhouse Gas emissions at Ball State University, it has been necessary for us to isolate that portion of annual steam production which was sold to the privately-held hospital adjacent to the university. Mr. Lowe's staff maintains records of the daily/monthly/annual steam production from the campus heat plant and the daily/monthly/annual amount of said steam production which is sold to the hospital. As a result, the total Greenhouse Gas emissions attributable to the campus are determined using the pro-rated split in pounds of steam produced for the campus as distinct from the pounds of steam sold to the hospital.

GHG Calculations:
Ball State University uses the Clean Air Cool Planet (CACP; now SiMap) calculator as the preferred/approved means of determining CO_2e emissions. This calculator was recommended by ACUPCC (now CLCC and STARS, and has been approved as a preferred methodology by Verified Carbon Standard (VCS). Within the calculator, we are able to select our electric utility region and associated conversion factors for Scope 2 CO_2e emissions. Thus the Greenhouse Gas Emissions reported to ACUPCC (now CLCC) and STARS align with those recognized for use in the VCS project templates.

Data Management:
The cross-checked utility data provided by Mr. Lowe and his staff are used by Mr. Koester to load into the Clean Air Cool Planet master spread sheet. These numbers are then cross-checked by Mr. Lowe and Mr. Koester to confirm that the public reporting using CACP (now SiMap) was consistent with the utility records of the university. *This checks-and-balances practice enables us to flag and resolve erroneous data entry.*

We also make use of the Clean Air Cool Planet tool to indicate those credits that are transacted to third parties such as we did previously with BEF as agent for the Chevrolet Carbon Reduction Initiative. These values are entered into the CACP (now SiMap) calculator as a "negative value" for offsets "purchased" which thereby adjusts the total Greenhouse Gas Emissions attributable to the campus for that given year for purposes of climate neutrality

reporting. This assures that the ACUPCC (now CLCC) and STARS public data reporting corresponds to the project data inputs and assumptions used in the VCS templates.

All records reported on the public websites of ACUPCC (now CLCC) and STARS will remain public under the auspices of those reporting organizations; all BSU records of project credit sales will be maintained within the institution for at least ten years to correspond to the duration of the carbon reduction transaction authorized through the VCS-approved methodology. Beyond the previously-executed transactions with BEF on behalf of Chevrolet, current and future transactions in the carbon market will continue to follow the same protocols for reporting as such transactions are registered in credible carbon registries.

NOTE:
The Excel project template issued by VCS were originally affirmed during validation by Det Norske Veritas (DNV) as corresponding to the requirements that the methodology lays out for project reviews/credit accounting—and draws upon the VCS-monitored parameters in an appropriate fashion. We will continue using these tools for each year of any credit calculations that are to be transacted in the carbon market.

III. INTERNAL AUDITING/CROSS-CHECKING/QA/QC PROCESSES:

Cross-checking of the VCS Project/Greenhouse Gas accounting was provided by the following:

- Public Greenhouse Gas Reporting through ACUPCC (now CLCC) and STARS includes stakeholder/peer review to establish/maintain due diligence of processes and accepted practices for accountability;
    - Internal auditing and cross-checking among team members under the direction of Mr. Lowe and Mr. Koester assures that all inputs and calculations are consistent with that established practice, the criteria of VCS templates, CACP (now SiMap) calculator requirements and ACUPCC/STARS reporting;
    - Utility data are randomly sampled for comparison with entries into the CACP (now SiMap) calculator to assure that the monthly/annual data entry corresponds to the monthly/annual data reported as inputs to the CACP (now SiMap) calculator;
    - For fiscal years 2012, 2013, 2014, an informal consultation with BEF, Climate Neutral Business Network (CNBN), and representatives of Chevrolet were especially helpful as Ball State University worked with these groups to help pilot the methodologies and processes by which such public reporting and carbon market transactions can be undertaken by the higher education sector;
    - We anticipate that similar informal consultation will continue to occur with other potential carbon brokers and/or purchasers of carbon reduction credits;
    - The internal cross-checking of data also was integral to the other mandated public recording such as the internal and external auditing of our Title V reports; and, finally
    - The university conducts annual financial audits at the close of each fiscal year to insure consistency and accuracy of reporting of all budgetary transactions; this review includes internal checking of invoicing for utility purchases and includes documentation of those carbon reductions/carbon credits created — including receipt of payments for transacted credits.

IV. SUPPLIER INFORMATION/FUEL MIX/SAMPLE INVOICES

Ball State University routinely will continue to provide to external validators/verifiers all necessary supporting documentation requested including utility purchasing/invoice data, consistent with sampling procedures mandated by the selected validator/verifier.

4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

The accompanying campus excel template sheet, supplied separately to verifiers, contains all the required calculations which Applicant believes are needed for section 4 and 2.1 above to demonstrate whether and how the additionality performance tests are satisfied and how the baseline, project emissions and project Emission Reductions are established. In the best judgment of the campus, this excel template accurately provides all relevant data and parameters on a reproducible basis to establish the project's performance in these regards, indexing clearly to the numbered equations applicable in VMD0038.

For stationary 1 and scope 2 electricity GHG calculations, specify the version of CACP (SiMap) calculator which has consistently been used to generate BEy, PEy, LEy and ERy (tCO2e)

Project year 1
Project year 2
Project year 3
Project year 4
Project year 5
SiMAP Project year 6
SiMAP Project year 7
Project year 8
Project year 9
Project year 10

Beyond any automatic changes derived from the use of different version of the CACP(SiMap) calculator as described above (e.g. vs 6.9 compared to vs 7.0 compared to vs 8.0), are there any other changes in the project data as submitted for later project year credit verification which have been made (e.g. to earlier year data)?

☒ *Yes* ☐ *No*

If yes, please describe:

With the filing of MR, we continue to cite the decimal percentages of steam sold to the regional hospital on the edge of campus. This provides a more exacting alignment of our internal record keeping with our public reporting. Every file (utility summary, CNBN excel templates, CACP(now SiMap) Calculator in the 6.9, 7.0 and 8.0 versions accordingly) have been updated with the new numbers shown in this current MR. As a result the original PBSc changed from 18.75% to 19.27% thus reinforcing even more strongly the project's original additionality validation decision.
Similarly, compared to the validation reporting, the results herein for actual BEy PEy and ERy have been refined and updated to be more accurate (reflecting now the use of decimal percentages in the parsing of steam values supplied to the hospital).
Since validation for FY 13, the accurate incremental electricity consumption due to the geothermal installation was confirmed and the values now used replace the earlier estimate submitted for validation. As a result, ΔEp=y for FY 13 was confirmed as 11,212 rather than 9,237.

And we compiled even more detailed kWh tracking and documentation. We assembled a 5-year baseline profile of electrical consumption for the south chiller plant from metered data as shown in the supplied spreadsheets, that data was accumulated on a monthly basis and we were able to gather readings for every month of the initial 5 years except for 2 in FY 2011. For those 2 months we were able to generate a proportional estimate of the likely consumption.

Then with the start of the geothermal project, the existing south chiller plant was maintained in service as the geothermal was brought on line. Specifically, of the 5 chillers in place, 3 were taken offline and 2 were continued in use as a back-up to the district scale geothermal system. During that transitional time, we were able to gather meter readings for FY 2012 and FY 2013.

However, with the final switch-out of equipment, including removal of the old cooling towers, the re-routing and replacing of some electrical circuitry in anticipation of the new (geothermal) District Energy Station South (DESS), there was a period of 1-1/2 years during which the meters were not usable for

documenting electrical flow. In fact, there were several months when the chillers were simply turned off because they had to be disconnected to rework the electrical system.

Thus for FY 2013, FY 2014 and FY 2015 (first half), we developed estimated profiles of consumption for the south chillers (old chiller plant) as follows: since the District Energy Station North (DESN) heat pump chillers will not even function unless they run at a minimum 50% load, we used that 50% assignable DESN value to pro-rate an electrical split for the south chiller plant.

And although there were days and even weeks when the DESN equipment was running near full capacity, we chose to be very conservative in our estimates by using the 50% base as the cut-off for splitting electrical supply between the north district energy station and the south chiller plant.

To corroborate the reasonableness of these pro-rata estimates, we also used the same form of analysis to backload calculations for the baseline years to determine if the figures were close to the metered readings for the south chill plant; they were. Thus we have a high level of confidence in our pro-rata proportioning and are comfortable with the fact that we are willing to accept such a conservative split of electrical supply.

During validation, Ball State was still using a proxy estimate for the electricity consumption from the geothermal system for year FY2013. This electricity consumption is fully monitored via sub-meters. And so during initial verification the accurate meter readings were provided for FY 2013 alongside new readings for FY2014/15 (first half).

> (Note: the FY2013 estimated kWh consumption was 25,000,000 kWh; the actual meter reading figure applied in the previous verification was 28,082,866 kWh).

During the transition to geothermal for both heating and cooling purposes, some of BSU's older chill plant facilities were continued in use with the expectation that, as the geothermal system was mainstreamed, they would ultimately be streamlined, backed down and even eliminated in the same way that the geothermal had replaced the coal energy inputs/boilers for heating purposes. As a result, when estimating the incremental electricity due to geothermal stationary 1 combustion adjustment technologies' incremental electricity consumption, BSU not only included the electricity increase required to run the geothermal system itself but also the incremental electricity needed to run those chillers.

This second source of incremental electricity consumption was estimated (as allowed per VMD0038 PE Adj route f) by: 1) tracking the electricity consumption of the chillers in each project year; and 2) subtracting out the 5 year baseline period average electricity consumption the chillers used in the same baseline period BSU used for its GHG VCS project baseline (FY2007-11).

In keeping with BSU's more complete reporting on decimal percentages, we have again re-examined the detailed internal record keeping bringing BSU's public reporting in line with these internal data sources.

Following this diligence, BSU's current MR and excel template relies upon this in-depth due diligence which: 1) refined the chiller kWh consumption in FY2012/FY2013; and 2) very slightly refined its chiller kWh consumption average over the baseline period; and 3) established the chiller kWh consumption figures for FY2014/15 first half, when the systems were gradually being phased out.

From an operational standpoint, the old chill plant had five chillers which continued to be used in FY2011/12 until the geothermal brought cooling on line in FY2012 (since the geothermal system was brought on line in stages and required calibration during commissioning). As the geothermal cooling services mainstreamed, BSU kept two chillers in place for any operational backup as/if needed. In CY 2015 these back up chillers were used to cover some of the cooling loads as we continued to commission the geothermal system. Thus from an operational standpoint, the incremental electricity consumption, over that consumed by the chiller plant prior to geothermal

systems' implementation during the FY2007-11 project baseline period, was a reasonable and conservative approach to ensure that all incremental electricity consumption loads were captured in BSU's PE Adj calculations (alongside the electricity obviously needed to power the geothermal system itself).

NOTE:
As of today, these 2 chillers are on line as part of the District Energy Station South (DESS) and the measured electricity consumption values for the DESS now integrate the new Heat Pump Chillers and the 2 remaining 'old' chillers as integral equipment.

Since we do not export chilled water to the regional hospital, the total consumption and percentage split of electrical energy is entirely internal to the campus.

As a result, from both an operational and accounting due diligence perspective, BSU considers the PE Adj estimates put forward with this MR template to be well founded.

4.1 Baseline Emissions

For FY 2012/13/14/15 (where applicable) using the version of CACP (SiMap) calculator consistently described above:

For stationary 1 reductions, BE 65,781

For years 2012	using CACP		tCO2e
For years 2013	using CACP		tCO2e
For years 2014	using CACP		tCO2e
For years 2015	using CACP	63,691	tCO2e
For years 2016	using CACP	62,863	tCO2e
For years 2017	using SiMAP v 1.0	62,046	tCO2e
		(Halved below for half year crediting for project year 6 in BE_5)	
For years 2018	using SiMAP v 1.0	61,239	tCO2e
		(Halved below for half year crediting for project year 7 in BE_5)	
For years	using CACP		
For years	using CACP		
For years	using CACP		

For scope 2 electricity reductions, BE N/A

For years	using CACP	N/A	tCO2e
For years	using CACP	N/A	tCO2e
For years	using CACP	N/A	tCO2e
For years	using CACP	N/A	tCO2e
For years	using CACP	N/A	tCO2e
For years	using CACP	N/A	tCO2e
For years	using CACP	N/A	tCO2e
For years	using CACP	N/A	tCO2e
For years	using CACP	N/A	tCO2e
For years	using CACP	N/A	tCO2e

Based on equations 13/24 (stat 1/scope 2):

$$BE_y = BE * (1 - 0.013)^{(y-1)}$$

For stationary 1, BEy (tCO2e)

	Project year 1 using CACP vs
	Project year 2 using CACP vs
	Project year 3 using CACP vs
	Project year 4 using CACP vs
	Project year 5 using CACP vs
31,023	Project year 6 half-year using SiMAP v 1.0
30,620	Project year 7 half-year using SiMAP v 1.0

		Project year 8 using CACP vs
		Project year 9 using CACP vs
		Project year 10 using CACP vs
For scope 2 electricity, BEy (tCO2e)	N/A	Project year 1 using CACP vs
	N/A	Project year 2 using CACP vs
	N/A	Project year 3 using CACP vs
	N/A	Project year 4 using CACP vs
	N/A	Project year 5 using CACP vs
	N/A	Project year 6 using CACP vs
	N/A	Project year 7 using CACP vs
	N/A	Project year 8 using CACP vs
	N/A	Project year 9 using CACP vs
	N/A	Project year 10 using CACP vs

4.2 Project Emissions

For FY 2012/13/14/15 (as applicable) using the version of CACP calculator consistently described above:

For stationary 1, PEy (tCO2e)		Project year 1 using CACP vs
		Project year 2 using CACP vs
		Project year 3 using CACP vs
		Project year 4 using CACP vs
		Project year 5 using CACP vs
	9,373	Project year 6 half-year using SiMAP v 1.0
	8,389	Project year 7 half-year using SiMAP v 1.0
		Project year 8 using CACP vs
		Project year 9 using CACP vs
		Project year 10 using CACP vs
For scope 2 electricity, PEy (tCO2e)	N/A	Project year 1 using CACP vs
	N/A	Project year 2 using CACP vs
	N/A	Project year 3 using CACP vs
	N/A	Project year 4 using CACP vs
	N/A	Project year 5 using CACP vs
	N/A	Project year 6 using CACP vs
	N/A	Project year 7 using CACP vs
	N/A	Project year 8 using CACP vs
	N/A	Project year 9 using CACP vs
	N/A	Project year 10 using CACP vs

For all FY years, using the appropriately generated GHG figures as above with CACP vs 6.9 for FY 2012/13 and CACP vs 7.0 for FY 2014/15 (as applicable):

Do any of the EE measures require PE adjustments? ☐ Yes ☒ No

If yes, resulting $PE\Delta_y$ for project year y (tCO_2e)	[$PE\Delta_1$ for project year 1]
	[$PE\Delta_2$ for project year 2]
	[$PE\Delta_3$ for project year 3]
	[$PE\Delta_4$ for project year 4]
	[$PE\Delta_5$ for project year 5]
3,998	[$PE\Delta_5$ for project half year 6]
7,424	[$PE\Delta_7$ for project half year 7]
	[$PE\Delta_8$ for project year 8]
	[$PE\Delta_9$ for project year 9]
	[$PE\Delta_{10}$ for project year 10]

4.3 Leakage

Project leakage is set at zero for all project years y:

Resulting LEy for project year y (tCO2e)	0 LE_y for all project years y

4.4 Net GHG Emission Reductions and Removals

For FY 2012, 2013, 2014, 2015, CY 2016, and CY 2017 (as applicable) using the relevant CAPC (SiMAP) generated results as described above:

For stationary 1 reductions:

Years	Baseline emissions or removals (tCO_2e) BE_y	Project emissions or removals (tCO_2e) PE_y	PE Adjustment emissions (tCO_2e) $PE\Delta_y$	Sq ft adjustment factor $SF\Delta_y$	Actual net GHG emission reductions or removals (tCO_2e) ER_y
Project Year 1					
Project Year 2					
Project Year 3					
Project Year 4					
Project Year 5					
Project Year 6 2nd ½ Fiscal Year 2017 (01 January 2017 - 30 June 2017)	31,023	9,373	7,995	1	18,145
Project Year 7 1st ½ Fiscal Year 2018 (01 July 2017 - 31 December 2017)	30,620	8,389	7,424	1	14,807
Project Year 8					
Project Year 9					
Project Year 10					
Total for this Monitoring Period Only (01 January 2017- 31 December 2017)	61,643	17,762	15,449	N/A	32,952

For scope 2 electricity-based reductions:

Years	Baseline emissions or removals (tCO_2e) BE_y	Project emissions or removals (tCO_2e) PE_y	PE Adjustment emissions (tCO_2e) $PE\Delta_y$	Sq ft adjustment factor $SF\Delta_y$	Actual net GHG emission reductions or removals (tCO_2e) ER_y
Project Year 1					
Project Year 2					
Project Year 3					
Project Year 4					
Project Year 5					
Project Year 6					
Project Year 7					
Project Year 8					
Project Year 9					
Project Year 10					
Total for this Monitoring Period (only)					

If both stationary 1 and scope 2 electricity reductions are sought, total project ERy (their sum) for each project year and for the total monitoring period following this same chart format, comprises:

Years	Baseline emissions or removals (tCO2e) BEy	Project emissions or removals (tCO2e) PEy	PE Adjustment emissions (tCO2e) PEΔy	Sq ft adjustment factor SFΔy	Actual net GHG emission reductions or removals (tCO2e) ERy
Total Project Year 1					
Total Project Year 2					
Total Project Year 3					
Total Project Year 4					
Total Project Year 5					
Total Project Year 6					
Total Project Year 7					
Total Project Year 8					
Total Project Year 9					
Total Project Year 10					
Total For This Monitoring Period					

APPENDIX A: CAMPUS MAP REFLECTING PROJECT BOUNDARY