



VERIFICATION REPORT FOR ECOBEE TECHNOLOGIES - IMPROVING ENERGY EFFICIENCY IN HOMES THROUGH SMART THERMOSTAT OPTIMIZATION



Report ID	VCS FVerR_0782782_ecobee
Project title	Improving Energy Efficiency in Homes Through Smart Thermostat Optimization
Project ID	3352
Verification period	03/03/2023 – 02/03/2025
Original date of issue	05/11/2025
Most recent date of issue	08/06/2026
Version	1.4.2
VCS Standard Version	V4.7

Client	ecobee Technologies, ULC
Prepared by	ERM Certification and Verification Services Ltd.
Approved by	Braulio Pikman (Technical Reviewer)
Work carried out by	Timothy Chan (Lead Auditor)

Summary:

ERM Certification and Verification Services Ltd. (ERM CVS) was contracted by ecobee Technologies, ULC (hereafter “the project proponent”, also referred to as “PP”, to perform an independent verification of the proposed VCS grouped project “Improving Energy Efficiency in Homes Through Smart Thermostat Optimization” in the United States of America (hereafter “the project”). This report describes the process of conducting the verification, summarizes the findings and concludes the verification opinion.

The verification was performed on the basis of criteria set out in Verra’s VCS Program. The auditing criteria prescribed by ISO 14064-3 2019 “Specification with guidance for the verification and validation of greenhouse gas statement” have been used for the verification of the project. The information documented in the Monitoring Report (MR) (version 3.0, dated 08/06/2026) of the proposed project is reviewed against the VCS Standard (Version 4.7) and the applied VCS methodology, VM0008: Weatherization of Single Family and Multi-Family Buildings, version 1.1.

This verification report is based on the assessment of the Project Description and Monitoring Report undertaken through the application of standard auditing techniques including but not limited to document reviews, site visit, and stakeholder interviews, review of the assertions, applied methodology and its underlying formulae and calculations. The verification shall ensure that reported emission reductions are complete and accurate in order to be certified. The verification comprises a review of the monitoring report cover the monitoring period 03/03/2023– 02/03/2025 based on the MR in part of the monitoring parameters and monitoring plan, emission reduction calculation spreadsheet, monitoring methodology and all related evidence provided by the PP.

As a result, the validation team has identified 2 corrective action requests (CAR), 13 clarification requests (CL) and 0 Forward Action Request (FAR). All the findings have been closed.

In ERM CVS’s opinion that the proposed project “Improving Energy Efficiency in Homes Through Smart Thermostat Optimization”, as described in the MR conforms with VCS Program rules. The GHG emission reductions reported for the project in the MR are fairly stated. The GHG emission reductions were calculated correctly on the basis of the applied monitoring methodology VM0008. (Version1.1) and the monitoring plan contained in the PD.

ERM CVS confirms that the GHG emissions reductions are calculated without material misstatements. Based on the evidence and information that are considered necessary to guarantee that GHG emission reductions are appropriately calculated, ERM CVS is able to certify that verified carbon units from “Improving Energy Efficiency in Homes Through Smart Thermostat Optimization” during the period 03/03/2023 – 02/03/2025 amount to 504,264tCO₂e.

Mr. Timothy Chan

(Team Leader)

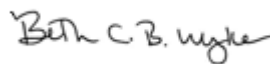
A handwritten signature in black ink, appearing to read 'Timothy Chan', with a large, sweeping flourish at the end.

ERM Certification and Verification Services Ltd.

08/06/2026

Ms. Beth Wyke

(Partner, Assurance Service)

A handwritten signature in black ink, appearing to read 'Beth C. B. Wyke', with a cursive style.

ERM Certification and Verification Services Ltd.

08/06/2026

CONTENTS

1	INTRODUCTION	6
1.1	Objective	6
1.2	Scope and Criteria	6
1.3	Level of Assurance.....	7
1.4	Summary Description of the Project	7
2	VERIFICATION PROCESS	8
2.1	Method and Criteria	8
2.2	Document Review	11
2.3	Interviews.....	11
2.4	Site Visits	12
2.5	Resolution of Findings	13
2.6	Eligibility for Validation Activities	14
3	VALIDATION FINDINGS.....	15
3.1	Methodology Deviations	15
3.2	Project Description Deviations.....	16
3.3	New Project Activity Instances in Grouped Projects	17
3.4	Baseline Reassessment.....	28
4	VERIFICATION FINDINGS.....	28
4.1	Project Details	28
4.2	Safeguards and Stakeholder Engagement	30
4.3	Accuracy of Reduction and Removal Calculations	40
4.4	Quality of Evidence to Determine Reductions and Removals	55
4.5	Non-Permanence Risk Analysis	59
5	VERIFICATION OPINION.....	59
5.1	Verification Summary.....	59
5.2	Verification Conclusion	61
5.3	Ex-ante vs Ex-post ERR Comparison.....	63
	APPENDIX 1: COMMERCIALLY SENSITIVE INFORMATION	64
	APPENDIX 2: DOCUMENT REFERENCE LIST.....	65

APPENDIX 3: <ERM CVS_LDV_INPUTS>	68
APPENDIX 4: <FINDINGS LIST>	98

1 INTRODUCTION

1.1 Objective

ERM Certification & Verification Services Inc. (Hereinafter referred to as ERM CVS) was contracted by “ecobee Technologies ULC” to perform the verification of the VCS registered grouped project “Improving Energy Efficiency in Homes Through Smart Thermostat Optimization” against the criteria set out in the VCS Standard, v4.7, VCS Program Guide, v4.4, VCS Program Definitions, v4.5, Registration and Issuance Process, v4.6, Validation and Verification Manual, v3.2, applied VCS methodology VM0008 Weatherization of Single Family and Multi-Family Buildings, v1.1. and associated methodological tools, and in accordance with ISO14064-3:2019.

The objective of this verification is to verify the verified carbon unit (VCUs) of the project “Improving Energy Efficiency in Homes Through Smart Thermostat Optimization” for the period from 03/03/2023 to 02/03/2025.

1.2 Scope and Criteria

The scope of the verification is the independent and objective review of the Monitoring Report (MR) Version 3.0, dated 08/06/2026 /38/ against the registered Project Description (PD) and relevant criteria (refer Section 1.1 above) and decisions by Verra, including the approved baseline and monitoring methodology. The verification was guided by ISO14064-3:2019.

The verification team employed an evidence-based approach for reaching reliable and reproducible verification conclusions which are based on sufficient and appropriate evidence.

The verification is not meant to provide any consultation regarding the project participants. However, stated requests for clarifications and/or corrective actions may have provided input for improvement of the monitoring report. The only purpose of the verification is its usage during the issuance process as part of the VCS project cycle. Therefore, ERM CVS can't be held liable by any party for decisions made or not made based on the verification opinion, which will go beyond that purpose.

The scopes of the verification are:

- To apply ERM CVS's own quality management system which has integrated the ISO 14064-3:2019 requirements and the VCS' Validation and Verification Manual (VVM) to determine if the project activity meets all applicable VCS requirements, including those specified in the VCS standard (Version 4.7), the applied methodology and associated tools.

- To verify that actual monitoring systems and procedures are in compliance with the monitoring systems and procedures described in the monitoring plan.
- To assess the accuracy, conservativeness, relevance, completeness, consistency and transparency of the information provided by the project proponent (PP) in the MR.
- To evaluate the GHG emission reduction data and express a conclusion with a reasonable level of assurance about whether the reported GHG emission reduction data is free from material misstatement.
- Where sampling is involved, to assess whether the standard for sampling and surveys is applied appropriately.

1.3 Level of Assurance

Evidence supporting the assumptions, limitations, and methods applied to quantify the estimated GHG emissions reductions due to the project, has been gathered and assessed by the VVB. The VVB deems the assumptions, limitations and methods reasonable for arriving at the GHG statement.

The verification was conducted to a reasonable level of assurance with a quantitative materiality threshold of 1%, meeting the VCS Standard requirements for projects: greater than or equal to 300,000 tonnes CO₂e per year. Qualitative matters that may be material were also considered.

1.4 Summary Description of the Project

The project under review involves ecobee's deployment of its eco+ thermostat optimization platform to enhance energy efficiency in residential heating and cooling systems. Eco+ is provided free of charge to all ecobee customers and operates as a software-based enhancement to existing smart thermostats. The platform aims to reduce electricity and natural gas consumption compared to the baseline scenario, which is defined as the use of an ecobee thermostat without eco+. This initiative does not generate additional revenue for ecobee but incurs significant costs, which the company intends to offset through carbon credit revenues.

The primary mechanism for energy savings is patented eco+ "Adjust For Humidity" feature, which applies thermal comfort principles and the humidex index to optimize HVAC setpoints based on indoor humidity conditions. This feature, combined with machine learning, occupancy sensing, geolocation, and real-time adjustments, enables micro-optimizations that reduce HVAC energy demand while maintaining user comfort. These micro-adjustments occur continuously throughout the year and across millions of devices, resulting in measurable reductions in greenhouse gas emissions.

For the 2nd monitoring period (MP2), it covers from March 3, 2023, to March 2, 2025. The project had a total of ecobee smart thermostat eligible users of 3,283,679 in the U.S., of which 1,226,319 devices received the free eco+ software through an over-the-air software upgrade and additional 2,057,360 devices offered eco+ for free upon installed (i.e., straight out-of-the-box).. The achieved verified emission reductions were totaling 504,264 tCO₂. Based on the evidence reviewed, the project demonstrates compliance with its stated methodology and objectives, delivering significant energy savings and emissions reductions without compromising consumer comfort.

2 VERIFICATION PROCESS

2.1 Method and Criteria

The verification method was guided by ISO14064-3:20219 and included the following steps:

1. Pre-engagement assessment which included establishing and agreeing with the Client¹ on the type of engagement (i.e. verification of a grouped project), objective(s) (to test the reasonableness of monitored parameters, assumptions, level of assurance, limitations, and methods that quantify the achieved emissions reductions), criteria (VCS Program), scope, materiality threshold.
2. Appointment of the verification team:

The verification team was established to collectively cover required knowledge and skills relevant to the applicable sectoral scope, local circumstances, the GHG Program, data and information auditing, and team leader knowledge. The selection of the team members followed ERM CVS' internal procedure to ensure that the team collectively has the competence to perform the verification and that the team is free of potential risk of conflict of interest. The three minimum qualification levels for team members that are assigned through ERM CVS' formal team selection procedure include: Lead Assessor (LA), Assessor (A), Technical Expert (E), Independent Technical Reviewer (TR)

The appointed verification team covers the required knowledge and skills as follows:

Table 1: Selected VVB team

Name	Role	Sectoral Scope	Technical Area	Specialist (local knowledge)
------	------	----------------	----------------	------------------------------

Timothy Chan	Lead Assessor/ Technical Expert	Yes	Yes	Yes
Braulio Pikman	Technical Reviewer	Yes	Yes	No

3. Verification planning, including a strategic analysis, risk assessment, materiality threshold, test estimates, GHG-related activity characteristics, and development of verification plan which includes an evidence-gathering plan.
4. Conduct the verification according to the plan, evaluation of the GHG statement and disclosure.

The evidence-gathering activities that were performed during the execution of the verification included an assessment of the PD, MR and supporting information and evidence (document review), an on-site visit to the PP's headquarter, and a stakeholder interviews. The following characteristics of the project were evaluated:

- Implementation of the project as per the registered PD and monitoring plan.
- Appropriateness of the project's boundaries and inclusion of all relevant sources sinks and reservoirs (SSRs).
- The execution of the monitoring plan, including monitoring team capacity, monitoring activities, data storage and analysis, etc.
- Activities involved with operating the project include the way in which data is measured, recorded, stored, controlled, and aggregated to determine how accurate, complete and conservative estimates are produced.
- The process of data analysis is conducted by a third-party measurement and verification (M&V) consultant, i.e. Demand Side Analytics, LLC (DSA).
- Appropriateness of the applied monitoring and quantification methodology and the correctness of its application to arrive at accurate, reliable, and conservative estimates.
- The project's operational procedures and how these safeguard the verifiability of the data.
- The calculations as presented in the ER spreadsheet,
- Uncertainty associated with monitoring
- Sensitivity of assumptions with high potential for change.

5. Completion of the verification through compilation of findings, conclusions and draft opinion in a draft verification report.

Following the evidence-gathering activities as described above, the findings are compiled in one table referred to as the Findings List that captures all Corrective Action Requests (CARs) and Clarification Requests (CLs) identified. This Findings List is submitted to the PP for resolution. The CARs and CLs raised, and responses received are summarized in Appendix 3. Upon resolving all the findings satisfactorily, a draft verification report is prepared.

6. Independent review.

The final step of the verification is an independent review which is performed by a Technical Reviewer (TR) who did not participate in verification activities. Subject to the independent review are the team competencies, the verification plan, including evidence-gathering plan, whether the verification was conducted in a complete manner, whether sufficient evidence was gathered, the decisions made by the assessment team during verification, completeness of draft verification report, and the Findings List including how the findings were resolved.

7. Issuance of opinion in a final verification report.

Only after an independent review has taken place, the verification report shall be signed off by the dedicated decision maker and submitted to the PP who can then request issuance of the Verified Carbon Units (VCUs) for the 2nd monitoring period.

Table 2: Key verification milestones

Key milestones	Date of completion
Kick-off meeting	13/05/2025
VCS MR ready for VVB for review	15/05/2025
Site visit	16/06/2025
Verification findings	14/07/2024
Resolving findings	14/07/2025 – 31/10/2025
Draft verification report	05/11/2025
Independent Technical Review	18/12/2025
Issuance of final verification Report to the PP	09/01/2026

Verra Project Review	11/03/2026
Response to Verra Project Review	08/06/2026

2.2 Document Review

The basis for the initial verification activity was the registered PD (v1.6, 19/07/2024) and the MR (v1.0, 15/05/2025) which was submitted to the VVB on 15/05/2025.

- VM0008: Weatherization of Single Family and Multi-Family Buildings, v1.1
- VCS Standard, v4.7
- VCS Program Guide, v4.4
- VCS Program Definitions, v4.5
- Registration and Issuance Process, v4.6
- Validation and Verification Manual, v3.2
- ISO14064-3:2019
- Other relevant documents, rules and requirements listed in Section 1.1 of this report.

The VVB conducted a desk review of the information documented in the PD and the MR. Including project design, baseline scenario, eligibility criteria, applied methodology, monitoring plan, emission reduction achieved during the 2nd monitoring period, sustainable development contributions. The list of documents, information and supporting evidence which was reviewed and used for cross-checking purposes during the verification process is tabulated in Appendix 2: Document Reference List.

2.3 Interviews

During the on-site visit, stakeholders were interviewed as recorded in Table 3 below.

Table 3: Interviewees

#	Full Name	Title	Organisation	Date and means of interview	Subject
IO1	Jeanny DoSr.	Specialist/ Project Manager	ecobee	16/06/2025 In-person	• Project design and implementation • Eligibility criteria & inclusion • Execution of monitoring plan

I02	Adam Noble Marks	Data Science/ Data Platform	ecobee	16/06/2025 In-person	• Total numbers of active users • Data measurement • Data storage and accessibility • Data quality controls • Missing data handling • Emission Reductions Calculation • Data management system • SDG safeguard
I02	Adam Noble Marks	Data Science/ Data Platform	ecobee	16/06/2025 In-person	• Execution of monitoring plan • Data measurement • Data storage and accessibility • Missing data handling
I03	Ben Dauvin	Firmware	ecobee	16/06/2025 In-person	• Data measurement • Procedures to verify connected devices and type of equipment
I03	Ben Dauvin	Firmware	ecobee	16/06/2025 In-person	• Data analysis procedures • Regression Model • Regression model translated to Python language • Quality control process • Data collection and record keeping
I04	Hal Gordan	M&V Consultant	DSA	16/06/2025 (Remote connection)	
I05	Nixon Candiales	M&V Consultant	DSA	16/06/2025 (Remote connection)	
I06	Jesse Smith	Principal M&V Consultant	DSA	16/06/2025 (Remote connection)	

2.4 Site Visits

The VVB has conducted a site-visit on 16/06/2025. The verification team was present in person at ecobee's headquarter in Toronto, Canada, where their core monitoring team and engineer are located. The site-visit was conducted to assess the implementation of the project activity, PAI inclusions, the monitoring plan, procedures of data collection and corresponding data quality management procedures. During the on-site visit, the PP's core monitoring team as well as the third-party M&V consultant (i.e. DSA) were interviewed, details of the site visit are presented in the table 4 below:

Table 4: Site visit details

Date	16/06/2025	
Location	207 Queens Quay W suite 600, Toronto, ON M5J 1A7 Canada	
Key Participants	Company Name	Role in the Organization/ Role in the validation team

Jeanny Do	ecobee	Sr. Specialist/ Project Manager (representative of the Project Proponent)
Adam Noble-Marks	ecobee	Sr. Machine Learning Engineer /Technical Lead/Subject Matter Expert
Hal Gordan	DSA	M&V Consultant
Timothy Chan	ERM CVS	Lead Assessor/Technical Expert/ Local Expert

2.5 Resolution of Findings

The verification of the project included the following phases:

During the verification process, ERM CVS issued 2 CARs and 13 CLs.

- Clarification Request (CL): where information is insufficient or unclear to support the future estimate and whether the applicable VCS requirements have been met.
- Corrective Action Request (CAR): This is issued in case of:
 - Non-conformities with the VCS requirement, the approved project design, the monitoring plan, or the VCS approved methodology found in monitoring and reporting, or if the evidence provided to prove conformity is unsatisfactory.
 - Mistakes have been made in applying assumptions, data or calculations of emission reductions that will impair the amount of emission reductions.

The verification process may be stopped until this information has been made available to the verifier's satisfaction. Failure to address a CL may result in a CAR. Response to CLs may also lead to a CAR.

The Findings List is used for the assessment of each requirement during the execution of verification and is provided in Appendix 4 of this Verification Report.

The table below describes how the findings list must be interpreted:

Table 5: Example of Findings List

Finding #	Number of CAR/CL/FAR and the subject to which the CAR/CL/FAR refers
Description of CAR/CL/FAR	· Description of how the requirement has not been met

	· Method of interrogation of the requirement being met, e.g., Document Review (DR), Interview (I), and Not Applicable (NA) · Elaboration and discussion of the conformance to the requirement by providing related references and document sources based on which the CAR/CL/FAR is issued or evidence is checked
Sections/Clauses of GHG Program Criteria	· Reference to the document where the requirement is provided
Client Response	Space where Client can provide response to CAR/CL
VVB Assessment	Either acceptable based on the evidence provided (OK), non-compliance with the requirement (CAR), further clarification (CL) due to insufficient, unclear or not transparent information, forward action request (FAR) that needs to be solved during the first verification
Client Response Round 2	Space where Client can provide response to CAR/CL
VVB Assessment Round 2	
Client Response Round 3	Space where Client can provide response to CAR/CL
VVB Assessment Round 3	

2.5.1 Forward Action Requests

Not applicable. There is no FARs issued during the verification.

2.6 Eligibility for Validation Activities

Not applicable. There is no validation activity taken place in this verification.

3 VALIDATION FINDINGS

3.1 Methodology Deviations

According to Section 3.2.1 of the MR, there are 3 methodological deviations listed:

Methodological Deviation 1

Instead of collecting electricity and fuel bills from the groups under monitoring, ecobee proposed to measure the intervals of time that an HVAC system is running by the embedded metering in the ecobee's smart thermostats.

Methodological Deviation 2

The project is deviated from the applied methodology by constructing "Control group" by the devices that never ever had the eco+ feature enabled.

Methodological Deviation 3

The deviation is that instead of applying VM0008's Equations 1 and 2 for household-level performance benchmarking, the project uses a **panel regression** to estimate the average effect across all devices.

The verification team reviewed the MR against the registered PD, these 3 methodological deviations are consistent with the PD. According to the approved Joint Validation and Verification Report, these 3 deviations had been assessed and accepted during validation and registration process.

During the on-site visit, the verification team assessed the implementation of the monitoring plan. The deviations described in the MR were observed consistently. In addition, it is confirmed that no other deviations are identified for this monitoring period.

ERM CVS concluded that there the methodological deviations as described in Section 3.2.1 of the MR are valid.

3.2 Project Description Deviations

The verification team reviewed section 1.1 of the MR against the registered PD, the description of the project activity is consistently described in both of the documents. The verification team conducted interviews with the monitoring team during the on-site visit to assess the implementation of the project. The project activities involved the roll out of the eco+ feature to the active ecobee smart thermostat installed in the residential homes within the geographical boundary of the United States. The eco+ feature is designed to enable ecobee's smart thermostats to optimize the home comfort level by controlling the operations of the HVAC equipment. The verification team confirmed the project description in line with that described in the registered PD.

As opposed to the baseline scenario (i.e. ecobee thermostat without eco+ "Adjust For Humidity" feature enabled), the feature deploys micro-adjusts to the HVAC operations based on several factors such as the occupancy, temperature and humidity, etc. to achieve the optimized indoor comfort level by taking the advantage of indoor humidex. For instance, in the summer or warmer seasons, the desired setpoint temperature could be raised while in cooling mode when the humidity is low, which results the HVAC or air conditioner only activating when the indoor "feels like" temperature is reached, resulting in energy saving from running the HVAC for cooling. During the winter or colder seasons, the executed temperature setpoint could go lower when the humidity is low, which results in less HVAC runtime for heating. The project measured the HVAC runtime by the embedded telemetry data/ run-time data of the ecobee smart thermostat. According to the Data Scientist /IO2/, all the data collected by the smart thermostat are transmitted to the ecobee's server hosted in Google's data centers every 5 minutes. The verification finds the baseline scenario consistent with the registered PD.

Additionality

According to Section 3.2.1 of the MR, the project deviated from the applied methodology for the demonstration of additionality. The project uses a panel regression to estimate the average effect across all devices instead of applying Equation 1 and Equation 2 prescribed by VM0008 for Category B. As per Section 5 of the MR, panel regression model developed by DSA has been employed to estimate the impact of the treatment (with eco+ "Adjust For Humidity" ON). which is consistent with the registered PD. During the on-site visit, the verification interviewed the M&V consultant /IO4/ for the design of the regression model. The verification team confirmed that the same regression model is applied in this monitoring period. No deviations from the registered PD are identified.

ERM CVS concluded that there are no deviations from the project description observed in this monitoring period.

3.3 New Project Activity Instances in Grouped Projects

According to the MR, there are a total of 3,283,679 ecobee thermostats in the U.S. incorporated during the 2nd monitoring period. With 2,524,333 smart thermostats valid since the previous monitoring period (according to p.20 of the registered PD), there are 759,346 new ecobee smart thermostats included in the 2nd monitoring period.

The verification verified the total number of ecobee thermostat by 1.) conducting management interview with the ecobee’s project manager /I01/ and the Data scientist /I02/ to confirm the process of extracting the total number of eligible ecobee thermostats during the monitoring period. 2.) witness the execution of live database queries to extract the total number of eligible devices by per day, and per state.

It is noted that the total number of ecobee eligible devices is revised from 3,882,395 to 3,283,679 during the Verra Project Review stage. ecobee explained that was due to an improvement on their internal query code. According to the explanation in Timeline of eco+ release, T&Cs and query code /30/, prior to the full roll out of eco+ feature, there were existing ecobee customers that had the options (after receiving firmware upgrade) of toggling eco+ feature to ON in order to enroll into eco+ (including “Adjust For Humidity”) feature. Ecobee’s database recorded the status of these devices by “acc.term_accepted” because the ecobee users had to manually accept the terms and conditions when eco+ featured rolled out in March 2021.

ecobee customers who purchased thermostats manufactured in May 2021 or later received devices with eco+ pre-installed in the firmware. Following device registration, both eco+ and the “Adjust For Humidity” feature were enabled “ON” by default. These ecobee devices had eco+ firmware pre-installed (i.e. straight out-of-the-box) at manufacturing. Once the users completed the new user registration process, their status would be recorded by ecobee database as “acc.enabled” which is the true record to indicate ecobee thermostat with eco+ feature enabled.

ecobee’s data scientist /I02/ explained that the query code is improved from “acc.term_accepeted OR acc.enabled” to “acc.enabled” only. By doing so, the number of ecobee devices extracted from the database has reduced from 3,882395 to 3,283,679. The verification assesses the rationales as reasonable and consider that the new query is more conservative.

The verification team witnessed the execution of query code by ecobee’s data scientist /I02/. During the live query, the data scientist executed the code documented on Timeline of eco+ release, T&Cs and query code / 30/ consistently to extract the number ecobee thermostat from their database. The improved query code lines are as follows:

```
=====
SELECT
```

```
        thermostat_id,
        LEFT(zip_code,5) as zip_code,
        date(last_updated_utc) as x_date,
        ROW_NUMBER() OVER(PARTITION BY date(last_updated_utc), thermostat_id) rn
FROM `chronos-production.chronos_audit_prod.accounts_shadow` acc
WHERE date(last_updated_utc) between '2023-03-03' and '2025-03-02'
AND acc.enabled
AND acc.humidity_enabled
), ecoPlus_latest_state_0 as (
SELECT
    els.thermostat_id,
    els.zip_code,
    els.x_date
FROM ecoPlus_latest_state els
WHERE els.rn=1
), ecoPlus_latest_state_1 as (
SELECT
    els.thermostat_id,
    els.zip_code,
    DATE_ADD(els.x_date, INTERVAL 1 DAY) as x_date,
FROM ecoPlus_latest_state els
WHERE els.rn=1
)
SELECT
    -- CASE glu.us_building_climate_zone
    -- WHEN 'Cold-Very_Cold' THEN 'Cold_Marine'
    -- WHEN 'Marine' THEN 'Cold_Marine'
    -- WHEN 'Hot_Humid' THEN 'Mixed_Humid_Hot_Dry'
```

```

-- WHEN 'Mixed_Dry-Hot_Dry' THEN 'Mixed_Humid_Hot_Dry'

-- WHEN 'Mixed_Humid' THEN 'Mixed_Humid_Hot_Dry'

-- END as USBuildingClimateZone,

glu.state,

glu.state_full_name,

xs.hasHeatPump,

IFNULL(els_0.x_date, els_1.x_date) as x_date,

count(*) as n_tstats,

CURRENT_DATE() AS last_updated_date


FROM ecoPlus_latest_state els_0

FULL OUTER JOIN ecoPlus_latest_state els_1

    USING (thermostat_id, zip_code, x_date)

JOIN `business-intel-prod.DATAMART_THERMOSTAT.XML_SETTING` xs

    ON els_0.thermostat_id = xs.identifier

JOIN `business-intel-prod.DATAMART_THERMOSTAT.GEOLOOKUP` glu

    ON IFNULL(els_0.zip_code, els_1.zip_code) = LPAD(glu.zipcode , 5, '0')

WHERE glu.us_building_climate_zone in (

    "Cold-Very_Cold",

    "Mixed_Humid",

    "Hot_Humid",

    "Mixed_Dry-Hot_Dry",

    "Marine"

)

AND glu.state NOT IN (

    'PR', 'HI', 'AK', 'VI', 'NL', 'NS', 'PE', 'NB', 'QC', 'ON', 'MB', 'SK', 'AB',

    'BC', 'NU', 'NT', 'YT', 'AE', 'AA', 'AP', 'AS', 'GU', 'PW', 'FM', 'MP', 'MH'

)

```

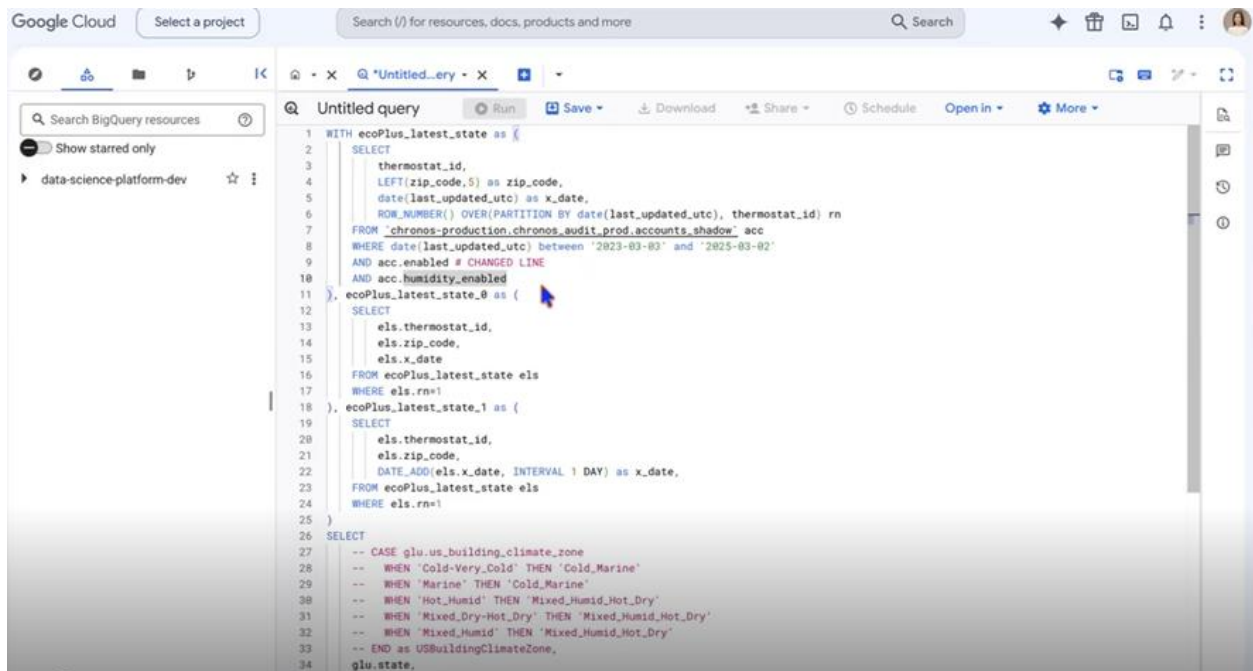
GROUP BY 1,2,3,4

ORDER BY 1,2,3,4;

=====

A list of total eligible ecobee devices /32/ for the 2nd monitoring period was generated from the live BigQuery script, the verification team confirms the total number of eligible ecobee devices as 3,283,679 (as of 02/03/2025). By assessing this list against with the revised ER calculation spreadsheet /33/, it matches with the data shown in the tab “Devices by Date”.

Screenshot taken during the live BigQuery witness.



```

1 WITH ecoPlus_latest_state as (
2   SELECT
3     thermostat_id,
4     LEFT(zip_code,5) as zip_code,
5     date(last_updated_utc) as x_date,
6     ROW_NUMBER() OVER(PARTITION BY date(last_updated_utc), thermostat_id) rn
7   FROM `chronos-production.chronos_audit.prod.accounts_shadow` acc
8   WHERE date(last_updated_utc) between '2023-03-03' and '2025-03-02'
9   AND acc.enabled = CHANGED_LINE
10  AND acc.humidity_enabled
11 ), ecoPlus_latest_state_0 as (
12   SELECT
13     els.thermostat_id,
14     els.zip_code,
15     els.x_date
16   FROM ecoPlus_latest_state els
17   WHERE els.rn=1
18 ), ecoPlus_latest_state_1 as (
19   SELECT
20     els.thermostat_id,
21     els.zip_code,
22     DATE_ADD(els.x_date, INTERVAL 1 DAY) as x_date,
23   FROM ecoPlus_latest_state els
24   WHERE els.rn=1
25 )
26 SELECT
27   -- CASE glu.us_building_climate_zone
28   -- WHEN 'Cold-Very_Cold' THEN 'Cold_Marine'
29   -- WHEN 'Marine' THEN 'Cold_Marine'
30   -- WHEN 'Hot_Humid' THEN 'Mixed_Humid_Hot_Dry'
31   -- WHEN 'Mixed_Dry-Hot_Dry' THEN 'Mixed_Humid_Hot_Dry'
32   -- WHEN 'Mixed_Humid' THEN 'Mixed_Humid_Hot_Dry'
33   -- END as USBuildingClimateZone,
34   glu.state,

```

Assessment of the BigQuery code in relation to demonstration compliance with eligibility criteria at PAI level. The is to demonstrate the verification of the data completeness and accuracy of the live query results.

Eligibility Criteria	Query Code line	Verification Assessment
----------------------	-----------------	-------------------------

located in the United State of America	-- CASE glu.us_building_climate_zone AND glu.state NOT IN ('PR', 'HI', 'AK', 'VI', 'NL', 'NS', 'PE', 'NB', 'QC', 'ON', 'MB', 'SK', 'AB', 'BC', 'NU', 'NT', 'YT', 'AE', 'AA', 'AP', 'AS', 'GU', 'PW', 'FM', 'MP', 'MH'	The code lines indicate the scope of the query as within the climate zones of the United State of America (USA), but excluding other US regions that are outside the contiguous USA. This excludes US territories: Puerto Rico, US Virgin Islands; US States: Hawaii and Alaska, and Canadian provinces and territories.
Meet the applicability condition set out in VM0008 Section 4 (Applicability Conditions)	See below.	See below.
New project activity instances will use the ecobee smart thermostat eco+ Adjust For Humidity energy efficiency enhancement technology	AND acc.enabled AND acc.humidity_enabled	These code lines are designed to extract the ecobee devices with eco+ feature on as well as “Adjust For Humidity feature” on.
New project activity instances will use the ecobee smart thermostat in exactly the same manner – to reduce energy use for both heating and cooling without reducing the overall level of service	N/A	The assessment is conducted at group level. Refer to the next table for further assessment.
Subject to the same baseline scenario as determined in the project description, within the project boundary of the contiguous USA and of Same Building Stock	N/A	The assessment is conducted at group level. Refer to the next table for further assessment.
Subject to the same additionality factors, as Specified in Section 3.5 (of the PD) and will apply to all new project activity instances.	N/A	The assessment is conducted at group level. Refer to the next table for further assessment.

Be included in the monitoring report with sufficient technical, financial, geographic and other relevant information to demonstrate compliance with the applicable set of eligibility criteria and enable sampling by the validation/verification body.	N/A	The assessment is conducted at group level. Refer to the next table for further assessment.
Have evidence of project ownership, in respect of each project activity instance held by project proponent from respective start date of each project activity instance	N/A	The assessment is conducted at group level. Refer to the next table for further assessment.
Have a start date that is the same as or later than the grouped project start date	N/A	Before the live BigQuery witness, the PP was requested to provide a list of ecobee devices identifier/31/. The list contains the thermostat ID, start date, zip code (to identify the location), status of eco+ feature, status of "Adjust For Humidity" feature, status of eco+ term and condition acceptance, technology group of the new devices added during the 2 nd monitoring period (i.e. new PAI added in the 2 nd monitoring period). In this list, all the ecobee devices (i.e. PAIs) were started during 03/03/2023 to 02/03/2025.

		The start date of ecobee device was further assessed by live sampling. During the witness of the live query, a total of 10 samples (by 10 unique thermostat ID) out of the list /31/ were selected randomly for additional assessment. The data scientist was requested to open the dedicated ecobee device profile to match with the sampled PAI (by thermostat ID) to verify the first date of connection to ecobee database, the zip code technology group. It is confirmed that they are all started after the group project start date and within the 2nd monitoring period. The operation of the sampled ecobee devices are further cross-checked against the ecobee runtime database /10/ to check if runtime data can be identified from the database. This step is to further assess whether those sampled eligible ecobee devices are actively feeding runtime data to ecobee server as per the design of their telemetry data collection process. ERM CVS confirms that the sampled devices are operational as proven by the runtime records.
Only be eligible for crediting from the later of start date of project activity instance or the start of the verification period in which they were added to the group project, through to the end of the total project crediting period	'2023-03-03' and '2025-03-02'	This code line designed to extract the number of eligible ecobee devices during this monitoring period time.
Not be or have been enrolled in another VCS project	N/A	The assessment is conducted at group level. Refer to the next table for further assessment.

Adhere to the clustering and capacity limited requirements for multiple project activity instances set out in VCS Standard 3.6.8 – 3.6.9	N/A	The assessment is conducted at group level. Refer to the next table for further assessment.
--	-----	---

Based on the above assessment of the improved query code, the verification team confirms that the improved query code are designed to extract relevant device data from ecobee's database that are considered reliable and accurate for the assessment of total number of eligible PAIs.

By reviewing the list of total eligible ecobee devices /32/ generated from the live BigQuery, a list of ecobee devices identifier/31/, joint validation and verification report for the 1st monitoring period /9/, the verification team confirmed that the number of new PAIs included from March 2023 – February 2025 is 759,346¹

To complete the verification of the eligibility criteria of the PAIs newly included during the 2nd monitoring period, in addition to the desktop review, the verification team requested live database query demonstration during the on-site visit. With the aid of ecobee's Data Scientist executing the query to grab the data from the Interval Status Messages (ISM) interface, the verification team confirmed the eligibility of the PAIs as follows:

Eligibility Criteria (Section 1.5.1 of the registered PD)	Verification Assessment
1) Occur within one of the designated geographic areas specified in the project description	The geographical boundary of the project is the United State of America. According to the file “ecobee footprint by US States_data - Mar 03 2023 to Mar 02 2025_forDSA”/11/, the breakdown number of the ecobee smart thermostat during the monitoring period 03/03/2023 – 02/03/2025 is shown. It is confirmed that all of the PAIs are located within the states of the US. For assessment at PAI level, please refer to the table above.

¹ Total eligible PAIs (i.e. ecobee device with eco + and “adjust for humidity”) as of the last date of 2nd monitoring period – total number of PAI verified in the first monitoring period = 3,283,679 – 2,524,333 = 759,346

2) Conform with at least one complete set of eligibility criteria for the inclusion of new project activity instances.

According to the PD, all new project activity instances will comply with the eligibility criteria for inclusion outlined in table above:

- 1) Meet the applicability condition set out in VM0008 Section 4 (Applicability Conditions)
- 2) New project activity instances will use the ecobee smart thermostat eco+ Adjust For Humidity energy efficiency enhancement technology
- 3) New project activity instances will use the ecobee smart thermostat in exactly the same manner – to reduce energy use for both heating and cooling without reducing the overall level of service
- 4) Subject to the same baseline scenario as determined in the project description, within the project boundary of the contiguous USA and of Same Building Stock
- 5) Subject to the same additionality factors, as Specified in Section 3.5 (of the PD) and will apply to all new project activity instances.

- 1) The new Project Activity Instances (PAIs) consist of connected ecobee smart thermostats located in the U.S. The verification team did not observe any changes to project implementation that would affect the ability of the new PAIs to meet the applicability conditions outlined in Section 4 of VM0008.
- 2) During the on-site visit, the verification team checked ecobee's user details from their Interval Status Messages (ISM) interface through a live query executed by the Data Scientist /I02/. All included users have eco+ "Adjust for Humidity" feature ON.
- 3) As per the interview with the ecobee's Sr. Specialist /I01/ and the Data Scientist /I02/, all the eligible ecobee smart thermostat with the eco+ feature "Adjust For Humidity" ON will work exactly the same to reduce energy use for both heating and cooling but maintaining the same comfort level.
- 4) All new PAIs are included in the panel regression model that are based on the same baseline scenario (i.e. ecobee smart thermostat user without the treatment (eco+ and "Adjust For Humidity" feature ON)). The baseline is the HVAC runtimes of the control group within the project boundary and of the same building stock. The verification team confirmed the same panel regression model employed in the ER calculations in this monitoring period through the interview with M&V consultant from DSA /I04/ and reviewing the CO2 Offset -Stata Code Walkthrough /I6/.
- 5) All new PAIs are included in panel regression model, which is in line with the additionality methods described in 3.5.2 of the PD.

For assessment at PAI level, please refer to the table in the above.

3) Be included in the monitoring report with sufficient technical, financial, geographic and other relevant information to demonstrate compliance with the applicable set of eligibility criteria and enable sampling by the validation/verification body.	All new project activity instances will be: 1) Reported in the monitoring reports 2) Compliant with all applicability conditions set out in VM0008 and found in PD Section 3.2 3) Have sufficient technical information to perform emission impact quantification, analysis and enable sampling by VVB 4) Be within the project geographic boundary of the contiguous USA
4) Have evidence of project ownership, in respect of each project activity instance held by project proponent from respective start date of each project activity instance.	All new project activity instances included from the respective start date of March 03, 2021 and later will remain under ecobee's ownership as ecobee is the sole project proponent and sole owner of all carbon offsets generated from the project activity. As noted in PD Section 1.8, ecobee has the right to claim ownership over environmental attributes from eco+ through the following clause in its Terms of Service for ecobee Remote Applications, Including eco+ Section 6 (g) "ecobee shall be eligible to claim any qualifying environmental attributes, benefits, credits, awards or bounties from Program Administrators resulting from savings gained by the benefit of eco+" During the on-site visit, the verification team checked ecobee's user details from their Interval Status Messages (ISM) interface through a live query executed by the Data Scientist /I02/. By randomly selecting the included users and looking for the details in the database, all of them have accepted eco+ terms of conditions. As confirmed by the Sr. Specialist of ecobee /I01/, by default the users won't be able to enable eco+ via their ecobee smart thermostat if the users do not accept the terms and conditions.

5)Have a start date that is the same as or later than the grouped project start date	According to “New ecobee devices (By Month) - Monitoring Period (Mar 2023 to Mar 2025) copy” /14/, it shows the breakdown number of new ecobee smart thermostat users. The verification team confirmed that new users included in this monitoring period joined after the project start date i.e. 03/03/2021.
6)Only be eligible for crediting from the later of start date of project activity instance or the start of the verification period in which they were added to the group project, through to the end of the total project crediting period	According to the MR, the 2 nd monitoring period is 03/03/2023 – 02/03/2025 which is falling within the crediting period 03/03/2021 to 02/03/2028. It is confirmed by checking the ER calculations spreadsheet that the panel regression output (i.e. “Inputs_LDV”) is calculated based on the telemetry data from eligible ecobee smart thermostat for the 2 nd monitoring period.
7)Not be or have been enrolled in another VCS project	All new project activity instances will be confirmed to not be or have been enrolled in another VCS project. By design, PAIs can only be included when they have installed eligible ecobee smart thermostat as well as accepted the ecobee’s terms and conditions. The telemetry data could only be transmitted via the smart thermostat to ecobee’s server. It is not possible to share the data with another GHG project by passing ecobee’s infrastructure. The verification team checked GHG program registries such as Gold Standard², CDM Registry³, International Carbon Registry⁴, there are no records of project registered under other GHG programs that applied the same technologies by the same PP.
8)Adhere to the clustering and capacity limited requirements for multiple project activity	As per 1.5.1 of the PD, this is not applicable to this grouped project and new project activity instances.

² [GSF Registry](#)

³ [CDM: Project Activities](#)

⁴ [Carbon Registry | Carbon Credits Overview](#)

instances set out in VCS Standard 3.6.8 – 3.6.9

The inclusion of 759,346 new Project Activity Instances during this verification period is valid. The validation process, including document review, site visits, live query witness, PAI sampling and interviews, confirmed that these new PAIs meet the eligibility criteria set out in the PD and methodology. The evidence was found to be complete and accurate, ensuring a reasonable level of assurance regarding their inclusion.

3.4 Baseline Reassessment

Did the project undergo baseline reassessment during the monitoring period?

☐ Yes ☒ No

4 VERIFICATION FINDINGS

4.1 Project Details

Item	Evidence gathering activities, evidence checked, and assessment conclusion:
Audit history	ecobee has contracted ERM CVS for the verification of the 2nd monitoring period of VCS 3352 “Improving Energy Efficiency in Homes Through Smart Thermostat Optimization” on 09/05/2025, A kick-off meeting was held on 13/05/2025. The MR and relevant documentations were provided 15/05/2025 after the kick-off meeting. The on-site visit was conducted on 16/06/2025, a list of findings was then issued on 14/07/2025. The PP had resolved all the open findings on 28/10/2025.
Double counting and participation under other GHG programs	Section 1.10 of the MR indicates that there are no double counting and participation under other GHG programs.

	The verification team checked GHG program registries such as Gold Standard⁵, CDM Registry⁶, International Carbon Registry⁷, there are no records of project registered under other GHG programs that applied the same technologies by the same PP. As per the joint validation and verification report of the project, it was validated that there was 1 CDM registration denial.
No double claiming with emissions trading programs or binding emission limits	Section 1.11.1 of the MR indicates that there is no double claiming with emissions trading programs or binding emission limits. There is no observation that is contradictory to the claim above.
No double claiming with other forms of environmental credit	Section 1.11.2 of the MR indicates that there is no double claiming with other forms of environmental credit. There is no observation suggesting that the project activity has sought, received, or is planning to receive credit from another GHG-related environmental credit system, assessing the evidence of no double claiming against VCS Standard requirements.
Supply chain (scope 3) emissions double claiming	Neither the PP nor the authorized representative is a buyer or seller of a product whose footprint is changed by the project activities. The emissions footprint changes take place at the user.
Sustainable development contributions	- There are 4 sustainable development contributions identified by Section 1.12 of the MR: - SDG target 7.3.1: the project has reduced the energy demand for cooling (707,930MWh) and heating (7,413,166 MMBTu) during the second monitoring period. This is consistent with figured reported by the revised ER calculation spreadsheet /27/. Refer to section 4.3 below for detailed assessment.

⁵ [GSF Registry](#)

⁶ [CDM: Project Activities](#)

⁷ [Carbon Registry | Carbon Credits Overview](#)

	- SDG Target 8.2.1: the project is supported by a professional team consisting of Data Scientist, Engineer, Experts. According to the eco Plus cost breakdown /24/ which shows the total budget for eco+ team, ERM CVS confirmed that there are more than 30 full-time employees working on this feature which is the same as per the approved monitoring report for the 1st monitoring period/28/. - SDG Target 11.6.2: According to the MR, 61,563lbs PM2.5 is reduced. ERM CVS confirmed the calculations as amount of electricity saved * National weighted average of Avoided PM2.5 rate⁸ (used 2022 AVERT emission rates, EPA)/29/. It is noted that 2023 AVERT emission rate is available since April 2024. When applying the PM2.5 emission rate value from 2023 AVERT, the total avoided PM2.5 would be 61,563lbs⁹. ERM CVS considered the reported avoided PM2.5 (i.e. 61,563lbs) as conservative and hence accepted. - SDG Target 13.0: According to the MR, 707,930 MWh electricity consumption and 7,413.166 MMBtu natural gas consumption are reduced. ERM CVS confirmed that the values are sourced from the DSA output as reported in the emission reduction calculation spreadsheet.
Additional information relevant to the project	The response should include: An assessment of whether any commercially sensitive information that has been excluded from the public versions of project documents conforms with the VCS Program requirements on what may be excluded. Provide further details in Appendix 1.

4.2 Safeguards and Stakeholder Engagement

4.2.1 Stakeholder Identification

⁸ National average value of "Portfolio EE" is used, i.e. 0.0887lbs/MWh.

⁹ 707,930MWh * 0.0887325564240251 = 62,816lbs

Item	Evidence gathering activities, evidence checked, and assessment conclusion
Stakeholder identification	According to the MR, there are 2 groups of stakeholders identified: Group 1: Industry Professionals; 2. ecobee users. The joint validation and verification report confirmed the stakeholders. ERM CVS did not observe any changes of the project implementation that may change the situation since the validation.
Legal or customary tenure/access rights	As confirmed by the joint validation report, this section is not applicable. ERM CVS did not observe any changes of the project implementation that may change the situation since the validation.
Stakeholder diversity and changes over time	As confirmed by the joint validation report, this section is not applicable as this project did not impact on the social, economic or cultural diversity of the stakeholder group. ERM CVS did not observe any changes of the project implementation that may change the situation since the validation.
Expected changes in well-being	As confirmed by the joint validation report, this section is not applicable. ERM CVS did not observe any changes of the project implementation that may change the situation since the validation.
Location of stakeholders	As confirmed by the joint validation and verification report, the stakeholder is located in the U.S. ERM CVS did not observe any changes of the project implementation that may change the situation since the validation.
Location of resources	As confirmed by the joint validation and verification report, the stakeholders who attended the consultation did not come from groups that hold customary access rights to resources and territories. ERM CVS did not observe any changes of the project implementation that may change the situation since the validation.

4.2.2 Stakeholder Consultation and Ongoing Communication

Item	Evidence gathering activities, evidence checked, and assessment conclusion
------	--

Ongoing consultation	There were 2 ongoing consultations conducted by the PP for each group of stakeholders. As confirmed by the joint validation and verification report, ecobee thoroughly explained the project design and any associated possible negative outcomes or possible obstacles. It was concluded that the stakeholder engagement process meets the VCS program requirements.
Date(s) of stakeholder consultation	Group 1: Industry Professionals – Virtual session held on 16-January-2023 Group 2: ecobee Customers – Virtual sessions held on 20-June-2024
Communication of monitored results	No additional comments or feedback has been received since 20-June-2024 and during the monitoring period as it pertains to the ecobee carbon project.
Consultation records	The ongoing stakeholder communication records were provided to cover the indicated monitoring period.
Stakeholder input	It is reported in the MR that Since the sessions on 20-June-2024, no additional comments, inquires and inputs have been received from the stakeholder group. ERM CVS interviewed with the project proponent /I01/ and reviewed the confirmation by ecobee's research team that there were no additional comments received since the last consultation on 20/06/2024.

4.2.3 Free, Prior, and Informed Consent

Item	Evidence gathering activities, evidence checked, and assessment conclusion
Consent	As confirmed by the joint validation and verification report, this section is not applicable. ERM CVS did not observe any changes of the project implementation that may change the situation since the validation.
Outcome of FPIC discussion	Not applicable.

4.2.4 Grievance Redress Procedure

Item	Evidence gathering activities, evidence checked, and assessment conclusion
Grievance received and steps taken to resolve the grievance including the outcomes of the resolution	According to the revised MR, it is reported that there are no grievances raised during the monitoring period despite the continuous monitoring of stakeholder feedback. As confirmed by the joint validation and verification report, this section is not applicable. ERM CVS did not observe any changes of the project implementation that may change the situation since the validation.
Grievance redress procedure	Not applicable.

4.2.5 Public Comments

Comments received	Actions taken by the project proponent	Evidence gathering activities, evidence checked, and assessment conclusion
No comments received outside the public comment period 26/07/2022 – 25/08/2022.	Not applicable	During the on-site visit, it is confirmed that there was no stakeholder comment received after the public comment period.

4.2.6 Risks to Local Stakeholders and the Environment

4.2.6.1 Management Experience

ERM CVS conducted a strategic and risk analysis and risk assessment to plan for the verification activities. Here is a list of evidence gathering activities:

- Review the documentations that are available on the Verra Registry for this project.
- Request relevant documentation for the indicated monitoring period.
- Conduct a site visit to assess the data collection system, data management system, QA/QC procedures within ecobee. Conduct interview to assess the data handling procedures and the process of executing the panel regression model by the external M&V contractor DSA.

- Assess the experience of the monitoring team of ecobee and DSA team. Evaluate the roles of the current monitoring teams and their competencies.
- Examine the implementation of the monitoring plan, application of the methodology as well as the panel regression model developed by DSA.

The verification team reviewed the following information:

- Registered joint Project Description and Monitoring Report.
- Approved Joint Validation and Verification Report.
- Monitoring report for MP2.
- ecobee_DSA Monitoring Team Organizational Chart.
- ecobee emissions reduction dashboard
- DSA Code Walkthrough

Based on the data reviewed and interviews with the ecobee core monitoring team, the verification team concluded that the management team in charge of the monitoring is competent. For the statistical analysis ecobee partnered with DSA who had demonstrated expertise in large data analysis.

4.2.6.2 Risk Assessment

Item	Evidence gathering activities, evidence checked, and assessment conclusion
Natural and human induced risks to stakeholders' wellbeing	The project is the roll out of eco+ software feature that optimizes the operations of HVAC systems installed at the users' homes. ERM CVS did not observe any risks of impacting stakeholders' wellbeing.
Risks to stakeholder participation	The roll out of the eco+ software feature takes place at the ecobee smart thermostat installed by the users at will. ERM CVS did not observe any risks to stakeholders' participation.
Working conditions	The roll out of the eco+ software feature aimed to optimize the HVAC operations at the users' homes. The feature could be switched off anytime by the user. ERM CVS did not observe any risks of impacting working conditions of any stakeholders.
Safety of women and girls	Not applicable. ERM CVS did not observe any risks to the safety of women and girls.

Safety of minority and marginalized groups, including children	Not applicable. ERM CVS did not observe any risks to the safety of minority and marginalized groups, including children.
Pollutants (air, noise, discharges to water, generation and release of hazardous materials and chemical pesticides and fertilizers)	The project is the roll out of eco+ software feature that optimizes the operations of HVAC systems installed at the users' homes. No additional pollutants are expected to be generated due to this feature. ERM CVS did not observe any risks of pollution.

4.2.7 Respect for Human Rights and Equity

4.2.7.1 Labor and Work

Item	Evidence gathering activities, evidence checked, and assessment conclusion
Discrimination	ecobee is a subsidiary of Generac Power System which is a member of Responsible Business Alliance(RBA)¹⁰. As reported in the MR, ecobee abide by the RBA Code of Conduct in their operations. The RBA code of conduct has delineated clearly the requirement on workplace discrimination, ERM CVS confirms that is sufficient to prevent discrimination. The project activity is improvements of energy efficiency by utilizing a free thermostat optimization platform (eco+ and humidity adjustment). This system reduces a home's incremental energy usage by regulating HVAC equipment. The project activity does not impact the human rights of users.
Sexual harassment	The RBA code of conduct has delineated clearly the requirement on workplace sexual harassment, ERM CVS confirms that is sufficient to prevent sexual harassment. The project activity is improvements of energy efficiency by utilizing a free thermostat optimization platform (eco+ and humidity adjustment). This system reduces a home's incremental energy usage

¹⁰ <https://www.responsiblebusiness.org/about/members/>

	by regulating HVAC equipment. The project activity does not impact the human rights of users.
Gender equity in labor and work	The RBA code of conduct has delineated clearly the requirement on workplace gender equality in wages and benefits, ERM CVS confirms that is sufficient to prevent gender inequality. The project activity is improvements of energy efficiency by utilizing a free thermostat optimization platform (eco+ and humidity adjustment). This system reduces a home's incremental energy usage by regulating HVAC equipment. The project activity does not impact the human rights of users.
Forced labor	The RBA code of conduct has delineated clearly the requirement on the prohibition of forced labor, ERM CVS confirms that is sufficient to prevent forced labor. The project activity is improvements of energy efficiency by utilizing a free thermostat optimization platform (eco+ and humidity adjustment). This system reduces a home's incremental energy usage by regulating HVAC equipment. The project activity does not impact the human rights of users.
Child labor	The RBA code of conduct has delineated clearly the requirement on the prohibition of child labor, ERM CVS confirms that is sufficient to prevent child labor. The project activity is improvements of energy efficiency by utilizing a free thermostat optimization platform (eco+ and humidity adjustment). This system reduces a home's incremental energy usage by regulating HVAC equipment. The project activity does not impact the human rights of users.
Human trafficking	The RBA code of conduct has delineated clearly the requirement on the prohibition of human trafficking, ERM CVS confirms that is sufficient to prevent human trafficking. The project activity is improvements of energy efficiency by utilizing a free thermostat optimization platform (eco+ and humidity

adjustment). This system reduces a home's incremental energy usage by regulating HVAC equipment. The project activity does not impact the human rights of users.

4.2.7.2 Human Rights

Risks identified	Evidence gathering activities, evidence checked, and assessment conclusion
N/A	ERM CVS did not find any risks to human rights protection. The project activity is improvements of energy efficiency by utilizing a free thermostat optimization platform (eco+ and humidity adjustment). This system reduces a home's incremental energy usage by regulating HVAC equipment.

4.2.7.3 Indigenous Peoples and Cultural Heritage

Risks identified	Evidence gathering activities, evidence checked, and assessment conclusion
N/A	ERM CVS did not find any risks to the protection of indigenous peoples and cultural heritage. The project activity is improvements of energy efficiency by utilizing a free thermostat optimization platform (eco+ and humidity adjustment). This system reduces a home's incremental energy usage by regulating HVAC equipment.

4.2.7.4 Property Rights

Risks identified	Evidence gathering activities, evidence checked, and assessment conclusion
N/A	ERM CVS did not find any risks to the protection of property rights. The project activity is improvements of energy efficiency by utilizing a free thermostat optimization platform (eco+ and humidity adjustment). This system reduces a home's incremental energy usage by regulating HVAC equipment.

4.2.7.5 Benefit Sharing

Item	Evidence gathering activities, evidence checked, and assessment conclusion
Summary of the benefit sharing plan	N/A. The project does not involve benefit sharing program.
Benefit sharing during the monitoring period	N/A. The project does not involve benefit sharing program.

4.2.8 Ecosystem Health

Item	Evidence gathering activities, evidence checked, and assessment conclusion
Impacts on biodiversity and ecosystems	N/A. ERM CVS did not observe any impacts on biodiversity and ecosystem, soil degradation and soil erosion, water consumption and stress. The project activity is improvements of energy efficiency by utilizing a free thermostat optimization platform (eco+ and humidity adjustment). This system reduces a home's incremental energy usage by regulating HVAC equipment
Soil degradation and soil erosion	
Water consumption and stress	

4.2.8.1 Rare, Threatened, and Endangered species

Item	Evidence gathering activities, evidence checked, and assessment conclusion
Species or habitat	

Areas needed for habitat connectivity	N/A. ERM CVS did not observe any impacts on species and the habitat. The project activity is improvements of energy efficiency by utilizing a free thermostat optimization platform (eco+ and humidity adjustment). This system reduces a home's incremental energy usage by regulating HVAC equipment
---------------------------------------	--

	Evidence gathering activities, evidence checked, and assessment conclusion
Habitats for rare, threatened, and endangered species	N/A. ERM CVS did not observe any impacts on species and the habitat. The project activity is improvements of energy efficiency by utilizing a free thermostat optimization platform (eco+ and humidity adjustment). This system reduces a home's incremental energy usage by regulating HVAC equipment
Areas for habitat connectivity	

4.2.8.2 Introduction of Species

Species introduced	Evidence gathering activities, evidence checked, and assessment conclusion
N/A	ERM CVS did not observe any activity of introduction of species. The project activity is improvements of energy efficiency by utilizing a free thermostat optimization platform (eco+ and humidity adjustment). This system reduces a home's incremental energy usage by regulating HVAC equipment

Existing invasive species	Evidence gathering activities, evidence checked, and assessment conclusion
N/A	ERM CVS did not observe any activity of introduction of species. The project activity is improvements of energy efficiency by utilizing a free thermostat optimization platform (eco+ and humidity adjustment). This system reduces a home's incremental energy usage by regulating HVAC equipment

	Evidence gathering activities, evidence checked, and assessment conclusion
Invasive species	N/A. ERM CVS did not observe any activity of introduction of species. The project activity is improvements of energy efficiency by utilizing a free thermostat optimization platform (eco+ and humidity adjustment). This system reduces a home's incremental energy usage by regulating HVAC equipment

4.2.8.3 Ecosystem conversion

Item	Evidence gathering activities and evidence checked
Ecosystem conversion	N/A. ERM CVS did not observe any impact on ecosystem. The project activity is improvements of energy efficiency by utilizing a free thermostat optimization platform (eco+ and humidity adjustment). This system reduces a home's incremental energy usage by regulating HVAC equipment

4.3 Accuracy of Reduction and Removal Calculations

ERM CVS applied the following steps in the course of verification of the accuracy of the emission reduction calculations:

Step 1. assess the emission reduction quantification method documented by the monitoring report against that described in the registered PD.

Emissions reduction calculation is described in Section 5 of the monitoring report (p.52-69). ERM CVS confirmed that the description of quantification methodology is consistent with that documented on the registered PD (p.41-60, p.65 – 72).

Below is a summary of the emission reduction calculations approach.

1. Overview of the quantification of emission reductions:

The emission reductions for the ecobee smart thermostat project are quantified by comparing the heating and cooling energy use of homes with and without the eco+ “Adjust For Humidity” feature. The analysis is performed using high-frequency telemetry data collected from ecobee devices, and the impact is estimated using panel regression models with lagged dependent variables (LDV).

2. Definitions of Baseline, Project, and Leakage Emissions

A. Baseline Emissions

- Baseline emissions represent the GHG emissions from heating and cooling in homes with ecobee thermostats that did not enable eco+ and “Adjust For Humidity.”.
- The baseline scenario reflects the HVAC runtime and associated energy use without the optimization feature. The baseline is estimated using telemetry data from control group devices (no eco+ enabled) and pre-treatment data from treated devices.
- Weather normalization is applied using controls for temperature (cooling/heating degree days) and humidity.

B. Project Emissions

- Project emissions are the GHG emissions from heating and cooling in homes with eco+ and “Adjust For Humidity” enabled.
- Project emissions are estimated using telemetry data from the treatment group during the post-treatment period.
- The same regression framework is used, controlling weather, time, and device-specific factors.

C. Leakage Emissions

- Leakage refers to emissions from improper disposal of appliances. For this project, leakage is not considered because no HVAC equipment is disposed of; only thermostat software is upgraded.

3. Panel Regression Model

As reported by the MR, DSA was hired by ecobee as a third party to analyze and quantify the emission reductions of the project during the 2nd monitoring period. ERM CVS confirmed the role of DSA in the project by interviewing DSA team (IO4, IO5, IO6) during the on-site visit. They are independent consultants who provide data analysis, run the regression model with ecobee supplied telemetry data, populates the modeling output in form of MS excel Dashboard (which is used by ecobee to calculate emission reductions), etc. The verification team reviewed the Consultant Agreement between DSA and ecobee to confirm DSA’s status of independent contractor and the consistent scope of services.

Sampling framework for the construction of panel regression model

According to the MR(p.58), the same set of sampled devices was applied across both Monitoring Period 1 and Monitoring Period 2 for the construction of the panel regression model. The verification team confirmed the same during management interviews with ecobee /IO1/ and Demand Side Analytics (DSA) /IO3/ as part of the verification process.

The sampled devices were originally selected as a random sample drawn from the ecobee customer base, and new monitoring data were collected for each reporting period while maintaining the same panel structure.

Assessment of representativeness over time

According to the MR (p.60 – 63), DSA conducted a statistical assessment using the full population dataset of ecobee devices across the United States between March 2021 and March 2025. The analysis evaluated whether the geographic distribution of devices (proxy for climate zone coverage) has changed materially over time, recognizing that climate zones are geographically determined. A chi-square test of independence was applied to assess changes in state-level distributions across the two monitoring periods. As the dataset covers the full population, Cramer's V was used as the primary indicator of practical significance.

The results show:

- Non-heat pump devices: Cramer's V = 0.0606
- Heat pump devices: Cramer's V = 0.0725

These values are close to zero, which indicating that differences in geographic distribution are negligible. This is further supported by the state-level comparison on p.60 -61 of the MR), where differences in state shares between the two monitoring periods are small, indicating no systematic redistribution of the population during the 2nd monitoring period for both heat pump and non-heat pump groups. ERM CVS confirms the same from the clarification email /36/ and the Geographical distribution of ecobee's devices in 2021 and 2025 /37/ provided by DSA.

As confirmed in the analysis that geographic stability directly implies climate zone stability, since climate classification is determined based on location. Therefore, ERM CVS considers that the sample continues to reflect the same distribution of climate conditions as the full population in the 2nd monitoring period.

By reviewing the Joint Validation and Verification Report /9/ for the 1st monitoring period, the sampling approach applied by ecobee is consistent with the applied methodology. The sample was randomly selected and stratified by equipment type, ensuring representation across regions and device types. The validation and verification body confirmed that the sampling approach that i.) avoids bias, ; ii). includes geographically dispersed dwellings, and; iii). is representative of the population.

Therefore, ERM CVS confirms that the sample framework applied in the 2nd monitoring period is in line with the requirements under VM0008, which require samples to be representative across geographic and climatic conditions.

Panel regression model

DSA had developed a quantification model that employs a panel regression model using lagged dependent variables and clustered standard errors to quantify the impacts of ecobee devices with eco+ and “Adjust For Humidity”. According to DSA, they used Stata software to conduct data analysis. Stata software is a specialized statistic software that ERM CVS’s team is not familiar with. With reference to the joint validation and verification report, the previous VVB employed Python to reanalyze the data. Therefore, DSA was requested to translate the panel regression model into Python language.

ERM CVS obtained the Python-translated panel regression model for the assessment. The Python scripts were examined line by line in order to verify the functionalities, data grabbing and processing mechanisms, parameters as well as the calculation equations. The verification team confirmed that the Python translated panel regression model works consistently as per the description of emission reduction quantification equations on the MR. Below are the findings based on the Python-translated panel regression model.

The model Inputs:

Dependent Variables: HVAC runtime in seconds per day for each device, for each function (cooling, heating, auxiliary heating).

Independent Variables:

- Treatment indicator (eco+ enabled or not)
- Lagged dependent variable (previous period’s runtime)
- Weather variables (cooling/heating degree days, humidity)
- Time fixed effects (year-month, day of week)
- Device characteristics (heat pump indicator, etc.)

Separate regressions are run for each of the following five technology groups:

1. Heat pump / cooling
2. Heat pump / heating (compressor)
3. Heat pump / auxiliary heating
4. Non-heat pump / cooling
5. Non-heat pump / heating

Each group’s regression estimates the effect of eco+ enablement on the relevant HVAC runtime, controlling for weather, time, and device-specific factors. For each group, the model is:

$$y_{it} = \beta_t m_t c_i + Y_{it-1} m_t + m_t + cdd_{it} + hdd_{it} + h_{it} + d_t + \varepsilon_{it}$$

Variable	Definition
Y_{it}	Runtime in seconds for device i on day t
β_t	Coefficient of Interest. Average daily runtime savings in seconds. DSA estimates separate coefficients for year month (m_t) and device i
m_t	Indicator variable for year-month
c_i	Indicator variable for treatment (1 if eco+ enabled, 0 otherwise)
$Y_{it-1} m_t$	Lagged dependent variable. mean of all dependent variable values in the pre-period in the month that day t is in for household i.
cdd_{it} hdd_{it}	Cooling degree days, heating degree days. Weather controls (continuous variable).
h_{it}	Humidity reported for device i in day t.
d_t	Indicator variable of day of week
ε_{imy}	Error term.

By running the regression model with the telemetry data collected by the ecobee smart thermostats, the outputs of each model are:

- Month fixed effects: coefficients for C(ym)
- Treatment effects by month: coefficients for complier:C(ym) (these are the runtime impacts attributed to eco+, month by month)
- LDV term by month: coefficients for pre_y:C(ym) (the pre-period baseline influence, month-specific)
- Weather controls: coefficients for outdoor_humidity, cdd60, hdd60
- Day-of-week controls: coefficients for C(dow)

It is noted that the python-translated panel regression model uses the upper bound of 95% confidence interval of the impact estimates. Since impact is negative runtime (i.e. savings), upper bounds of the CI impact estimate mean less negative. For example, if the impact is -100 seconds with a confidence interval from -150 to -50 seconds, that is analogous to savings of 100 seconds with a confidence interval from 50 to 150 seconds. The lower savings estimate (50 seconds), which is the upper bound of the impact (e.g. -50 seconds). Therefore, using upper bound of CI impact is in line with the MR (p.61) which indicates the use of lower bound of the 95% CI of the treatment effect.

Each coefficient comes with standard error, t-statistic, p-value, and 95% confidence interval. The MR Appendix D logs show the full output tables.

4. From Runtime to Emissions

- The estimated reduction in HVAC runtime (seconds/day) is converted to energy savings (kWh) using assumptions about equipment size and efficiency.
- Energy savings are then converted to CO₂ reductions using EPA eGRID emission factors (lbs/MWh for electricity, lbs/MMBtu for natural gas).

Cooling: Heat Pumps (HP) and Non-Heat Pumps (Non-HP):

$$\frac{\beta_{it}}{3600} * days * \frac{kWperdevice}{1000} * \frac{CO_2rate}{2204.6}$$

Heating: Non-Heat Pumps:

$$\frac{\beta_{it}}{3600} * days * \frac{furnacesize(kBTU)}{1000} * \frac{117}{2204.6} + \frac{\beta_{it}}{3600} * days * \frac{furnacefan(kW)}{1000} * \frac{CO_2rate}{2204.6}$$

Heating: Heat-Pumps, Compressors:

$$\frac{\beta_{it}}{3600} * days * \frac{HeatPumpCompressor}{1000} * \frac{CO_2rate}{2204.6}$$

Heating: Heat-Pumps, Auxiliary:

$$\frac{\beta_{it}}{3600} * days * \frac{HeatPumpAuxiliary}{1000} * \frac{CO_2rate}{2204.6}$$

ERM CVS confirmed the Python-translated scripts convert the runtime to emissions according to the above equations per technology group. Below is the assessment of the parameters used in the conversions:

Parameter	Monitoring Report Description	Value in Monitoring Report	Value in Python-translated scripts	Identified usage in Python-translated scripts
kWperdevice (Cooling)	Weighted average for cooling devices	3.21 kW	3.21 kW	Used for cooling runtime to kWh conversion
eGRID Emission Factor (HP)	National average for heat pump customers	718 lbs/MWh	718 lbs/MWh	Used for heat pump CO ₂ conversion
eGRID Emission Factor (Non-HP)	National average for non-heat pump customers	720 lbs/MWh	720 lbs/MWh	Used for non-heat pump CO ₂ conversion
Natural Gas Emission Factor	CO ₂ per MMBtu for furnace heating	117 lbs/MMBtu	117 lbs/MMBtu	Used for non-heat pump heating
Seconds to Hours Conversion	Converts runtime seconds to hours	÷ 3600	÷ 3600	Used in all runtime conversions
kWh to MWh Conversion	Converts kWh to MWh	÷ 1000	÷ 1000	Used in all electricity conversions
lbs to Metric Tons Conversion	Converts pounds to metric tons	÷ 2204.6	÷ 2204.6	Used in all CO ₂ conversions

ERM CVS has assessed the eGRID emission factors as reported in Appendix C of the MR. It is confirmed that the CO₂ emissions rates of each state are consistent with EPA eGRID summary table for both 2022 /18/ and 2023 /19/. Therefore, ERM CVS confirmed that the calculated weighted national average as 755.44 lbs/MWh (HP) and 776.42 lbs/MWh (non-HP) for 2022; and 717.77 lbs/MWh (HP) and 720.20 lbs/MWh (non-HP) for 2023.

- The emission conversion results are aggregated across all devices and months and summed for each technology group. It is confirmed that the Python-translated script does not take into account the 20% discount when calculating the emissions. According to the PP /I01/, ecobee had conducted an Occupancy analysis to meet VM0008 applicability conditions of “occupied dwellings”. The subject of the analysis were the same set of sampled ecobee devices submitted to DSA for panel regression modelling. The analysis rely on 3 set of telemetry data points which are 1) telemetry HVAC runtime data (i.e., record of when HVAC equipment is on or off), 2) motion events (i.e., detection of motion within the vicinity of the device and/or detection of motion from external room sensors) and 3) temperature set point holds (i.e., temperature holds manually set on the device or in-app)..

As per the ecobee’s Carbon Project – Occupancy Analysis /34/, for the samples (111,282 ecobee devices) covered by the analysis, the results are:

- **80%** of 3-month periods contained in the sample featured 288 motion events or 12 set point hold were made on the device. Based on these results, ecobee infers these devices are in occupied homes.
- **2.0%** of 3-month periods contained in the sample featured less than 288 motion events and experienced no set point hold made on the device. Based on these results, ecobee infers these devices could be in unoccupied homes.
- **18%** of 3-month periods contained in the sample corresponded to devices without motion detection capabilities (i.e., ecobee3 lite without SmartSensor) and featured no set point holds made on the device. Based on these results, ecobee cannot make an inference on the occupancy of the home (ie., inconclusive).

Based on the above analysis, ERM CVS considers that the applied dwelling occupancy discount (i.e. 20%) is substantiated by the occupancy analysis. By applying the 20% discount in the ER calculations after the panel regression modelling is conservative and also appropriate to demonstrate the compliance with the applicability criterion of the applied methodology.

The converted emissions per each technology group is a straight output without discount. This is the same situation as DSA’s output by Stata. According to the tab”Results_LDV” of ER calculation spreadsheet, the occupancy dwelling discount is applied on top of the panel regression modelling results. It is confirmed in line with the MR and the registered PD.

Step 2. Reproduce the emissions per technology group by running the Python-translated program with the telemetry data collected for the monitoring period.

The Python-translated program is a series of Python scripts that are prepared by DSA to replicate the functionality of the Stata software for the panel regression model. The purpose and output of each script file are summarized below:

Script File	Main Purpose & Usage	Output / Correlation to Next Step
_00_Headers.py	Sets up project directories, imports libraries, and ensures reproducibility. Used as a header to initialize the environment for all other scripts. Paths in this script is modified to match the local directory of the telemetry data.	No direct output; establishes environment and directory structure. Called at the start of all other scripts.
_01_Prep_Runtime.py	Prepares and processes telemetry runtime data: unzips, merges, cleans, and formats device runtime data for analysis. Handles treatment switching, creates lagged dependent variables, and saves processed datasets for regression modeling.	Outputs cleaned and merged runtime datasets (e.g., LDV Data.parquet, participant lists, crossover lists). These are used as inputs for regression scripts (_02_LDV_Regression.py, _02_LDV_RegressionTIC.py).
_02_LDV_Regression.py	Runs Lagged Dependent Variable (LDV) regressions to estimate treatment effects on device runtime. Aggregates results by heat pump status and dependent variable, outputs coefficients and standard errors.	Outputs regression coefficients and statistics (e.g., LDV_Coefficients.pkl). These are used for plotting (_02b_LDV_Plts.py) and for emissions calculations (_03_CO2_Conversions.py).
_02_LDV_RegressionTIC.py	Similar to _02_LDV_Regression.py, but may use a different monitoring period or sample. Runs LDV regressions, aggregates by heat pump and dependent variable, and outputs regression results.	Outputs alternative regression results (LDV_Coefficients.pkl for TIC sample). Can be used for sensitivity analysis or comparison in downstream scripts.

_02b_LDV_Plts.py	Loads regression results and generates plots of coefficients and confidence intervals by month, heat pump status, and dependent variable. Produces visualizations for reporting.	Outputs figures/plots (e.g., PNG files) visualizing regression results. Used for reporting and presentations.
_03_CO2_Conversions.py	Converts regression outputs and runtime data into CO2 emission reductions. Merges device counts, load assumptions, and eGRID emission factors. Calculates and exports monthly/annual emission savings and baseline/project emissions.	Outputs Excel files (e.g., LDV_Inputs.xlsx) with quantified emission reductions, baseline/project emissions, and supporting data for reporting or further analysis.
_03b_Egrid_Prep.py	Prepares and processes EPA eGRID emission factor data. Merges with device counts by state and heat pump status to generate weighted average emission rates for use in CO2 calculations.	Outputs processed eGRID emission rates (egrid_df). These are merged into the emissions calculation script (_03_CO2_Conversions.py).
_04_Treatment_Switching.py	Processes device characteristic data to identify and track units switching from control to treatment (Eco+ enabled). Generates lists and plots of crossover units for further analysis.	Outputs crossover lists (e.g., 04_Deniers_Crossover_List.csv) and plots. These are referenced in _01_Prep_Runtime.py and used to update runtime datasets for regression.

ERM CVS ran the above Python-Translated program at ERM CVS's terminal with the raw telemetry data of the period Mar 2023 – Mar 2025. They were analyzed and processed by the program. An output excel file was successfully generated (refer to Appendix 2 of this verification report).

Step 3. Assess the emission reduction outcome as compared with the LDV output reported on the CO2 Dashboard and hence reported in the MR.

ERM CVS compared the ERM CVS output file with the output file reported in the ER calculation spreadsheet dated /15/(i.e. tab “Inputs_LDV”). The LDV results are documented in Appendix The values in both files represent the emissions before applying for a 20% discount.

Heat Pump

	mt_CO2_saved		mt_co2_project		Variance ¹¹	
	ecobee	ERM CVS	ecobee	ERM CVS	mt_CO2_saved	mt_co2_project
2023	26,426	27,088	1,002,811	961,886	3%	-4%
2024	40,027	41,668	1,587,576	1,587,576	4%	0%
2025	3,372	3,126	419,863	419,863	-7%	0%
Total MP2	69,825	71,881	3,010,250	2,969,326	3%	-1%

Non-Heat Pump

	mt_CO2_saved		mt_co2_project		Variance ¹²	
	ecobee	ERM CVS	ecobee	ERM CVS	mt_CO2_saved	mt_co2_project
2023	205,313	203,945	4,157,588	4,021,902	-1%	-3%
2024	307,135	311,270	6,940,436	6,940,436	1%	0%
2025	94,815	95,558	2,941,684	2,941,684	1%	0%
Total MP2	607,264	610,772	14,039,708	13,904,022	1%	-1%

Heat Pump + Non-Heat Pump

	mt_CO2_saved		mt_co2_project		Variance ¹³	
--	--------------	--	----------------	--	------------------------	--

¹¹ Variance is calculated by: (erm cvs result – ecobee result)/ecobee result*100%

¹² Variance is calculated by: (erm cvs result – ecobee result)/ecobee result*100%

¹³ Variance is calculated by: (erm cvs result – ecobee result)/ecobee result*100%

	ecobee	ERM CVS	ecobee	ERM CVS	mt_CO2_saved	mt_co2_project
2023	231,739	231,032	5,160,399	4,983,789	0%	-3%
2024	347,162	352,937	8,528,012	8,528,012	2%	0%
2025	98,188	98,684	3,361,547	3,361,547	1%	0%
Total MP2	677,089	682,653	17,049,958	16,873,348	0.82%	-1.04%

As shown by the above comparison table (Heat Pump + Non-Heat Pump), the emission reductions reproduced by ERM CVS are 0.82% higher than the result reported by ecobee. It is noted that there are factors that may impact the results using Python-translated panel regression model. **The minor variance (i.e. 0.82%) between ecobee results and ERM CVS results suggests that the Python-translated panel regression model is reasonably considered identical to running the panel regression model with Stata by DSA.**

Plus, as discussed in Step 1, the verification team was able to assess and confirm that the Python-translated panel regression model is scripted appropriately as per the MR. Therefore, ERM CVS concluded that emission reduction calculations applied by DSA (i.e. Stata panel regression model) is accurate as per description of the MR.

Update during Verra's Project Review stage:

The regression model outcome reproduction performed by ERM CVS was conducted as a targeted validation procedure to assess the integrity and correctness of the calculation methodology, through independent review of the Python-translated script and comparison against the LDV outputs reported in Appendix D of MR v2.0 (/26/) and the corresponding ER calculation spreadsheet (/15/). The objective of this procedure was not to independently re-perform the full emission reduction calculation, but to verify that the model logic, parameterization, and computational steps are implemented consistently with the methodology and Monitoring Report.

The close alignment between ERM CVS-reproduced results and the ecobee-reported LDV outputs (variance of 0.82%) provides corroborative evidence that the Python-translated implementation faithfully replicates the Stata-based panel regression model applied by DSA. In conjunction with the Step 1 assessment confirming that the model is scripted in accordance with the MR, ERM CVS considers that sufficient and appropriate evidence has been obtained to conclude that the regression model outputs provided by DSA (i.e., “Inputs_LDV” of the latest ER calculation spreadsheet /27/) are reliable for the purpose of emission reduction quantification. Accordingly, ERM CVS’ verification conclusion on ER is based on the demonstrated correctness and consistency of the model implementation rather than re-performance of the full regression analysis.

Emission Reduction Pro-rating

According to the ER calculation spreadsheet, for the period of 03/03/2023 – 31/03/2023 and 01/03/2025 – 02/03/2025, the emission reductions are calculated by pro-rating to the monthly emission reduction as calculated by the regression model. ERM CVS has assessed the methodological appropriateness of this approach in the context of VM0008 and concludes that the applied treatment is reasonable and consistent with the underlying intent of the methodology, for the following reasons.

First, the regression model underpinning the ER calculations is designed to generate **normalized energy consumption estimates**, which already incorporate adjustments for key temporal drivers, particularly weather variability.

$$y_{it} = \beta_t m_t c_i + Y_{it-1} m_t + m_t + cdd_{it} + hdd_{it} + h_{it} + d_t + \varepsilon_{it}$$

The regression model explicitly incorporates weather variables, including cooling degree days (CDD), heating degree days (HDD), and humidity-related parameters, thereby controlling for weather-driven variability in energy consumption.

VM0008 requires that emission reductions be based on energy consumption estimates that are normalized for temperature and temporal variation, for example through Heating/Cooling Degree Day correction factors and other normalization approaches. The regression model applied in this project directly integrates these normalization principles by embedding weather-related variables and temporal effects within the statistical model structure. As such, the model outputs represent weather-normalized and temporally adjusted energy consumption values, rather than raw, month-specific consumption.

Second, the regression model has been developed using a large and statistically robust dataset, comprising more than 111,000 ecobee device runtime observations across multiple states (climate zones) and spanning the full monitoring period. The regression is based on the data inputs of daily runtime data (seconds per device per day).

This broad dataset captures seasonal variation, geographic diversity, and temporal dynamics across different climatic conditions. In line with VM0008 requirements for statistically sound and representative data, the model therefore reflects an average, generalized relationship between energy use and relevant drivers, rather than being dependent on the characteristics of any single calendar month. Consequently, the model outputs can reasonably be interpreted as month-specific, daily-normalized estimates of consumption effects, rather than discrete monthly measurements tied to specific calendar lengths.

This modeling impacts across the full range of weather conditions. The regression output (β coefficients) represents a daily marginal impact of the treatment (eco+) on runtime, which is already: 1. normalized for weather; 2. adjusted for temporal variation; 3. controlled for household heterogeneity.

As per the equations converting seconds of runtime to emissions reductions. By taking “Cooling: Heat Pumps and Non-Heat Pumps” as an example:

$$\frac{\beta_{it}}{3600} * days * \frac{kW_{perdevice}}{1000} * \frac{CO_2rate}{2204.6}$$

Where “ β_{it} ” is the predicted change in seconds. Dividing by 3600 puts it in hours per day, and then multiplying it by the number of days in the month translates it to hours per month. The β coefficients of different technology groups are explicitly scaled by the number of days in the period (i.e., $\beta \times days$) to derive monthly emission reduction estimates, as implemented in the ER calculation spreadsheet. Accordingly, the model does not directly estimate fixed monthly consumption values, but rather normalized effects that are aggregated to the reporting period based on the applicable number of days.

Third, the prorating approach applied to partial months constitutes a linear temporal scaling of already-normalized daily marginal effects, rather than a substitution for normalization procedures. Because the regression outputs represent daily treatment effects that are explicitly aggregated using the number of days, adjusting those outputs proportionally to the number of days in a partial month ensures that the calculation remains fully consistent with the model structure. Importantly, this scaling does not introduce additional assumptions regarding weather or usage patterns, as these factors are already accounted for within the regression framework. In this respect, prorating is appropriate and necessary application of the calculation methodology to align results with the actual monitoring period. This ensures that emission reductions are calculated strictly within the defined monitoring period boundaries and avoids applying full-month impacts to periods where treatment was not active.

Based on the above considerations, ERM CVS concludes that:

- The regression model outputs are already fully normalized for weather and temporal variability in accordance with VM0008 requirements for deriving emission reductions from normalized energy consumption and ensuring unbiased and representative estimation of actual project impacts over the monitoring period;
- The approach is supported by a large, representative dataset and preserves statistical integrity;
- No explicit requirement in VM0008 prohibits such treatment, and the approach remains consistent with the methodology's intent to produce unbiased, representative emission reduction estimates.

Accordingly, ERM CVS considers the applied prorating approach to be methodologically appropriate and consistent with VM0008.

Assessment on the connected load assumptions

According to Appendix A and B of the registered PD, the connected load parameters are derived from multiple established industry sources, including technical reference manuals, appliance saturation studies, and evaluation reports consolidated in Appendix B. These sources are specifically designed to represent large residential populations and provide standardized estimates of HVAC system capacities and performance.

The approach to estimating connected load explicitly accounts for geographic and climatic diversity by stratifying assumptions across five climate zones (Cold, Dry, Hot Humid, Mixed Humid, Marine). As HVAC system sizing and utilization are fundamentally driven by climatic conditions, this stratification ensures that regional variations in cooling and heating demand are systematically reflected in the applied parameters. Consequently, any expansion in project coverage is inherently accommodated through climate zone assignment.

The representativeness of these assumptions is further supported by DSA's analysis of the full ecobee device population (2021–2025), which demonstrates that the geographic distribution and the climate zone composition has not changed materially over time. This indicates that the underlying distribution of building stock characteristics and HVAC system types in the project population remains stable.

Given that the connected load assumptions are climate-zone-specific proxies for average equipment characteristics and building stock conditions, the demonstrated stability in geographic and climatic distribution supports the conclusion that these assumptions remain representative of the current project population.

In addition, the use of panel regression with controls for weather conditions, household characteristics, and equipment type ensures that emission reduction estimates are primarily driven by observed changes in runtime rather than absolute connected load values. This reduces sensitivity of the results to potential variation in connected load and introduces an additional layer of conservativeness in the quantification approach.

Consistent with VM0008 requirements that data inputs be appropriate, unbiased, and based on a sample that is “representative of the population,” ERM CVS concludes that the connected load parameters, when applied consistently and stratified by climate zone, remain appropriate for the purpose of quantifying emission reductions for the current project population, including in the 2nd monitoring period.

Assessment Conclusion

Based on the above assessment, the verification team confirmed that the emissions reduction calculations are consistent with the description provided in the MR and the registered PD. As suggested by the Python-translated program, the LDV outputs provided by DSA are accurately calculated in accordance with the methodology.

4.4 Quality of Evidence to Determine Reductions and Removals

The monitoring plan is described in Section 4.3 of the MR which is consistent with that described in Section 5 of the registered PD.

ERM CVS conducted desktop review as well as interviewing ecobee data scientist during the on-site visit to assess the process of data collection, analysis, data transfer and quality controls measures.

Data Collection Procedures

Telemetry Data Source:

It is confirmed by the Data scientist that all registered ecobee smart thermostats collect granular runtime data for HVAC systems. Each thermostat records whether specific relays (corresponding to HVAC equipment) are powered or unpowered, discretized into 5-minute intervals, and send packets every **15 minutes** containing the prior three intervals to server-side systems. This reduces manual handling and establishes a structured, repeatable data collection process before the data enters the server-side pipeline. The verification team reviewed the raw telemetry data files /10/ provided by ecobee for the monitoring period. It is confirmed that ecobee receive the telemetry data at a 5-mins interval every day from the connected ecobee smart thermostats.

On the server side, this data is processed and stored in a Google Cloud BigQuery table called ISM (Interval Status Messages). The verification team was able to witness a live demonstration data query during the on-site visit (refer to Section 3.3 above for detailed witness assessments). The ecobee data scientist executed a query via Google Cloud Bigquery to show the live ISM table which is the primary sources for runtime data used in DSA's analysis. Below is a list of data (non-exhaustive) that were observed being collected by the smart thermostats:

- Device ID
- Eco+ feature enablement
- Date & time
- HVAC mode
- Calendar event
- Humidity
- Runtime per different technology groups

Data Completeness and Integrity Controls

ERM CVS confirms that the project relies on a fully automated telemetry-based data collection system in which:

- HVAC runtime, setpoints, motion signals, and environmental data are recorded directly from ecobee smart thermostats at high frequency intervals (5-minute resolution), and transmitted periodically to centralized servers.
- Data is systematically ingested, validated, and stored within a structured cloud-based data pipeline (ISM data architecture).
- During the site visit, the VVB observed that:
- Data flows are fully automated from device to ingestion to transformation then to storage, with no manual modification of raw data.
- Each device generates continuous time-series data, enabling monitoring of data continuity at the individual PAI level.

Based on this, ERM CVS concludes that data completeness is structurally enforced at the system level, and gaps can be systematically detected rather than going unnoticed.

Data quality control

ERM CVS interviewed ecobee Data scientist /I02/ to assess the data collection processes and data management systems. It is confirmed that there is a dedicated team to monitor the operation of the data collection pipeline. According to the ecobee monitoring team organizational chart, Engineering Manager is responsible for maintaining the data pipelines for any new library/data upgrades, creating monitoring policies to ensure the team is aware of if the pipeline is not working as intended and maintaining the data storage where the thermostat runtime data gets stored as an end result.

Data quality controls are implemented at different level of the data pipeline including data validation upon receiving the data from the thermostat. There is automatic monitoring system that alert the engineering team to follow up. The verification team raised CL3 to question the fluctuations of users reported by the ISM table. From the response, it demonstrated proactive and timely response by ecobee team. ERM CVS confirmed ecobee's monitoring team are competent to ensure proper data quality management. ecobee's data management system and the controls are considered reliable.

Missing Data Identification and Treatment

Data pipeline level

ERM CVS confirms that pipeline-level controls are implemented to ensure data integrity throughout the ingestion and processing stages. Automated validation procedures are embedded within both ingestion and transformation processes to identify abnormal records at an early stage. In parallel, continuous pipeline monitoring is maintained through defined alert thresholds for unprocessed messages, real-time tracking of pipeline execution, and established response protocols to promptly address any data pipeline failures. These are evidenced by the ecobee's Internal policy to handle data non-conformance/35/ and confirmed through the management interview /I01/ /I02/.

With respect to the handling of incomplete or erroneous data, ERM CVS observed that a series systematic treatment mechanisms are applied. Data batches that do not meet defined completeness thresholds (empty data or less than 655.375MB) are excluded from further processing to prevent the inclusion of unreliable information. Additionally, standardized preprocessing rules—such as null handling and formatting normalization—are applied to ensure consistency and integrity of the dataset prior to analysis.

Data cleaning at modelling level

According to the interview with DSA /I04/ /I05/ /I06/, when DSA received the runtime data from ecobee, the issues (e.g., pipeline interruptions, missing data,) are explicitly excluded from monthly average calculations to avoid bias in emission reduction estimates.

ERM CVS verified through the Python script inspection that missing values are explicitly detected by the script (i.e. using np.nan assignment in 01 Prep Runtime /17/) and are subsequently excluded from regression analysis. While the regression function relies on statsmodels, which by default removes observations with missing dependent or independent variables during model fitting, this behavior was confirmed through script walkthrough and replication testing. This ensures that only complete runtime data of the ecobee devices are used in β coefficient estimation.

These controls were substantiated through script walkthroughs, inspection of runtime datasets, and independent re-execution of the regression model by the VVB. Based on this review, ERM CVS concludes that missing data is systematically identified at the pipeline level and conservatively treated at the modelling stage through exclusion of incomplete observations prior to regression estimation.

Data reporting and transfer between ecobee and DSA

At the end of the monitoring period (i.e. March 2025), ecobee ran the query to grab the data from ISM. There was an occupancy analysis performed by the ecobee that serves as an additional layer of data validation at the PAI eligibility level. As discussed in Section 4.3 above, the analysis is used to ensure that only devices associated with occupied dwellings are included in the eligible population included in the dataset used for regression modelling. Devices that do not meet the occupancy criteria are excluded. While this procedure does not directly address missing or anomalous data in the telemetry dataset, it the dwelling discount rate by ensuring that emission reduction calculations are accounted for eligible subset of project activity instances and that results are not overstated due to inclusion of unoccupied dwellings.

Then, ecobee sent the data to DSA through Google Cloud Storage bucket. DSA downloaded the data in the format of .csv. Data anonymization is done by creating DSA id to mask the thermostat id. Then the data was fed into the Stata software to conduct the analysis. The analysis outputs for each regression model and each month within the monitoring period were exported in the file name “input_LDV” then sent to ecobee.

ERM CVS has determined that the data collection process aligns with the monitoring plan. The data utilized to quantify GHG emission reductions is reliable. The data flow from thermostats through aggregation systems, storage, analysis, and final transposition into the monitoring report is traceable. Although the monitoring plan does not specify a calibration frequency, the telemetry system installed in each thermostat is considered appropriate and reliable given the nature of the project. The evidence supporting the determination of emissions reductions is both appropriate and complete.

Reliability of ecobee's Data Management System

Based on the assessment performed, the data management system is highly automated. With data directly captured from devices and processed through a structured cloud-based pipeline with embedded validation, monitoring, and response controls, it minimizes risks of manual error and ensuring consistent data handling.

At both the data pipeline and modelling stages, systematic procedures are applied to identify and conservatively handle incomplete or anomalous data, ensuring that only valid and complete runtime data are used in regression analysis.

By conducting document review, management interviews, system walkthroughs, and independent testing, ERM CVS concludes that ecobee has implemented a robust and well-controlled data management system that provides a reliable basis for the quantification of emission reductions. The system is therefore considered sufficiently robust to support the completeness and accuracy of the data used in emission reduction calculations, and **this assessment forms the primary basis of the verification team's reliance on the project data.**

4.5 Non-Permanence Risk Analysis

Not applicable.

5 VERIFICATION OPINION

5.1 Verification Summary

ecobee Technologies ULC has commissioned ERM Certification and Verification Services Limited [ERM CVS] to carry out the verification of the of the project "Improving Energy Efficiency in Homes Through Smart Thermostat Optimization" (VCS3352) against the criteria set out by the VCS Version 4 and the registered project description.

The project activity has undergone its 2nd verification with a monitoring period from 03/03/2023 to 02/03/2025 (including both days). ecobee Technologies ULC is responsible for the overall project management, data collection, aggregation and preparation. DSA supports ecobee for the data analysis by running a panel regression model with the historical telemetry data provided by ecobee. DSA provides the regression model outputs to ecobee who is responsible for the presentation of activities and related GHG data in public disclosures (such as the monitoring report, emission reduction calculation sheet, submitted documents, emails, and communications). The verification engagement is based on the assumption that the GHG data provided is complete, sufficient, accurate, and free from material misstatements.

ERM CVS applied its own quality management system and compliance policies for quality control, in accordance with ISO/IEC 17029:2019 – Conformity Assessment Requirements for Validation and Verification bodies providing environmental information (ISO 14065:2020) and greenhouse gas audit (ISO 14064-3:2019) standards, and maintains a comprehensive quality control system including documented policies and procedures to ensure compliance with ethical requirements, professional standards, and applicable legal and regulatory requirements.

The resulting emission reductions are confirmed in conformance with the requirements from the following standards and design documents:

- VCS Standard, Version 4.7 (16/04/2024)
- VCS Program Guide Version 4.4 (29 August 2023)
- VM0008 - Weatherization of Single Family and Multi-Family Buildings – Sectoral Scope 3. V. 1.1 (10 October 2012)
- ISO 14064-3:2019 “Greenhouse gases – Part 3: Specification with guidance for the validation and verification of greenhouse gas statements”
- Improving Energy Efficiency in Homes Through Smart Thermostat Optimization Project Description Document. Version 1.6 dated 19 July 2024.

During the Verra Project Review (PRR), the Monitoring Report, ER calculations, and Verification Report were revised to enhance transparency, consistency, and audit traceability.

The eligible project activity instances (i.e. eco+ with “Adjust For Humidity”) population was conservatively refined to approximately 3.28 million devices following improvements to the BigQuery script, ensuring alignment with the defined applicability criteria.

The panel regression approach, including the treatment–control framework, was applied consistently and confirmed to produce statistically robust and conservative estimates based on lower-bound coefficients.

The emission reduction calculations were further clarified by establishing a transparent linkage from runtime impacts to energy use and emissions, with partial months prorated in a manner consistent with normalized daily regression outputs.

Additional analysis demonstrated that the sampled devices remain representative of the broader population across climate zones and HVAC characteristics.

It is ERM CVS's responsibility to provide an independent verification statement on the reported GHG emission reductions for the project. Based on an understanding of the risks associated with reporting of GHG emission data and the controls in place to mitigate these, ERM CVS planned and conducted the assessment to obtain the information and explanations that we considered necessary to provide reasonable assurance that the reported GHG emission reductions are free from material misstatement.

5.2 Verification Conclusion

ERM CVS has performed the verification of the emission reductions that have been reported for the VCS project activity "Improving Energy Efficiency in Homes Through Smart Thermostat Optimization" in the United State of America for the monitoring period 03/03/2023 - 02/03/2025. The project activity was correctly implemented according to selected monitoring methodology and monitoring plan as per the registered PD.

The verification conclusion is based on an assessment that:

- (i) the monitoring plan has been implemented as described, including the collection, processing, and quality control of HVAC runtime data used as the primary activity data input;
- (ii) the panel regression modelling approach, including the use of treatment and control groups, has been applied consistently with the registered and validated project design, and produces statistically robust and conservative estimates of emission reductions through the application of lower-bound confidence interval coefficients;
- (iii) the conversion of runtime impacts to energy and emissions using connected load assumptions and emission factors has been performed in a transparent and internally consistent manner, with conservative parameter choices applied where project-specific measurements are not feasible;
- (iv) the prorating of emission reductions for partial months at the beginning and end of the monitoring period is mathematically consistent with the regression framework, which estimates normalized daily treatment effects, and therefore does not introduce material bias;

(v) the project activity instances included in the monitored population meet the applicability conditions and eligibility criteria defined in the methodology and registered project description, and the procedures applied to determine the eligible population, including updates to internal BigQuery logic, have been verified and found to be reasonable and conservative; and

(vi) the sampled devices used in the regression analysis remain geographically and technologically representative of the broader project population, as demonstrated through comparative analysis of device distribution across climate zones and HVAC system types during the monitoring period.

As per the discussion in Section 4.3 and 4.4 above, ERM CVS assessed the emission reductions by reviewing the panel regression model applied by DSA (i.e. a third-party consultant to ecobee), the data collection and controls. ERM CVS confirmed that the data output by DSA is appropriately calculated in accordance with the methodology described in the registered PD. The regression model output by DSA is reported in the tab “Inputs_LDV” of the emission reduction calculation spreadsheet. ecobee applied 20% discount (to account for unoccupied dwelling) to the DSA output to calculate the emission reductions achieved by the project activity during the monitoring period. ERM CVS confirmed the calculations are done correctly. Based on the evidence and information that are considered necessary to provide reasonable assurance that the reported GHG emission reductions are free of material misstatement. ERM CVS concludes that the VCU generated from the “Improving Energy Efficiency in Homes Through Smart Thermostat Optimization” in the United State of America during the period 03/03/2024 - 02/03/2025 is fairly stated in the MR.

Verification period: From 03/03/2023 – 02/03/2025

Verified GHG emission reductions and carbon dioxide removals in the above verification period:

Vintage period	Baseline emissions (tCO ₂ e)	Project emissions (tCO ₂ e)	Leakage emissions (tCO ₂ e)	Reduction VCU (tCO ₂ e)	Removal VCU (tCO ₂ e)	Total VCUs (tCO ₂ e)
03/03/2023 to 31/12/2023	5,237,639	5,012,127	0	0	0	225,512
01/01/2024 to 31/12/2024	8,875,174,514,752	8,528,012,220,247	0	0	0	294,505
01/01/2025 to 02/03/2025	3,524,026,459,735	3,413,713,61,547	0	0	0	110,312

Gross Total	17,727,0471 6,276,417	17,049,958 15,646,088	0	0	0	630,330
Occupied Dwelling Discount (20%)	-	-	-	-	-	504,264

5.3 Ex-ante vs Ex-post ERR Comparison

Vintage period	Ex-ante estimated reductions / removals (tCO2)	Achieved reductions/ removals (tCO2)	Percent difference	Explanation for the difference	VCU issued by Vintage (tCO2)
03/03/2023 to 31/12/2023	278,337	225,512	-18.98%	The difference for the ex-ante estimated reductions calculated in 2023 and the achieved reductions for monitoring period 2 calculated was -16.29% and can be attributed to a few factors:	180,410
01/01/2024 to 31/12/2024	399,069	294,505	-26.20%		235,604
01/01/2025 to 02/03/2025	75,606	110,312	+45.90%		88,250
Gross Total	753,012.5	630,330	-16.29%	1) Changes in eGRID emission factors 2022 and 2023 2) Changes in device footprint and enablement of Adjust For Humidity during the Monitoring Period 3) Changes in number of equipment types during the Monitoring Period	504,264

APPENDIX 1: COMMERCIALLY SENSITIVE INFORMATION

Use the table below to describe the commercially sensitive information included in the monitoring report to be excluded in the public version.

Section	Information	Justification	Assessment method and conclusion
N/A			

APPENDIX 2: DOCUMENT REFERENCE LIST

Item	Document title	Issuer/ Provider
/1/	ISO14064-3:2019	ISO
/2/	VCS Standard, v4.7, 16/04/2024	Verra
/3/	VCS Program Guide, v4.4	Verra
/4/	VCS Program Definitions, v4.5	Verra
/5/	Registration and Issuance Process, v4.6	Verra
/6/	Validation and Verification Manual, v3.2	Verra
/7/	VM0008: Weatherization of Single Family and Multi-Family Buildings, v1.1	Verra
/8/	Registered Project Description Improving Energy Efficiency in Homes Through Smart Thermostat Optimization, v1.6, 19/07/2024	ecobee
/9/	Joint Validation and Verification report “VALIDATION AND VERIFICATION OF IMPROVING ENERGY EFFICIENCY IN HOMES THROUGH SMART THERMOSTAT OPTIMIZATION”, v1.0, 16/07/2024	TUV Nord
/10/	Telemetry data for MP2 (Mar 2023 – Mar 2025) runtime_data_2023_000000000000.csv runtime_data_2024_000000000000.csv runtime_data_2025_000000000000.csv	ecobee
/11/	ecobee footprint by US States_data - Mar 03 2023 to Mar 02 2025_forDSA	ecobee
/12/	device_characteristics_all_devices_2025_update device_characteristics_acceptors_heat_pump.csv device_characteristics_acceptors_no_heat_pump.csv device_characteristics_deniers_heat_pump.csv device_characteristics_deniers_no_heat_pump.csv	ecobee
/13/	Ecobee database live query	ecobee

/14/	New ecobee devices (By Month) - Monitoring Period (Mar 2023 to Mar 2025) copy	ecobee
/15/	ER calculation spreadsheet, "08AUG_ERR_CO2_Dashboard_V2_LowerBound_0425_V2"	ecobee
/16/	CO2 Offset -STATA Code Walkthrough, 15/06/2025	DSA
/17/	Python-translated panel regression model scripts _00_Headers.py _01_Prep_Runtime.py _02_LDV_Regression.py _02_LDV_RegressionTIC.py _02b_LDV_Plts.py _03_CO2_Conversions.py _03b_Egrid_Prep.py _04_Treatment_Switching	DSA
/18/	EPA eGRID Summary Tables 2022	EPA
/19/	EPA eGRID Summary Tables 2023	EPA
/20/	Consulting agreement between ecobee and DSA	ecobee
/21/	ecobee_DSA_Monitoring Team Org Chart	ecobee
/22/	Responsible Business Alliance Code of Conduct, version 8.0.1(2025)	RBA
/23/	ISM 2.0 Data Architecture	ecobee
/24/	Eco Plus Cost Breakdown (as of Apr 2022)	ecobee
/25/	Monitoring Report, Version 1.0, 15/05/2025	ecobee
/26/	Monitoring Report, Version 2.0, 09/01/2026	ecobee
/27/	<u>Revised ER Calculations</u> <u>"CO2 Dashboard V2 LowerBound 20260409"</u>	<u>ecobee</u>
/28/	<u>Monitoring Report for the 1st monitoring period, version 1.6.</u> <u>19/07/2024</u>	<u>ecobee</u>
/29/	<u>AVERT v4.3 Avoided Emission Rates 2017 – 2023</u>	<u>US EPA</u>

	https://www.epa.gov/system/files/documents/2024-04/avert_emission_rates_04-11-24_0.xlsx	
/30/	Timeline of eco+ release, T&Cs and query code, 08/04/2026	ecobee
/31/	List of new ecobee devices added during the 2nd monitoring period. “2026 carbon 2026 submission thermostats Terms PAlsampling.csv”	ecobee
/32/	Live query output for total eligible ecobee devices. “26Mar-ecobee updated device counts.csv”	ecobee
/33/	Revised ER calculation spreadsheet. “CO2 Dashboard V2 Lowerbound 20260409.xlsx”	ecobee
/34/	Carbon Project – Occupancy Analysis Mar 2023 – Mar 2025	ecobee
/35/	Internal policy to handle data non-conformance	ecobee
/36/	DSA email clarification on the representativeness of the sample framework for panel regression model	DSA
/37/	Geographical distribution of ecobee’s devices in 2021 and 2025	DSA
/38/	Monitoring Report, Version 3.0, 08/06/2026	ecobee

APPENDIX 3: <ERM CVS_LDV_INPUTS>

	climate_z one	heat_pu mp	depvar	year	mon th	day s	N	mt_co2_sa ved	mmbtu_sa ved	mwh_sa ved	min_da y	beta	beta_lo wer	tstat	pval	ci_lowe r	ci_uppe r	r 2	avg_runtime_t reat	mt_co2_pro ject	egrid_ba sis
0	All	No	auxheat 1	202 3	3	31	19991 45	35375.05	-634570	5197.34	8.985 42	638.4 95	539.12 5	50.699 81	2.29E- 36	737.86 5	539.12 5		9248.429	606841.6	2023
25	All	No	compc ol1	202 3	3	31	19991 45	2182.789		6681.72	2.015 22	159.5 52	120.91 3	19.713 98	5.81E- 16	198.19 1	120.91 3		1168.541	21095.12	2023
50	All	Yes	auxheat 1	202 3	3	31	56997 3.6	0		0	0	0	0	55.545 83	0.1899 12	36.056 1	181.67 96		862.6741	11745.43	2023
75	All	Yes	compc ol1	202 3	3	31	56997 3.6	321.8899		988.666	1.045 86	187.7 93	62.751 6	63.798 05	0.0032 45	312.83 5	62.751 6		3373.491	17304.62	2023
100	All	Yes	comphe at1	202 3	3	31	56997 3.6	1842.845		5660.19	6.355 99	629.4 18	381.35 9	126.56 31	6.59E- 07	877.47 8	381.35 9		7459.705	36047.59	2023
1	All	No	auxheat 1	202 3	4	30	20287 08	16484.35	-295702	-2421.9	4.263 62	313.5 67	255.81 7	29.464 87	1.9E-26	371.31 7	255.81 7		3753.834	241889.6	2023
26	All	No	compc ol1	202 3	4	30	20287 08	3635.977		11130.1	3.418 2	263.6 03	205.09 2	29.853 19	1.05E- 18	322.11 4	205.09 2		2719.563	48213.83	2023
51	All	Yes	auxheat 1	202 3	4	30	58348 0.5	0		0	0	0	0	20.365 26	0.0694 13	2.9375 5	76.892 78		241.3752	3255.711	2023
76	All	Yes	compc ol1	202 3	4	30	58348 0.5	2452.013		7531.22	8.041 88	662.0 9	482.51 3	91.622 74	4.96E- 13	841.66 8	482.51 3		6604.194	33560.9	2023
101	All	Yes	comphe at1	202 3	4	30	58348 0.5	917.5034		2818.06	3.194 26	319.8 74	191.65 6	65.418 57	1.01E- 06	448.09 2	191.65 6		2413.698	11554.96	2023
2	All	No	auxheat 1	202 3	5	31	20501 09	6065.041	-108797	891.082	1.502 25	120.5 91	-90.135	15.538 89	8.45E- 15	151.04 6	90.135		1019.069	68571.47	2023
27	All	No	compc ol1	202 3	5	31	20501 09	7627.203		23347.6	6.866 63	510.9 95	411.99 8	50.509 55	4.65E- 24	609.99 2	411.99 8		6851.055	126831.7	2023
52	All	Yes	auxheat 1	202 3	5	31	59513 8	119.7046		367.666	0.140 34	20.60 72	8.4202 7	6.2179 36	0.0009 19	32.794 1	8.4202 7		43.97693	625.1869	2023
77	All	Yes	compc ol1	202 3	5	31	59513 8	1847.173		5673.49	5.747 92	594.3 99	344.87 5	127.31 01	3.03E- 06	843.92 2	344.87 5		12275.67	65749.24	2023
102	All	Yes	comphe at1	202 3	5	31	59513 8	412.5886		1267.24	1.362 85	136.3 75	81.771 1	27.859 46	9.83E- 07	190.97 8	81.771 1		629.2972	3175.216	2023
3	All	No	auxheat 1	202 3	6	30	20873 95	765.9193	-13739.3	-112.53	0.192 53	31.04 98	-11.552	9.9480 71	0.0018 01	50.547 7	11.552		152.189	10090.45	2023
28	All	No	compc ol1	202 3	6	30	20873 95	3230.73		9889.57	2.951 83	314.7 09	-177.11	70.204 67	7.37E- 06	452.30 7	177.11		13776.44	251301.3	2023
53	All	Yes	auxheat 1	202 3	6	30	61183 1.8	467.8295		1436.91	0.551 29	40.58 32	33.077 2	3.8296 41	3.07E- 26	48.089 1	33.077 2		5.848194	82.71432	2023

78	All	Yes	compco ol1	202 3	6	30	61183 1.8	3229.152	-	10.09 99	924.4 04	605.99 5	162.45 64	1.27E- 08	1242.8 1	605.99 5	20259.53	107956.5	2023	
103	All	Yes	comphe at1	202 3	6	30	61183 1.8	63.14174	-	0.209 64	46.63 67	12.578 4	17.377 03	0.0072 79	80.695 1	12.578 4	89.86764	451.1228	2023	
4	All	No	auxheat 1	202 3	7	31	21272 78	0	0	0	0	0	6.0257 75	0.0290 8	1.3403 87	24.960 99	33.2055	2318.448	2023	
29	All	No	compco ol1	202 3	7	31	21272 78	20652.85	-	17.91 89	1249. 64	1075.1 3	89.033 85	9.45E- 45	1424.1 4	1075.1 3	22469.87	431636.8	2023	
54	All	Yes	auxheat 1	202 3	7	31	62994 0.9	564.8657	-	0.625 64	45.96 93	37.538 6	4.3014 38	1.17E- 26	54.399 9	37.538 6	3.318584	49.93671	2023	
79	All	Yes	compco ol1	202 3	7	31	62994 0.9	5095.369	-	14.97 95	1287. 19	898.76 9	198.18 01	8.3E-11	1675.6 2	898.76 9	29863.74	169305.8	2023	
104	All	Yes	comphe at1	202 3	7	31	62994 0.9	0	0	0	0	0	7.5896 68	0.5824 4	19.048 5	10.702 49	24.32787	129.9283	2023	
5	All	No	auxheat 1	202 3	8	31	21705 78	0	0	0	0	0	7.0869 32	0.1704 2	4.1749 8	23.605 29	29.92868	2132.191	2023	
30	All	No	compco ol1	202 3	8	31	21705 78	21121.58	-	-17.96 47	1251. 47	-1077.6 22	88.710 22	3.42E- 45	1425.3 4	1077.6	20646.28	404679.2	2023	
55	All	Yes	auxheat 1	202 3	8	31	64956 2.6	597.3732	-	0.641 66	46.49 25	38.499 7	4.0780 41	4.15E- 30	54.485 3	38.499 7	2.335129	36.23257	2023	
80	All	Yes	compco ol1	202 3	8	31	64956 2.6	3144.154	-	8.964 04	931.1 34	537.84 2	200.66 26	3.48E- 06	1324.4 3	537.84 2	28930.84	169125.8	2023	
105	All	Yes	comphe at1	202 3	8	31	64956 2.6	0	0	0	0	0	7.3323 5	0.6581 96	-	11.127 27	19.86152	109.3789	2023	
6	All	No	auxheat 1	202 3	9	30	22113 85	127.0921	-2279.82	-	0.030 16	24.28 37	1.8093 9	11.466 71	0.0341 96	46.758 1	1.8093 9	152.6618	10723.03	2023
31	All	No	compco ol1	202 3	9	30	22113 85	8875.438	-	7.654 58	590.3 9	459.27 5	66.896 67	1.09E- 18	721.50 5	459.27 5	12706.9	245559.7	2023	
56	All	Yes	auxheat 1	202 3	9	30	66706 6.9	514.9343	-	0.556 55	41.62 72	-33.393	4.2011 84	3.83E- 23	49.861 3	33.393	4.079951	62.91458	2023	
81	All	Yes	compco ol1	202 3	9	30	66706 6.9	1868.068	-	5.359 01	638.8 47	321.54 1	161.89 42	7.94E- 05	956.15 4	321.54 1	19617.78	113974.2	2023	
106	All	Yes	comphe at1	202 3	9	30	66706 6.9	47.67927	-	0.145 19	43.00 3	8.7116 6	17.495 93	0.0139 76	77.294 4	8.7116 6	103.0574	564.0374	2023	
7	All	No	auxheat 1	202 3	10	31	22546 86	12757.6	-228850	-	2.873 22	220.4 5	172.39 3	24.519 18	2.45E- 19	268.50 6	172.39 3	2302.982	170427.5	2023
32	All	No	compco ol1	202 3	10	31	22546 86	2462.084	-	2.015 45	195.9 18	120.92 7	38.261 37	3.05E- 07	270.90 9	120.92 7	4525.675	92143.16	2023	
57	All	Yes	auxheat 1	202 3	10	31	68333 4.1	136.755	-	0.139 63	-39.22	8.3780 5	15.735 99	0.0126 89	-	8.3780 5	111.2613	1816.12	2023	
82	All	Yes	compco ol1	202 3	10	31	68333 4.1	0	0	0	0	0	101.61 24	0.4270 66	279.85 9	118.45 38	8521.001	52402.44	2023	
107	All	Yes	comphe at1	202 3	10	31	68333 4.1	182.0631	-	0.523 77	121.1 1	-31.426	45.758 18	0.0081 27	210.79 5	31.426	1590.782	9216.027	2023	

8	All	No	auxheat 1	202 3	11	30	22890 66	28588.89	-512838	4200.31	-	6.553 38	484.3 44	393.20 3	46.501 64	2.1E-25	575.48 6	393.20 3	7417.319	539296.9	2023
33	All	No	compco ol1	202 3	11	30	22890 66	2183.944		6685.26	-	1.819 61	147.4 37	109.17 7	19.520 93	4.26E- 14	185.69 7	109.17 7	948.7456	18978.47	2023
58	All	Yes	auxheat 1	202 3	11	30	70037 8.4	0		0	0	0	0	0	43.726 4	0.7738 83	98.264 7	73.139 62	627.837	10164.98	2023
83	All	Yes	compco ol1	202 3	11	30	70037 8.4	0		0	0	0	0	0	58.455 8	0.9973 53	114.76 5	114.37 73	2520.345	15373.76	2023
108	All	Yes	comphe at1	202 3	11	30	70037 8.4	1242.059		3814.91	-	3.602 46	453.0 67	216.14 7	120.87 98	0.0001 78	689.98 8	216.14 7	7093.176	40759.88	2023
9	All	No	auxheat 1	202 3	12	31	23411 44	34021.28	-610286	4998.44	-	7.379 18	549.3 51	442.75 1	54.388 98	5.5E-24	655.95 2	442.75 1	9913.848	761787.1	2023
34	All	No	compco ol1	202 3	12	31	23411 44	209.7682		-642.12	0.165 37	37.30 41	9.9224 3	13.970 49	0.0075 8	64.685 7	9.9224 3	373.5337	7896.809	2023	
59	All	Yes	auxheat 1	202 3	12	31	71965 9.1	0		0	0	0	0	0	65.155 4	0.5100 75	170.62 1	84.783	973.0703	16727.78	2023
84	All	Yes	compco ol1	202 3	12	31	71965 9.1	0		0	0	0	0	0	42.600 06	0.1686 14	24.848 3	142.14 09	967.3843	6265.471	2023
109	All	Yes	comphe at1	202 3	12	31	71965 9.1	2160.404		6635.56	-	5.901 43	671.7 34	354.08 6	162.06 87	3.4E-05	989.38 3	354.08 6	11225.78	68492.51	2023
10	All	No	auxheat 1	202 4	1	31	23751 62	42031.42	-753974	-6175.3	-8.986	676.7 83	-539.16	70.216 87	5.5E-22	814.40 5	539.16	15785.25	1230574	2023	
35	All	No	compco ol1	202 4	1	31	23751 62	624.3889		1911.31	-	0.485 2	55.36 53	29.111 8	13.394 9	3.58E- 05	81.618 8	29.111 8	245.2191	5259.461	2023
60	All	Yes	auxheat 1	202 4	1	31	73358 4.9	4380.007		13452.9	-	4.165 87	450.6 19	249.95 2	102.38 3	1.08E- 05	651.28 6	249.95 2	3122.322	54713.62	2023
85	All	Yes	compco ol1	202 4	1	31	73358 4.9	0		0	0	0	0	0	38.626 91	0.2762 54	33.651 4	117.76 33	615.2743	4062.066	2023
110	All	Yes	comphe at1	202 4	1	31	73358 4.9	0		0	0	0	0	0	202.70 57	0.4803 75	540.34 5	254.24 67	16570.81	103060.9	2023
11	All	No	auxheat 1	202 4	2	29	24004 42	30555.16	-548109	-4489.2	6.909 44	527.7 36	414.56 6	57.740 5	6.26E- 20	640.90 5	414.56 6	10549.61	777547.4	2023	
36	All	No	compco ol1	202 4	2	29	24004 42	832.9209		2549.65	-	0.684 59	73.01 42	41.075 5	16.295 55	7.44E- 06	104.95 3	41.075 5	464.9904	9428.989	2023
61	All	Yes	auxheat 1	202 4	2	29	74607 7.9	0		0	0	0	0	0	67.751 94	0.4000 71	75.778 5	189.80 42	1101.627	18366.34	2023
86	All	Yes	compco ol1	202 4	2	29	74607 7.9	0		0	0	0	0	0	44.822 21	0.7311 36	103.25 2	72.448 33	930.1434	5842.493	2023
111	All	Yes	comphe at1	202 4	2	29	74607 7.9	2367.941		-7273	6.669 59	731.7 62	400.17 6	169.18	1.52E- 05	1063.3 5	400.17 6	10743.04	63569.34	2023	
12	All	No	auxheat 1	202 4	3	31	24333 96	31024.64	-556531	4558.17	-	6.474 1	476.8 29	388.44 6	45.094 17	3.93E- 26	565.21 2	388.44 6	7177.756	573277.1	2023
37	All	No	compco ol1	202 4	3	31	24333 96	1833.25		5611.75	-	1.390 48	125.3 9	83.428 6	21.409 47	4.72E- 09	167.35 2	83.428 6	1105.746	24297.5	2023

62	All	Yes	auxheat 1	202 4	3	31	76217 8.3	0	0	0	0	0	44.008 29	0.1711 96	- 26.035	146.47 43	550.2987	10018.95	2023	
87	All	Yes	compco ol1	202 4	3	31	76217 8.3	519.5898	1595.89	- 1.262 48	220.2 78	75.748 9	73.740 48	0.0028 15	364.80 6	75.748 9	2884.347	19784.81	2023	
11 2	All	Yes	comphe at1	202 4	3	31	76217 8.3	2261.899	6947.29	- 5.833 99	576.1 62	350.03 9	115.37 1	5.91E- 07	802.28 5	350.03 9	5603.565	36209.36	2023	
13	All	No	auxheat 1	202 4	4	30	24755 08	21250.14	-381193	- 3122.09	4.504 26	330.2 79	270.25 6	4.07E- 27	390.30 3	270.25 6	3585.056	281892.2	2023	
38	All	No	compco ol1	202 4	4	30	24755 08	3155.748	9660.04	- 2.431 27	214.4 69	145.87 6	34.996 95	8.89E- 10	283.06 2	145.87 6	3100.68	67077.14	2023	
63	All	Yes	auxheat 1	202 4	4	30	78307 4.6	0	0	0	0	0	24.729 9	0.6687 68	37.889 3	59.050 12	194.2449	3516.249	2023	
88	All	Yes	compco ol1	202 4	4	30	78307 4.6	2098.129	6444.28	- 5.127 32	511.8 94	307.63 9	104.21 36	9.02E- 07	716.14 9	307.63 9	6786.161	46282.27	2023	
11 3	All	Yes	comphe at1	202 4	4	30	78307 4.6	1293.661	3973.41	- 3.355 88	335.4 25	201.35 3	68.405 24	9.41E- 07	469.49 7	201.35 3	2366.971	15207.42	2023	
14	All	No	auxheat 1	202 4	5	31	24830 63	6736.22	-120837	- 989.693	1.377 57	114.0 43	82.654 3	16.014 86	1.07E- 12	145.43 1	82.654 3	647.4095	52763.06	2023
39	All	No	compco ol1	202 4	5	31	24830 63	7530.934	23052.9	- 5.597 78	452.3 92	335.86 7	59.452 69	2.76E- 14	568.91 7	335.86 7	8588.573	192576.1	2023	
64	All	Yes	auxheat 1	202 4	5	31	79231 9.7	24.47415	75.1709	- 0.021 55	16.11 54	1.2931 2	7.5625 39	0.0330 93	30.937 7	1.2931 2	27.62042	522.7549	2023	
89	All	Yes	compco ol1	202 4	5	31	79231 9.7	2296.069	7052.24	- 5.366 68	638.4 98	322.00 1	161.48 1	7.69E- 05	954.99 5	322.00 1	16009.88	114160.6	2023	
11 4	All	Yes	comphe at1	202 4	5	31	79231 9.7	500.2583	1536.51	- 1.241 2	132.2 25	74.472 2	29.466 23	7.21E- 06	189.97 8	74.472 2	360.0257	2418.432	2023	
15	All	No	auxheat 1	202 4	6	30	24163 99	0	0	0	0	0	9.5338 81	0.9191 64	17.718 5	19.653 63	84.94133	6519.442	2023	
40	All	No	compco ol1	202 4	6	30	24163 99	8899.639	27242.6	- 7.024 24	592.7 46	421.45 4	87.395 25	1.18E- 11	764.03 7	421.45 4	18310.2	386647.2	2023	
65	All	Yes	auxheat 1	202 4	6	30	77941 5	481.177	1477.91	- 0.445 1	38.49 19	-26.706	6.0132 95	1.54E- 10	50.277 7	26.706	5.00117	90.1088	2023	
90	All	Yes	compco ol1	202 4	6	30	77941 5	2763.496	8487.92	- 6.785 03	803.5 28	407.10 2	202.26 23	7.11E- 05	1199.9 6	407.10 2	26007.84	176547	2023	
11 5	All	Yes	comphe at1	202 4	6	30	77941 5	0	0	0	0	0	12.607 59	0.8541 15	27.028 6	22.392 26	71.34427	456.2336	2023	
16	All	No	auxheat 1	202 4	7	31	25969 22	0	0	0	0	0	7.2892 4	0.0215 22	2.4691 44	31.042 44	24.37234	2077.396	2023	
41	All	No	compco ol1	202 4	7	31	25969 22	32852.43	-100564	- 23.34 88	1593. 09	1400.9 3	98.042 76	2.27E- 59	1785.2 5	1400.9 3	22257.49	521949.8	2023	
66	All	Yes	auxheat 1	202 4	7	31	84638 6.5	656.7674	2017.22	- 0.541 41	40.57 01	32.484 5	4.1254 13	8.02E- 23	48.655 8	32.484 5	3.494129	70.64395	2023	
91	All	Yes	compco ol1	202 4	7	31	84638 6.5	8283.197	25441.4	- 18.12 38	1519. 77	1087.4 3	220.58 35	5.59E- 12	1952.1	1087.4 3	29766.2	226735.7	2023	

11 6	All	Yes	comphe at1	202 4	7	31	84638 6.5	0	0	0	0	0	9.9138 32	0.4269 39	11.554 8	27.306 71	22.82859	163.8127	2023
17	All	No	auxheat 1	202 4	8	31	26476 92	0	0	0	0	0	7.1392 5	0.3813 77	20.242 1	7.7432 45	31.05431	2698.687	2023
42	All	No	compco ol1	202 4	8	31	26476 92	19745.82	60443.8	13.76 46	1008. 25	825.87 5	93.049 47	2.33E- 27	1190.6 2	825.87 5	20707.1	495085.7	2023
67	All	Yes	auxheat 1	202 4	8	31	86999 0.3	672.3233	-2065	0.539 19	58.01 72	32.351 6	13.094 9	9.4E-06	83.682 7	32.351 6	3.537791	73.52144	2023
92	All	Yes	compco ol1	202 4	8	31	86999 0.3	1934.677	-5942.25	4.118 27	666.4 63	247.09 6	213.96 66	0.0018 41	1085.8 3	247.09 6	27869.74	218210.2	2023
11 7	All	Yes	comphe at1	202 4	8	31	86999 0.3	0	0	0	0	0	10.294 11	0.7595 36	23.327 16	17.025 16	26.79993	197.6733	2023
18	All	No	auxheat 1	202 4	9	30	26795 22	2035.074	-36505.9	0.398 52	41.53 3	23.911 1	8.9909 36	3.85E- 06	59.155 1	23.911 1	83.4851	7105.407	2023
43	All	No	compco ol1	202 4	9	30	26795 22	11103.69	-33989.4	7.903 25	615.5 73	474.19 5	72.132 84	1.42E- 17	756.95 5	474.19 5	12386.3	290036.1	2023
68	All	Yes	auxheat 1	202 4	9	30	88755 8.1	647.1892	-1987.8	0.525 72	55.28 15	31.543 3	12.111 51	5.01E- 06	79.019 6	31.543 3	2.904278	59.58843	2023
93	All	Yes	compco ol1	202 4	9	30	88755 8.1	2926.297	-8987.95	6.309 33	718.9 99	-378.56	173.69 68	3.48E- 05	1059.4 4	378.56	18552.81	143414.8	2023
11 8	All	Yes	comphe at1	202 4	9	30	88755 8.1	15.79118	-48.5017	0.036 14	32.17 76	-2.1685	15.311 07	0.0355 89	62.186 8	2.1685	63.57895	462.9878	2023
19	All	No	auxheat 1	202 4	10	31	27422 98	13228.33	-237294	2.449 49	-194.4 9	146.96 9	24.199 73	9.5E-16	241.83 1	146.96 9	1629.54	146670.5	2023
44	All	No	compco ol1	202 4	10	31	27422 98	3316.978	-10153.6	2.232 46	222.3 78	133.94 7	45.118 35	8.28E- 07	310.80 8	133.94 7	5098.908	126265.7	2023
69	All	Yes	auxheat 1	202 4	10	31	91319 8.7	0	0	0	0	0	14.530 95	0.9368 69	27.329 2	29.631 07	88.8355	1937.845	2023
94	All	Yes	compco ol1	202 4	10	31	91319 8.7	421.4096	-1294.34	0.854 59	286.6 5	51.275 7	120.09 14	0.0169 89	522.02 5	51.275 7	9461.653	77760.69	2023
11 9	All	Yes	comphe at1	202 4	10	31	91319 8.7	878.6741	-2698.8	1.891 52	216.1 08	113.49 1	52.356 49	3.67E- 05	318.72 5	113.49 1	1400.208	10840.71	2023
20	All	No	auxheat 1	202 4	11	30	27877 23	39037.2	-700263	7.347 76	537.5 03	440.86 6	49.305 81	1.13E- 27	634.14 1	440.86 6	6327.597	560287.7	2023
45	All	No	compco ol1	202 4	11	30	27877 23	1833.302	-5611.91	1.254 24	122.9 31	75.254 3	24.325 21	4.33E- 07	170.60 7	75.254 3	1538.302	37475.23	2023
70	All	Yes	auxheat 1	202 4	11	30	93275 0.3	0	0	0	0	0	44.839 6	0.2231 81	33.264 2	142.50 38	489.1397	10546.91	2023
95	All	Yes	compco ol1	202 4	11	30	93275 0.3	0	0	0	0	0	81.207 37	0.3400 9	81.692 8	236.63 43	4226.575	34335.34	2023
12 0	All	Yes	comphe at1	202 4	11	30	93275 0.3	2173.046	-6674.39	4.732 52	520.1 46	283.95 1	120.50 95	1.59E- 05	756.34 1	283.95 1	5253.414	40203.74	2023
21	All	No	auxheat 1	202 4	12	31	28392 23	33642.5	-603491	6.016 92	489.1 22	361.01 5	65.361 85	7.25E- 14	617.22 9	361.01 5	12143.35	1131621	2023

46	All	No	compco ol1	202 4	12	31	28392 23	0	0	0	0	0	14.807 49	0.1408 55	50.827 8	7.2164 35	440.8508	11302.77	2023	
71	All	Yes	auxheat 1	202 4	12	31	95403 0.1	0	0	0	0	91.797 88	0.9616 23	175.50 3	184.33 76	1686.483	38433.62	2023		
96	All	Yes	compco ol1	202 4	12	31	95403 0.1	0	0	0	0	51.144 66	0.0353 66	7.3741 1	207.85 75	1002.064	8603.704	2023		
12 1	All	Yes	comphe at1	202 4	12	31	95403 0.1	4071.559	- 12505.6	8.389 72	- 5	893.2 3	503.38 52	198.91 7.1E-06	1283.1 2	503.38 3	12449.4	100695.6	2023	
22	All	No	auxheat 1	202 5	1	31	28763 69	61691.29	-1106640	- 9063.75	10.89 09	- 15	815.3 653.45	82.582 5.47E- 23	977.17 4	653.45 6	18093.52	1708169	2023	
47	All	No	compco ol1	202 5	1	31	28763 69	203.2556	-	622.184	0.130 42	26.93 27	7.8253 6	9.7488	0.0057 33	-46.04 6	7.8253 6	160.6376	4172.394	2023
72	All	Yes	auxheat 1	202 5	1	31	97112 2.5	1165.759	-	3580.56	0.837 56	334.7 06	50.253 6	145.13 12	0.0210 98	619.15 8	50.253 6	4154.712	96378.95	2023
97	All	Yes	compco ol1	202 5	1	31	97112 2.5	0	0	0	0	33.592 82	0.0002 34	57.764 25	189.44 57	328.6777	2872.58	2023		
12 2	All	Yes	comphe at1	202 5	1	31	97112 2.5	0	0	0	0	283.46 5	0.0700 96	1069.0 2	42.144 03	19854.46	163467.7	2023		
23	All	No	auxheat 1	202 5	2	28	28983 14	29756.36	-533780	- 4371.84	5.771 96	- 48	481.4 346.31	68.945 2.89E- 12	616.57 8	346.31 8	13601.68	1168685	2023	
48	All	No	compco ol1	202 5	2	28	28983 14	1742.309	-	5333.37	1.228 4	103.2 96	73.703 8	15.098 53	7.84E- 12	132.88 9	73.703 8	644.6869	15239.98	2023
73	All	Yes	auxheat 1	202 5	2	28	98408 1.1	0	0	0	0	102.99 53	0.6469 72	249.03 6	154.69 8	2300.853	48852.13	2023		
98	All	Yes	compco ol1	202 5	2	28	98408 1.1	0	0	0	0	57.268 8	0.9380 37	116.69 7	107.79 29	1710.423	13682.28	2023		
12 3	All	Yes	comphe at1	202 5	2	28	98408 1.1	1759.512	-	5404.24	3.891 47	638.5 8	233.48 8	206.68 33	0.0020 04	1043.6 7	233.48 8	11794.65	88881.65	2023
24	All	No	auxheat 1	202 5	3	31	29451 19	31443.31	-564041	- 4619.68	5.421 4	417.6 95	325.28 4	47.149 5	8.08E- 19	510.10 6	325.28 4	6918.802	668800.8	2023
49	All	No	compco ol1	202 5	3	31	29451 19	2109.612	-	6457.72	1.322 07	124.2 19	79.324 3	22.906 07	5.86E- 08	169.11 4	79.324 3	1322.468	35170.75	2023
74	All	Yes	auxheat 1	202 5	3	31	10029 24	0	0	0	0	47.879 76	0.0447 24	2.2637 2	189.94 89	615.168	14737.68	2023		
99	All	Yes	compco ol1	202 5	3	31	10029 24	0	0	0	0	72.860 6	0.2322 22	229.84 7	55.760 98	2949.882	26625.67	2023		
12 4	All	Yes	comphe at1	202 5	3	31	10029 24	3105.298	-	9537.74	6.086 73	612.4 65	365.20 4	126.15 61	1.2E-06	859.72 7	365.20 4	5577.182	47422.31	2023

LDV INPUTS (AS REPORTED IN APPENDIX D OF MONITORING REPORT VERSION 2.0)

```
-----
name: LDV_Regressions
log: F:\Projects\Ecobee\2025 CO2 Offsets\Modified Data\05 Output\LDV Regression Output
> .log
log type: text
opened on: 21 Apr 2025, 15:58:57
```

non_heat_pumps, compcool1

```
Linear regression
Number of obs      = 77596021
F(155, 61214)      = 3583.02
Prob > F            = 0.0000
R-squared           = 0.6840
Root MSE           = 7658.4
```

(Std. err. adjusted for 61,215 clusters in dsa_id)

		Robust				
compcool1	Coefficient	std. err.	t	P> t	[95% conf. interval]	
ym						
2021m4	-132.8972	18.42528	-7.21	0.000	-169.0108	-96.78356
2021m5	-790.7762	37.49363	-21.09	0.000	-864.2639	-717.2886
2021m6	-1914.867	72.63814	-26.36	0.000	-2057.238	-1772.497
2021m7	-4870.011	82.0966	-59.32	0.000	-5030.92	-4709.101
2021m8	-3825.658	85.6778	-44.65	0.000	-3993.587	-3657.729
2021m9	-2055.084	60.96012	-33.71	0.000	-2174.566	-1935.602
2021m10	-826.3664	32.0079	-25.82	0.000	-889.102	-763.6308

2021m11		-6.640075	17.25614	-0.38	0.700	-40.46216	27.18201
2021m12		-122.1458	18.14379	-6.73	0.000	-157.7077	-86.58392
2022m1		-198.4021	15.22321	-13.03	0.000	-228.2396	-168.5645
2022m2		-142.6856	13.95503	-10.22	0.000	-170.0376	-115.3337
2022m3		-69.66055	14.70685	-4.74	0.000	-98.48601	-40.83509
2022m4		-273.6317	22.33979	-12.25	0.000	-317.4177	-229.8456
2022m5		-979.3881	43.48417	-22.52	0.000	-1064.617	-894.159
2022m6		-2735.15	70.96034	-38.54	0.000	-2874.232	-2596.067
2022m7		-5375.716	90.46801	-59.42	0.000	-5553.034	-5198.399
2022m8		-3950.142	90.41243	-43.69	0.000	-4127.351	-3772.933
2022m9		-1882.355	63.55859	-29.62	0.000	-2006.93	-1757.78
2022m10		-646.7668	30.43297	-21.25	0.000	-706.4155	-587.1181
2022m11		-78.18518	17.3578	-4.50	0.000	-112.2065	-44.16384
2022m12		-241.6059	18.3738	-13.15	0.000	-277.6186	-205.5932
2023m1		-193.3014	18.92768	-10.21	0.000	-230.3997	-156.2031
2023m2		-136.6599	15.90473	-8.59	0.000	-167.8332	-105.4866
2023m3		-128.4145	15.74647	-8.16	0.000	-159.2776	-97.55138
2023m4		-84.28633	23.10832	-3.65	0.000	-129.5787	-38.99395
2023m5		-498.8167	42.26258	-11.80	0.000	-581.6514	-415.9819
2023m6		-2660.803	65.16749	-40.83	0.000	-2788.531	-2533.074
2023m7		-4807.947	92.74123	-51.84	0.000	-4989.72	-4626.174
2023m8		-3661.282	91.95733	-39.82	0.000	-3841.519	-3481.045
2023m9		-2064.925	64.1939	-32.17	0.000	-2190.746	-1939.105
2023m10		-677.8826	36.35288	-18.65	0.000	-749.1344	-606.6309
2023m11		-46.14308	19.30907	-2.39	0.017	-83.98892	-8.297248
2023m12		-128.5002	19.76885	-6.50	0.000	-167.2472	-89.75315
2024m1		-282.631	21.07953	-13.41	0.000	-323.9469	-241.315
2024m2		-95.73509	19.28147	-4.97	0.000	-133.5268	-57.94336
2024m3		17.44882	18.05775	0.97	0.334	-17.94443	52.84206
2024m4		78.493	27.87083	2.82	0.005	23.8661	133.1199
2024m5		-576.627	49.78958	-11.58	0.000	-674.2147	-479.0393
2024m6		-1648.403	82.32642	-20.02	0.000	-1809.763	-1487.043
2024m7		-3664.514	103.1378	-35.53	0.000	-3866.664	-3462.363
2024m8		-3307.55	94.49743	-35.00	0.000	-3492.765	-3122.335
2024m9		-1754.756	69.2812	-25.33	0.000	-1890.547	-1618.964
2024m10		-305.3059	40.63031	-7.51	0.000	-384.9414	-225.6703
2024m11		124.0919	22.80613	5.44	0.000	79.39188	168.792
2024m12		-184.9655	19.07657	-9.70	0.000	-222.3556	-147.5753
2025m1		-222.6742	16.45817	-13.53	0.000	-254.9322	-190.4161

2025m2		-162.1255	18.6182	-8.71	0.000	-198.6173	-125.6338
2025m3		74.60234	20.05545	3.72	0.000	35.2936	113.9111
ym#c.pre_compcool1							
2021m3		.517666	.0179817	28.79	0.000	.4824218	.5529101
2021m4		.4689912	.0092969	50.45	0.000	.4507693	.487213
2021m5		.3941146	.0040399	97.56	0.000	.3861964	.4020327
2021m6		.6464348	.0037837	170.85	0.000	.6390188	.6538509
2021m7		.6630951	.0031454	210.81	0.000	.6569301	.6692602
2021m8		.6932551	.0037332	185.70	0.000	.685938	.7005723
2021m9		.5568269	.0039532	140.85	0.000	.5490786	.5645752
2021m10		.4711939	.006173	76.33	0.000	.4590948	.483293
2021m11		.2773411	.0134907	20.56	0.000	.2508993	.3037828
2021m12		.599016	.0315533	18.98	0.000	.5371715	.6608606
2022m1		.4754091	.0383963	12.38	0.000	.4001522	.5506661
2022m2		.4422114	.0237093	18.65	0.000	.395741	.4886817
2022m3		.5537827	.0181348	30.54	0.000	.5182383	.589327
2022m4		.5154909	.0101646	50.71	0.000	.4955683	.5354135
2022m5		.5265189	.0044677	117.85	0.000	.5177621	.5352756
2022m6		.6814493	.0039633	171.94	0.000	.6736813	.6892173
2022m7		.7273495	.0035155	206.90	0.000	.7204591	.7342399
2022m8		.6686695	.0038539	173.50	0.000	.6611158	.6762232
2022m9		.5243951	.0039301	133.43	0.000	.5166921	.5320981
2022m10		.3778509	.0059345	63.67	0.000	.3662192	.3894826
2022m11		.4734299	.0150311	31.50	0.000	.4439689	.5028909
2022m12		.4723712	.0278821	16.94	0.000	.4177221	.5270202
2023m1		.56072	.0573982	9.77	0.000	.4482193	.6732207
2023m2		.6229131	.0316311	19.69	0.000	.560916	.6849102
2023m3		.5638941	.0208646	27.03	0.000	.5229994	.6047888
2023m4		.4444301	.0096548	46.03	0.000	.4255066	.4633536
2023m5		.3992244	.004193	95.21	0.000	.3910061	.4074427
2023m6		.5654632	.0038538	146.73	0.000	.5579097	.5730168
2023m7		.6794762	.0035901	189.26	0.000	.6724396	.6865128
2023m8		.6523478	.004002	163.01	0.000	.6445039	.6601918
2023m9		.5373083	.0042788	125.57	0.000	.5289218	.5456948
2023m10		.4261859	.0064808	65.76	0.000	.4134835	.4388883
2023m11		.3580671	.0145663	24.58	0.000	.329517	.3866171
2023m12		.3159748	.0246951	12.80	0.000	.2675724	.3643772
2024m1		.3820805	.0408556	9.35	0.000	.3020034	.4621577

2024m2		.318151	.0263419	12.08	0.000	.2665209	.3697811
2024m3		.5058252	.0195355	25.89	0.000	.4675356	.5441148
2024m4		.463943	.0097252	47.71	0.000	.4448815	.4830044
2024m5		.5032609	.0050719	99.22	0.000	.4933199	.5132019
2024m6		.6717013	.0044902	149.59	0.000	.6629005	.6805022
2024m7		.6532611	.0038108	171.42	0.000	.6457918	.6607303
2024m8		.6420458	.0042312	151.74	0.000	.6337526	.650339
2024m9		.4903946	.0043381	113.04	0.000	.4818919	.4988974
2024m10		.4546146	.0071866	63.26	0.000	.4405289	.4687003
2024m11		.4795598	.0156137	30.71	0.000	.4489568	.5101628
2024m12		.3926777	.0326503	12.03	0.000	.3286831	.4566724
2025m1		.2678916	.0344885	7.77	0.000	.2002942	.3354891
2025m2		.4952236	.027033	18.32	0.000	.4422388	.5482085
2025m3		.4706352	.0200933	23.42	0.000	.4312522	.5100182
ym#c.complier							
2021m3		-201.0662	19.31523	-10.41	0.000	-238.9241	-163.2083
2021m4		-288.415	28.70258	-10.05	0.000	-344.6721	-232.1578
2021m5		-464.7576	45.91098	-10.12	0.000	-554.7432	-374.7719
2021m6		-702.158	76.64472	-9.16	0.000	-852.3819	-551.9342
2021m7		-1681.583	78.3184	-21.47	0.000	-1835.087	-1528.079
2021m8		-1355.668	83.57442	-16.22	0.000	-1519.474	-1191.862
2021m9		-1084.442	64.41582	-16.84	0.000	-1210.697	-958.1866
2021m10		-409.796	36.24639	-11.31	0.000	-480.839	-338.753
2021m11		-241.2552	19.20834	-12.56	0.000	-278.9036	-203.6068
2021m12		-109.4937	18.52216	-5.91	0.000	-145.7971	-73.19016
2022m1		-85.69115	11.4743	-7.47	0.000	-108.1808	-63.20149
2022m2		-175.9749	12.35339	-14.25	0.000	-200.1876	-151.7622
2022m3		-198.6193	19.68058	-10.09	0.000	-237.1933	-160.0453
2022m4		-232.9756	30.10746	-7.74	0.000	-291.9863	-173.9649
2022m5		-379.3317	51.60146	-7.35	0.000	-480.4707	-278.1927
2022m6		-341.8833	74.80111	-4.57	0.000	-488.4937	-195.2729
2022m7		-1279.485	86.65113	-14.77	0.000	-1449.321	-1109.648
2022m8		-1274.598	86.56254	-14.72	0.000	-1444.26	-1104.935
2022m9		-676.9837	65.74258	-10.30	0.000	-805.8393	-548.128
2022m10		-184.0085	33.20849	-5.54	0.000	-249.0973	-118.9198
2022m11		-139.231	18.1731	-7.66	0.000	-174.8504	-103.6117
2022m12		-50.62799	14.05161	-3.60	0.000	-78.16917	-23.0868
2023m1		-87.69555	15.24268	-5.75	0.000	-117.5712	-57.81986

2023m2		-87.85051	15.72182	-5.59	0.000	-118.6653	-57.0357
2023m3		-149.1082	19.63717	-7.59	0.000	-187.5971	-110.6193
2023m4		-254.3324	29.6377	-8.58	0.000	-312.4224	-196.2424
2023m5		-494.4952	50.29429	-9.83	0.000	-593.0722	-395.9183
2023m6		-280.2067	69.96056	-4.01	0.000	-417.3296	-143.0838
2023m7		-1226.181	88.70696	-13.82	0.000	-1400.047	-1052.315
2023m8		-1234.907	88.73202	-13.92	0.000	-1408.822	-1060.992
2023m9		-567.627	66.83993	-8.49	0.000	-698.6334	-436.6205
2023m10		-186.8523	38.04664	-4.91	0.000	-261.4239	-112.2808
2023m11		-138.6552	19.43024	-7.14	0.000	-176.7385	-100.5718
2023m12		-29.16018	13.9314	-2.09	0.036	-56.46576	-1.854598
2024m1		-51.3783	13.35979	-3.85	0.000	-77.56352	-25.19308
2024m2		-65.44306	16.25519	-4.03	0.000	-97.30328	-33.58283
2024m3		-118.3714	21.31978	-5.55	0.000	-160.1582	-76.58454
2024m4		-202.5645	34.80277	-5.82	0.000	-270.778	-134.351
2024m5		-440.88	59.1681	-7.45	0.000	-556.8497	-324.9104
2024m6		-573.8384	87.01768	-6.59	0.000	-744.3933	-403.2835
2024m7		-1592.767	97.74959	-16.29	0.000	-1784.356	-1401.177
2024m8		-983.7694	92.90702	-10.59	0.000	-1165.867	-801.6714
2024m9		-595.2807	71.94244	-8.27	0.000	-736.2881	-454.2734
2024m10		-220.614	44.9965	-4.90	0.000	-308.8073	-132.4208
2024m11		-111.5301	24.35861	-4.58	0.000	-159.2731	-63.78719
2024m12		-14.07914	14.72873	-0.96	0.339	-42.94748	14.7892
2025m1		-23.12501	9.709621	-2.38	0.017	-42.1559	-4.094128
2025m2		-96.10035	15.03796	-6.39	0.000	-125.5748	-66.62592
2025m3		-113.7139	22.7875	-4.99	0.000	-158.3774	-69.05031
dow							
Monday		-89.67867	4.116166	-21.79	0.000	-97.74637	-81.61097
Tuesday		-166.5602	4.604691	-36.17	0.000	-175.5854	-157.535
Wednesday		-189.1871	4.612945	-41.01	0.000	-198.2285	-180.1457
Thursday		-156.361	4.436704	-35.24	0.000	-165.0569	-147.665
Friday		-189.5316	4.046047	-46.84	0.000	-197.4619	-181.6013
Saturday		-141.6059	2.629816	-53.85	0.000	-146.7603	-136.4514
outdoor_humidity		13.8088	.8018109	17.22	0.000	12.23725	15.38035
cdd60		799.7521	3.712434	215.43	0.000	792.4757	807.0284
hdd60		17.85091	.5664374	31.51	0.000	16.74069	18.96113
_cons		-1050.544	48.25296	-21.77	0.000	-1145.12	-955.9677

```

-----
name: LDV_Regressions
log: F:\Projects\Ecobee\2025 CO2 Offsets\Modified Data\05 Output\LDV Regression Output
> .log
log type: text
resumed on: 21 Apr 2025, 16:12:38
non_heat_pumps, auxheat1

```

```

Linear regression
Number of obs      = 77596021
F(155, 61214)      = 2779.15
Prob > F            = 0.0000
R-squared           = 0.6656
Root MSE           = 5506.2

```

(Std. err. adjusted for 61,215 clusters in dsa_id)

		Robust				
auxheat1	Coefficient	std. err.	t	P> t	[95% conf. interval]	
ym						
2021m4	642.6007	31.02634	20.71	0.000	581.789	703.4124
2021m5	1146.444	47.06771	24.36	0.000	1054.191	1238.697
2021m6	1414.089	46.96023	30.11	0.000	1322.047	1506.131
2021m7	1479.572	44.23125	33.45	0.000	1392.878	1566.265
2021m8	1496.514	45.23888	33.08	0.000	1407.846	1585.182
2021m9	1434.783	50.69157	28.30	0.000	1335.428	1534.139
2021m10	1235.827	44.68316	27.66	0.000	1148.248	1323.406
2021m11	-119.4448	50.88739	-2.35	0.019	-219.1842	-19.70536
2021m12	-425.6241	62.43398	-6.82	0.000	-547.9949	-303.2534
2022m1	-1223.914	68.30634	-17.92	0.000	-1357.795	-1090.034
2022m2	-807.9486	66.16847	-12.21	0.000	-937.6389	-678.2582
2022m3	-327.6188	42.41489	-7.72	0.000	-410.7521	-244.4855
2022m4	545.1602	42.40958	12.85	0.000	462.0373	628.2831
2022m5	1301.88	53.73089	24.23	0.000	1196.567	1407.192
2022m6	1373.47	47.05386	29.19	0.000	1281.244	1465.695
2022m7	1430.811	44.7475	31.98	0.000	1343.105	1518.516
2022m8	1479.11	45.26376	32.68	0.000	1390.393	1567.827
2022m9	1381.904	50.15434	27.55	0.000	1283.601	1480.206

2022m10		1051.777	44.69555	23.53	0.000	964.1738	1139.381
2022m11		847.818	54.33422	15.60	0.000	741.3228	954.3132
2022m12		-195.2178	71.81578	-2.72	0.007	-335.9769	-54.45863
2023m1		358.4576	64.79233	5.53	0.000	231.4645	485.4508
2023m2		-18.31886	63.46799	-0.29	0.773	-142.7163	106.0786
2023m3		172.0217	49.98413	3.44	0.001	74.05264	269.9907
2023m4		768.6286	42.27175	18.18	0.000	685.7758	851.4813
2023m5		1338.961	45.82074	29.22	0.000	1249.152	1428.769
2023m6		1449.407	45.3685	31.95	0.000	1360.484	1538.329
2023m7		1441.591	44.07993	32.70	0.000	1355.194	1527.988
2023m8		1476.517	45.00476	32.81	0.000	1388.307	1564.726
2023m9		1510.78	51.7479	29.20	0.000	1409.354	1612.206
2023m10		1132.687	46.01223	24.62	0.000	1042.503	1222.871
2023m11		110.3273	54.38896	2.03	0.043	3.724789	216.9298
2023m12		-215.2367	67.41793	-3.19	0.001	-347.376	-83.09739
2024m1		-41.61948	75.58481	-0.55	0.582	-189.7659	106.5269
2024m2		-123.0979	66.72077	-1.84	0.065	-253.8707	7.675031
2024m3		125.3601	49.861	2.51	0.012	27.63242	223.0878
2024m4		951.1654	43.15604	22.04	0.000	866.5794	1035.751
2024m5		1356.292	45.35225	29.91	0.000	1267.401	1445.183
2024m6		1444.638	43.77479	33.00	0.000	1358.84	1530.437
2024m7		1479.087	43.4188	34.07	0.000	1393.986	1564.188
2024m8		1510.771	43.44349	34.78	0.000	1425.621	1595.92
2024m9		1514.233	43.63146	34.71	0.000	1428.715	1599.75
2024m10		1118.349	45.37983	24.64	0.000	1029.404	1207.293
2024m11		519.2551	58.12801	8.93	0.000	405.3241	633.1862
2024m12		-673.3707	79.82855	-8.44	0.000	-829.8349	-516.9065
2025m1		-423.9426	88.4628	-4.79	0.000	-597.33	-250.5553
2025m2		-657.7495	77.63278	-8.47	0.000	-809.91	-505.589
2025m3		57.42737	54.78098	1.05	0.295	-49.94351	164.7982
ym#c.pre_auxheat1							
2021m3		.4477263	.0042493	105.36	0.000	.4393975	.456055
2021m4		.4043418	.0060663	66.65	0.000	.3924518	.4162318
2021m5		.51214	.0250227	20.47	0.000	.4630955	.5611845
2021m6		.4774438	.0948812	5.03	0.000	.2914764	.6634112
2021m7		.6884512	.112105	6.14	0.000	.4687251	.9081773
2021m8		.5676992	.1639377	3.46	0.001	.2463808	.8890176
2021m9		.3399713	.0972985	3.49	0.000	.1492659	.5306767

2021m10		.2790891	.0074068	37.68	0.000	.2645718	.2936064
2021m11		.4750036	.004774	99.50	0.000	.4656465	.4843608
2021m12		.5272811	.0052295	100.83	0.000	.5170312	.5375309
2022m1		.6169523	.0045533	135.50	0.000	.6080278	.6258768
2022m2		.7807511	.0064694	120.68	0.000	.768071	.7934312
2022m3		.5094293	.0047568	107.10	0.000	.500106	.5187526
2022m4		.5551462	.0072618	76.45	0.000	.540913	.5693794
2022m5		.501219	.0329177	15.23	0.000	.4367003	.5657377
2022m6		.6360261	.0915594	6.95	0.000	.4565695	.8154827
2022m7		.6566995	.1307598	5.02	0.000	.40041	.912989
2022m8		.5424085	.1775382	3.06	0.002	.1944332	.8903838
2022m9		.3430189	.0938315	3.66	0.000	.1591088	.526929
2022m10		.376893	.0085219	44.23	0.000	.36019	.3935961
2022m11		.4168364	.0046917	88.85	0.000	.4076407	.4260321
2022m12		.6302317	.0057048	110.47	0.000	.6190502	.6414132
2023m1		.4405439	.0039383	111.86	0.000	.4328249	.4482628
2023m2		.6595752	.00595	110.85	0.000	.6479131	.6712372
2023m3		.5065544	.0050292	100.72	0.000	.4966972	.5164116
2023m4		.3659067	.0054053	67.69	0.000	.3553123	.3765011
2023m5		.396695	.0210702	18.83	0.000	.3553973	.4379927
2023m6		.5771122	.0858984	6.72	0.000	.4087511	.7454733
2023m7		.6990578	.119025	5.87	0.000	.4657684	.9323472
2023m8		.5586649	.1674697	3.34	0.001	.2304237	.886906
2023m9		.3967361	.1069784	3.71	0.000	.187058	.6064141
2023m10		.3321933	.0080485	41.27	0.000	.3164182	.3479683
2023m11		.398072	.0046198	86.17	0.000	.3890172	.4071268
2023m12		.4674834	.0051916	90.05	0.000	.4573079	.4776589
2024m1		.5229842	.0044799	116.74	0.000	.5142036	.5317647
2024m2		.571345	.0058645	97.42	0.000	.5598505	.5828394
2024m3		.4184134	.0046304	90.36	0.000	.4093378	.427489
2024m4		.3619171	.0059713	60.61	0.000	.3502134	.3736208
2024m5		.3257489	.0186043	17.51	0.000	.2892844	.3622134
2024m6		.3016221	.0712884	4.23	0.000	.1618967	.4413476
2024m7		.3752718	.1425196	2.63	0.008	.095933	.6546106
2024m8		.2507725	.1177076	2.13	0.033	.0200652	.4814798
2024m9		.155294	.0313161	4.96	0.000	.0939143	.2166737
2024m10		.2461098	.0067421	36.50	0.000	.2328953	.2593243
2024m11		.3446681	.0045997	74.93	0.000	.3356526	.3536836
2024m12		.5630242	.0060104	93.68	0.000	.5512439	.5748046

2025m1		.5977996	.004975	120.16	0.000	.5880487	.6075505
2025m2		.6941493	.0066807	103.90	0.000	.6810552	.7072434
2025m3		.3946154	.0047513	83.05	0.000	.3853029	.403928
ym#c.complier							
2021m3		-513.2404	40.216	-12.76	0.000	-592.0639	-434.417
2021m4		-296.4072	27.69661	-10.70	0.000	-350.6926	-242.1218
2021m5		-46.22068	16.54034	-2.79	0.005	-78.6398	-13.80156
2021m6		26.86594	7.799392	3.44	0.001	11.57911	42.15277
2021m7		35.59244	7.685025	4.63	0.000	20.52977	50.65511
2021m8		18.7935	7.882696	2.38	0.017	3.343394	34.24361
2021m9		-2.27846	9.651876	-0.24	0.813	-21.19616	16.63924
2021m10		-222.4671	21.43948	-10.38	0.000	-264.4885	-180.4457
2021m11		-484.362	45.37614	-10.67	0.000	-573.2994	-395.4247
2021m12		-627.1546	54.66709	-11.47	0.000	-734.3022	-520.0069
2022m1		-716.5396	68.25768	-10.50	0.000	-850.3248	-582.7544
2022m2		-232.3486	63.04355	-3.69	0.000	-355.9141	-108.7831
2022m3		-300.2326	42.6865	-7.03	0.000	-383.8983	-216.5669
2022m4		-342.0249	33.203	-10.30	0.000	-407.1028	-276.9469
2022m5		-122.2567	17.08893	-7.15	0.000	-155.751	-88.76232
2022m6		-14.96848	12.1387	-1.23	0.218	-38.76036	8.823392
2022m7		-1.839512	9.123149	-0.20	0.840	-19.72091	16.04189
2022m8		23.07007	7.70215	3.00	0.003	7.973837	38.16631
2022m9		-4.012653	9.740204	-0.41	0.680	-23.10348	15.07817
2022m10		-207.5388	25.68602	-8.08	0.000	-257.8835	-157.1941
2022m11		-686.347	49.22487	-13.94	0.000	-782.8279	-589.8661
2022m12		-605.8028	62.76722	-9.65	0.000	-728.8267	-482.7789
2023m1		-908.7181	61.91589	-14.68	0.000	-1030.073	-787.3628
2023m2		-631.5306	59.48034	-10.62	0.000	-748.1122	-514.9489
2023m3		-638.0459	50.64363	-12.60	0.000	-737.3076	-538.7843
2023m4		-311.032	29.45151	-10.56	0.000	-368.7571	-253.307
2023m5		-119.5451	15.56444	-7.68	0.000	-150.0515	-89.03879
2023m6		-25.27556	9.851216	-2.57	0.010	-44.58397	-5.967152
2023m7		21.03001	6.015186	3.50	0.000	9.24023	32.81979
2023m8		14.93659	6.966018	2.14	0.032	1.283175	28.59001
2023m9		-18.14151	11.37456	-1.59	0.111	-40.43569	4.152665
2023m10		-215.7625	24.52359	-8.80	0.000	-263.8288	-167.6962
2023m11		-483.9454	46.47019	-10.41	0.000	-575.0271	-392.8637
2023m12		-553.1027	54.32711	-10.18	0.000	-659.584	-446.6214

2024m1		-677.1744	70.13173	-9.66	0.000	-814.6328	-539.716
2024m2		-528.2169	57.6936	-9.16	0.000	-641.2965	-415.1373
2024m3		-474.2989	45.06833	-10.52	0.000	-562.633	-385.9649
2024m4		-327.303	30.61019	-10.69	0.000	-387.2991	-267.307
2024m5		-107.8567	16.0558	-6.72	0.000	-139.3261	-76.38731
2024m6		10.14879	9.635647	1.05	0.292	-8.737101	29.03469
2024m7		26.18147	7.388355	3.54	0.000	11.70027	40.66266
2024m8		1.472532	7.326118	0.20	0.841	-12.88668	15.83174
2024m9		-36.54303	9.097599	-4.02	0.000	-54.37435	-18.71171
2024m10		-189.5702	24.24696	-7.82	0.000	-237.0943	-142.0461
2024m11		-539.3523	49.26241	-10.95	0.000	-635.9067	-442.7978
2024m12		-489.6878	65.3371	-7.49	0.000	-617.7487	-361.627
2025m1		-814.6945	82.51196	-9.87	0.000	-976.4181	-652.9708
2025m2		-476.4789	68.90197	-6.92	0.000	-611.5269	-341.4308
2025m3		-418.4467	47.1225	-8.88	0.000	-510.807	-326.0865
dow							
Monday		10.17065	2.40057	4.24	0.000	5.465525	14.87577
Tuesday		-61.50397	2.39142	-25.72	0.000	-66.19116	-56.81678
Wednesday		-39.95528	2.457941	-16.26	0.000	-44.77285	-35.13771
Thursday		-31.85623	2.481348	-12.84	0.000	-36.71968	-26.99278
Friday		-17.32219	2.356125	-7.35	0.000	-21.9402	-12.70418
Saturday		56.41745	1.664901	33.89	0.000	53.15424	59.68066
outdoor_humidity		-15.10642	.3189555	-47.36	0.000	-15.73157	-14.48126
cdd60		.6187115	.7397674	0.84	0.403	-.8312347	2.068658
hdd60		406.1258	1.746766	232.50	0.000	402.7022	409.5495
_cons		-467.2473	47.92554	-9.75	0.000	-561.1815	-373.3131

```

-----
name: LDV_Regressions
log: F:\Projects\Ecobee\2025 CO2 Offsets\Modified Data\05 Output\LDV Regression Output
> .log
log type: text
resumed on: 21 Apr 2025, 16:26:30
heat_pumps, compcool1

Linear regression                                Number of obs    =    29486071
                                                F(155, 23685)   =     1905.35

```

```

Prob > F      = 0.0000
R-squared     = 0.6822
Root MSE     = 8959.3

```

(Std. err. adjusted for 23,686 clusters in dsa_id)

compcool1	Coefficient	Robust std. err.	t	P> t	[95% conf. interval]	
ym						
2021m4	-205.5882	60.67091	-3.39	0.001	-324.5071	-86.66932
2021m5	-2457.244	114.566	-21.45	0.000	-2681.8	-2232.687
2021m6	-2577.187	181.9747	-14.16	0.000	-2933.869	-2220.505
2021m7	-4875.539	212.2751	-22.97	0.000	-5291.612	-4459.466
2021m8	-3204.395	215.5903	-14.86	0.000	-3626.965	-2781.824
2021m9	-2269.838	157.4915	-14.41	0.000	-2578.532	-1961.145
2021m10	-1587.148	102.9909	-15.41	0.000	-1789.016	-1385.279
2021m11	-258.9241	68.04205	-3.81	0.000	-392.2908	-125.5573
2021m12	-455.7499	74.12147	-6.15	0.000	-601.0327	-310.4671
2022m1	-332.4508	63.33098	-5.25	0.000	-456.5835	-208.318
2022m2	-368.2777	58.52216	-6.29	0.000	-482.9849	-253.5705
2022m3	-181.5141	59.95309	-3.03	0.002	-299.026	-64.00216
2022m4	-279.3006	80.09186	-3.49	0.000	-436.2858	-122.3154
2022m5	-2520.36	134.1654	-18.79	0.000	-2783.333	-2257.388
2022m6	-3238.66	187.9436	-17.23	0.000	-3607.041	-2870.278
2022m7	-4439.138	236.676	-18.76	0.000	-4903.038	-3975.238
2022m8	-2464.37	230.5932	-10.69	0.000	-2916.347	-2012.392
2022m9	-1483.855	174.4296	-8.51	0.000	-1825.748	-1141.962
2022m10	-1188.609	96.37439	-12.33	0.000	-1377.509	-999.7091
2022m11	-170.2539	72.9393	-2.33	0.020	-313.2196	-27.28816
2022m12	-545.9467	62.41868	-8.75	0.000	-668.2914	-423.6021
2023m1	-446.5595	64.18212	-6.96	0.000	-572.3605	-320.7584
2023m2	-299.5296	61.88841	-4.84	0.000	-420.8348	-178.2243
2023m3	-51.87037	65.79279	-0.79	0.430	-180.8285	77.08772
2023m4	-18.22794	88.31627	-0.21	0.836	-191.3335	154.8776
2023m5	-1625.275	134.1825	-12.11	0.000	-1888.281	-1362.268
2023m6	-3145.204	185.3702	-16.97	0.000	-3508.542	-2781.867
2023m7	-3496.414	246.9959	-14.16	0.000	-3980.542	-3012.287
2023m8	-2272.389	242.2074	-9.38	0.000	-2747.131	-1797.647

2023m9		-1615.351	179.6621	-8.99	0.000	-1967.5	-1263.202
2023m10		-1002.494	109.4121	-9.16	0.000	-1216.949	-788.0391
2023m11		-245.1966	71.10485	-3.45	0.001	-384.5667	-105.8265
2023m12		-459.9819	67.18673	-6.85	0.000	-591.6722	-328.2916
2024m1		-638.2623	67.3122	-9.48	0.000	-770.1986	-506.3261
2024m2		-274.1733	65.55989	-4.18	0.000	-402.6749	-145.6718
2024m3		47.40109	74.20515	0.64	0.523	-98.04577	192.8479
2024m4		240.5575	101.9547	2.36	0.018	40.71988	440.3952
2024m5		-1692.051	169.6669	-9.97	0.000	-2024.609	-1359.493
2024m6		-1482.162	221.7898	-6.68	0.000	-1916.884	-1047.44
2024m7		-2052.089	268.9228	-7.63	0.000	-2579.195	-1524.983
2024m8		-2067.536	251.9429	-8.21	0.000	-2561.36	-1573.711
2024m9		-1854.188	192.0871	-9.65	0.000	-2230.691	-1477.685
2024m10		-259.3574	127.6644	-2.03	0.042	-509.5879	-9.126936
2024m11		205.5811	88.23628	2.33	0.020	32.63228	378.5298
2024m12		-462.1816	70.40051	-6.57	0.000	-600.1712	-324.1921
2025m1		-369.9577	65.19741	-5.67	0.000	-497.7488	-242.1666
2025m2		-333.879	70.62406	-4.73	0.000	-472.3067	-195.4513
2025m3		298.6079	77.81427	3.84	0.000	146.0869	451.1288
ym#c.pre_compcool1							
2021m3		.6334431	.0247946	25.55	0.000	.5848441	.6820421
2021m4		.4987483	.0088551	56.32	0.000	.4813917	.5161048
2021m5		.5059103	.0051509	98.22	0.000	.4958143	.5160063
2021m6		.615916	.0055193	111.59	0.000	.6050977	.6267343
2021m7		.667151	.0058197	114.64	0.000	.6557439	.678558
2021m8		.6531783	.006637	98.41	0.000	.6401693	.6661873
2021m9		.5063167	.0055713	90.88	0.000	.4953966	.5172369
2021m10		.4946383	.006942	71.25	0.000	.4810316	.5082451
2021m11		.2482158	.0127933	19.40	0.000	.2231401	.2732915
2021m12		.6567833	.0431349	15.23	0.000	.5722361	.7413305
2022m1		.4333679	.0432392	10.02	0.000	.3486162	.5181195
2022m2		.41496	.0211278	19.64	0.000	.3735482	.4563719
2022m3		.6236979	.0248916	25.06	0.000	.5749088	.6724871
2022m4		.5485512	.0096814	56.66	0.000	.5295749	.5675275
2022m5		.59759	.0060784	98.31	0.000	.585676	.609504
2022m6		.6873386	.0063261	108.65	0.000	.674939	.6997382
2022m7		.7100425	.0067562	105.10	0.000	.6968	.723285
2022m8		.6102889	.0068151	89.55	0.000	.5969309	.6236469

2022m9		.4700222	.0057176	82.21	0.000	.4588154	.481229
2022m10		.375138	.0064131	58.50	0.000	.362568	.3877081
2022m11		.4317299	.0131363	32.87	0.000	.4059818	.457478
2022m12		.4663958	.0247045	18.88	0.000	.4179734	.5148182
2023m1		.4781712	.0413055	11.58	0.000	.3972098	.5591326
2023m2		.5857442	.0238361	24.57	0.000	.5390238	.6324646
2023m3		.6879247	.0292675	23.50	0.000	.6305585	.7452908
2023m4		.5310107	.0101606	52.26	0.000	.5110954	.5509261
2023m5		.4575702	.0058864	77.73	0.000	.4460324	.4691079
2023m6		.5753869	.0061256	93.93	0.000	.5633803	.5873935
2023m7		.6681587	.0069846	95.66	0.000	.6544684	.681849
2023m8		.6393267	.0075125	85.10	0.000	.6246017	.6540516
2023m9		.4944782	.0063	78.49	0.000	.4821299	.5068266
2023m10		.4039775	.0070917	56.96	0.000	.3900773	.4178777
2023m11		.3261838	.0116803	27.93	0.000	.3032897	.349078
2023m12		.3631326	.0233482	15.55	0.000	.3173686	.4088965
2024m1		.2969445	.0408374	7.27	0.000	.2169005	.3769885
2024m2		.2857574	.0185293	15.42	0.000	.2494388	.322076
2024m3		.5800961	.0287422	20.18	0.000	.5237595	.6364327
2024m4		.4926636	.0108828	45.27	0.000	.4713326	.5139945
2024m5		.5826861	.0071574	81.41	0.000	.568657	.5967151
2024m6		.6555237	.0068783	95.30	0.000	.6420417	.6690057
2024m7		.6392921	.0073478	87.01	0.000	.62489	.6536941
2024m8		.6138967	.0075935	80.84	0.000	.5990129	.6287804
2024m9		.4651854	.0065049	71.51	0.000	.4524354	.4779354
2024m10		.4204544	.0083577	50.31	0.000	.4040728	.4368361
2024m11		.5018446	.0158591	31.64	0.000	.4707598	.5329294
2024m12		.3762639	.0337111	11.16	0.000	.310188	.4423398
2025m1		.2193393	.035371	6.20	0.000	.1500098	.2886688
2025m2		.4839201	.0247022	19.59	0.000	.4355022	.5323379
2025m3		.5119539	.0287834	17.79	0.000	.4555365	.5683713
ym#c.complier							
2021m3		-309.0682	57.87652	-5.34	0.000	-422.5099	-195.6265
2021m4		-621.6076	81.56676	-7.62	0.000	-781.4837	-461.7316
2021m5		-736.0003	113.8709	-6.46	0.000	-959.1946	-512.8059
2021m6		-1591.452	158.2931	-10.05	0.000	-1901.716	-1281.187
2021m7		-1871.048	167.9696	-11.14	0.000	-2200.279	-1541.816
2021m8		-1540.218	173.7666	-8.86	0.000	-1880.811	-1199.624

2021m9		-891.1311	144.3673	-6.17	0.000	-1174.1	-608.1619
2021m10		-346.7674	98.43696	-3.52	0.000	-539.7102	-153.8247
2021m11		-82.82883	48.24059	-1.72	0.086	-177.3835	11.72581
2021m12		11.2769	54.17744	0.21	0.835	-94.91435	117.4682
2022m1		77.45864	33.16561	2.34	0.020	12.45192	142.4654
2022m2		41.35366	38.51045	1.07	0.283	-34.1293	116.8366
2022m3		-178.8128	58.76453	-3.04	0.002	-293.995	-63.6305
2022m4		-418.681	85.75156	-4.88	0.000	-586.7596	-250.6025
2022m5		-398.659	129.2933	-3.08	0.002	-652.0822	-145.2358
2022m6		-767.8212	168.3075	-4.56	0.000	-1097.715	-437.9277
2022m7		-1208.715	187.0793	-6.46	0.000	-1575.403	-842.0279
2022m8		-1103.501	184.6983	-5.97	0.000	-1465.521	-741.4803
2022m9		-728.4353	155.8029	-4.68	0.000	-1033.819	-423.0517
2022m10		42.39543	87.98051	0.48	0.630	-130.052	214.8429
2022m11		-24.39045	62.22551	-0.39	0.695	-146.3564	97.57554
2022m12		19.32703	38.10921	0.51	0.612	-55.36946	94.02352
2023m1		26.97678	41.06006	0.66	0.511	-53.50356	107.4571
2023m2		-53.05829	53.24828	-1.00	0.319	-157.4283	51.31176
2023m3		-174.7358	63.6396	-2.75	0.006	-299.4735	-49.99812
2023m4		-644.7569	91.16047	-7.07	0.000	-823.4373	-466.0765
2023m5		-556.971	127.1074	-4.38	0.000	-806.1096	-307.8324
2023m6		-880.3507	162.0261	-5.43	0.000	-1197.932	-562.7691
2023m7		-1240.459	197.5722	-6.28	0.000	-1627.713	-853.2052
2023m8		-884.3299	200.5858	-4.41	0.000	-1277.491	-491.1689
2023m9		-598.1226	161.6758	-3.70	0.000	-915.0177	-281.2276
2023m10		-53.37869	101.2349	-0.53	0.598	-251.8055	145.0481
2023m11		10.02927	58.06797	0.17	0.863	-103.7877	123.8462
2023m12		59.29286	42.24464	1.40	0.160	-23.50935	142.0951
2024m1		43.92083	38.46838	1.14	0.254	-31.47966	119.3213
2024m2		-10.28821	44.58663	-0.23	0.818	-97.68087	77.10445
2024m3		-208.8782	73.50817	-2.84	0.004	-352.959	-64.79752
2024m4		-487.5851	103.8488	-4.70	0.000	-691.1354	-284.0347
2024m5		-595.3225	161.2165	-3.69	0.000	-911.3172	-279.3279
2024m6		-755.9407	201.5392	-3.75	0.000	-1150.971	-360.9109
2024m7		-1480.878	220.0022	-6.73	0.000	-1912.096	-1049.659
2024m8		-616.1976	213.5776	-2.89	0.004	-1034.823	-197.5718
2024m9		-675.2099	173.3376	-3.90	0.000	-1014.963	-335.457
2024m10		-250.3683	119.7949	-2.09	0.037	-485.174	-15.56257
2024m11		84.81797	81.05872	1.05	0.295	-74.06231	243.6983

2024m12		108.7338	50.67869	2.15	0.032	9.400328	208.0673
2025m1		121.63	33.26643	3.66	0.000	56.4257	186.8344
2025m2		5.07526	56.78086	0.09	0.929	-106.2189	116.3694
2025m3		-76.59571	72.44436	-1.06	0.290	-218.5913	65.39989
dow							
Monday		-142.8418	8.781706	-16.27	0.000	-160.0545	-125.6291
Tuesday		-304.3789	9.642854	-31.57	0.000	-323.2796	-285.4783
Wednesday		-399.7806	9.798838	-40.80	0.000	-418.9869	-380.5742
Thursday		-342.0589	9.335521	-36.64	0.000	-360.3571	-323.7607
Friday		-326.7764	8.336333	-39.20	0.000	-343.1162	-310.4367
Saturday		-185.7721	4.841531	-38.37	0.000	-195.2618	-176.2824
outdoor_humidity		36.52268	1.440239	25.36	0.000	33.69972	39.34564
cdd60		773.9793	5.431435	142.50	0.000	763.3333	784.6252
hdd60		23.30178	1.308716	17.81	0.000	20.73662	25.86695
_cons		-2362.137	104.3056	-22.65	0.000	-2566.582	-2157.691

```

-----
name: LDV_Regressions
log: F:\Projects\Ecobee\2025 CO2 Offsets\Modified Data\05 Output\LDV Regression Output
> .log
log type: text
resumed on: 21 Apr 2025, 16:33:00
heat_pumps, auxheat1

```

```

Linear regression
Number of obs      = 29486071
F(155, 23685)      = 2235.48
Prob > F            = 0.0000
R-squared           = 0.2819
Root MSE            = 3570.8

```

(Std. err. adjusted for 23,686 clusters in dsa_id)

			Robust				
auxheat1		Coefficient	std. err.	t	P> t	[95% conf. interval]	
ym							
2021m4		485.6166	28.93156	16.79	0.000	428.9089	542.3244

2021m5		658.5056	37.76084	17.44	0.000	584.4919	732.5193
2021m6		556.3564	39.55802	14.06	0.000	478.8201	633.8926
2021m7		503.0208	39.40673	12.76	0.000	425.7811	580.2606
2021m8		501.2009	39.38099	12.73	0.000	424.0117	578.3902
2021m9		647.2531	39.48639	16.39	0.000	569.8572	724.6489
2021m10		639.3074	37.44363	17.07	0.000	565.9155	712.6994
2021m11		-147.1106	43.941	-3.35	0.001	-233.2378	-60.98346
2021m12		-104.2702	50.68534	-2.06	0.040	-203.6167	-4.923687
2022m1		-500.7524	93.62136	-5.35	0.000	-684.2563	-317.2486
2022m2		-108.3081	76.94509	-1.41	0.159	-259.1254	42.50922
2022m3		79.81809	40.83261	1.95	0.051	-.2164387	159.8526
2022m4		419.2916	37.68363	11.13	0.000	345.4293	493.1539
2022m5		633.7613	38.51117	16.46	0.000	558.2769	709.2456
2022m6		532.1575	39.57012	13.45	0.000	454.5975	609.7175
2022m7		441.5472	39.38703	11.21	0.000	364.3461	518.7483
2022m8		505.3753	39.42107	12.82	0.000	428.1075	582.6431
2022m9		627.5035	39.66059	15.82	0.000	549.7661	705.2408
2022m10		550.1383	37.89657	14.52	0.000	475.8586	624.418
2022m11		86.63873	51.17887	1.69	0.090	-13.67515	186.9526
2022m12		489.3201	74.24676	6.59	0.000	343.7917	634.8485
2023m1		-491.7774	62.8113	-7.83	0.000	-614.8916	-368.6632
2023m2		-81.97037	61.66956	-1.33	0.184	-202.8467	38.90593
2023m3		-139.6212	48.10648	-2.90	0.004	-233.9129	-45.32936
2023m4		476.5334	37.26488	12.79	0.000	403.4918	549.575
2023m5		693.5003	39.35995	17.62	0.000	616.3523	770.6484
2023m6		626.6286	39.78697	15.75	0.000	548.6436	704.6136
2023m7		450.5639	39.50425	11.41	0.000	373.1331	527.9948
2023m8		478.409	39.63601	12.07	0.000	400.7199	556.0981
2023m9		643.0692	39.8365	16.14	0.000	564.9871	721.1513
2023m10		625.5829	39.53441	15.82	0.000	548.0929	703.0729
2023m11		-8.933232	50.00059	-0.18	0.858	-106.9376	89.07114
2023m12		-325.4035	62.05137	-5.24	0.000	-447.0282	-203.7788
2024m1		230.8245	92.575	2.49	0.013	49.37156	412.2775
2024m2		-299.2701	64.26033	-4.66	0.000	-425.2244	-173.3157
2024m3		145.0092	45.21272	3.21	0.001	56.38936	233.629
2024m4		514.0764	41.28785	12.45	0.000	433.1495	595.0032
2024m5		647.0854	41.35226	15.65	0.000	566.0323	728.1384
2024m6		532.162	39.81655	13.37	0.000	454.119	610.205
2024m7		470.6539	39.47442	11.92	0.000	393.2815	548.0263

2024m8		526.0897	41.31967	12.73	0.000	445.1005	607.0789
2024m9		674.4719	41.61861	16.21	0.000	592.8967	756.047
2024m10		609.8438	40.25365	15.15	0.000	530.9441	688.7435
2024m11		189.4036	52.10996	3.63	0.000	87.26469	291.5424
2024m12		-253.4611	83.51503	-3.03	0.002	-417.1559	-89.76625
2025m1		-5.006427	131.8579	-0.04	0.970	-263.4564	253.4436
2025m2		84.09956	94.76105	0.89	0.375	-101.6382	269.8373
2025m3		136.6029	50.4401	2.71	0.007	37.73711	235.4688
ym#c.pre_auxheat1							
2021m3		.3541314	.0143935	24.60	0.000	.3259193	.3823436
2021m4		.3457452	.0247707	13.96	0.000	.297193	.3942974
2021m5		.6130402	.0840689	7.29	0.000	.4482597	.7778207
2021m6		.7205895	.1526165	4.72	0.000	.4214513	1.019728
2021m7		.7303459	.0517258	14.12	0.000	.62896	.8317319
2021m8		.6730784	.035606	18.90	0.000	.6032883	.7428684
2021m9		.3606336	.1162642	3.10	0.002	.1327483	.5885189
2021m10		.1775551	.0183145	9.69	0.000	.1416575	.2134526
2021m11		.2827422	.0154994	18.24	0.000	.2523624	.313122
2021m12		.3393957	.0171109	19.84	0.000	.3058572	.3729343
2022m1		.5648378	.0157785	35.80	0.000	.533911	.5957646
2022m2		.6665195	.0236486	28.18	0.000	.6201668	.7128723
2022m3		.3346349	.0139944	23.91	0.000	.307205	.3620648
2022m4		.3688831	.0264161	13.96	0.000	.3171059	.4206603
2022m5		.4654222	.0755883	6.16	0.000	.3172643	.6135801
2022m6		.7943546	.1351604	5.88	0.000	.5294316	1.059278
2022m7		.550607	.0474056	11.61	0.000	.4576891	.643525
2022m8		.5681805	.0547336	10.38	0.000	.4608991	.6754619
2022m9		.3021554	.1019944	2.96	0.003	.1022398	.502071
2022m10		.1732542	.0201991	8.58	0.000	.1336628	.2128457
2022m11		.2447042	.0140978	17.36	0.000	.2170717	.2723367
2022m12		.4194696	.0197908	21.20	0.000	.3806784	.4582608
2023m1		.2395266	.0110539	21.67	0.000	.2178603	.261193
2023m2		.4113215	.0184609	22.28	0.000	.375137	.447506
2023m3		.2700884	.0152114	17.76	0.000	.240273	.2999039
2023m4		.1597599	.0165712	9.64	0.000	.1272793	.1922406
2023m5		.2350599	.0405408	5.80	0.000	.1555974	.3145225
2023m6		.3883138	.0757457	5.13	0.000	.2398474	.5367803
2023m7		.6433613	.0592112	10.87	0.000	.5273036	.7594191

2023m8		.570361	.0548247	10.40	0.000	.4629011	.6778209
2023m9		.2109266	.1068665	1.97	0.048	.0014614	.4203919
2023m10		.065245	.0122946	5.31	0.000	.0411469	.0893432
2023m11		.1569963	.0145483	10.79	0.000	.1284807	.1855118
2023m12		.2002904	.0134358	14.91	0.000	.1739553	.2266254
2024m1		.3772407	.0129726	29.08	0.000	.3518136	.4026678
2024m2		.2851211	.0153369	18.59	0.000	.2550599	.3151824
2024m3		.1526276	.0130452	11.70	0.000	.1270581	.1781971
2024m4		.1204265	.0177054	6.80	0.000	.0857227	.1551302
2024m5		.2853652	.1488957	1.92	0.055	-.00648	.5772104
2024m6		.5417989	.0453188	11.96	0.000	.4529712	.6306266
2024m7		.8226325	.0336595	24.44	0.000	.7566577	.8886073
2024m8		.9418819	.1629578	5.78	0.000	.6224741	1.26129
2024m9		.1156759	.0476139	2.43	0.015	.0223496	.2090022
2024m10		.0400696	.0095382	4.20	0.000	.0213742	.058765
2024m11		.0998212	.0082952	12.03	0.000	.0835621	.1160803
2024m12		.3010958	.0170176	17.69	0.000	.2677402	.3344514
2025m1		.5081072	.0160559	31.65	0.000	.4766366	.5395777
2025m2		.5042767	.021218	23.77	0.000	.4626881	.5458653
2025m3		.1564493	.011064	14.14	0.000	.1347631	.1781356
ym#c.complier							
2021m3		66.06233	44.72183	1.48	0.140	-21.59533	153.72
2021m4		-38.0359	28.85574	-1.32	0.187	-94.59501	18.5232
2021m5		-41.01762	9.943814	-4.12	0.000	-60.50813	-21.5271
2021m6		-36.4357	3.834198	-9.50	0.000	-43.95097	-28.92042
2021m7		-25.66903	3.642068	-7.05	0.000	-32.80771	-18.53034
2021m8		-30.75745	3.366843	-9.14	0.000	-37.35668	-24.15822
2021m9		-32.59716	4.010614	-8.13	0.000	-40.45822	-24.7361
2021m10		-7.557923	12.69441	-0.60	0.552	-32.43978	17.32393
2021m11		16.83515	48.24209	0.35	0.727	-77.72244	111.3927
2021m12		-43.62558	62.45166	-0.70	0.485	-166.0348	78.78368
2022m1		-345.7746	107.3299	-3.22	0.001	-556.148	-135.4012
2022m2		-108.3127	89.11459	-1.22	0.224	-282.983	66.35762
2022m3		-18.95727	48.55165	-0.39	0.696	-114.1216	76.20708
2022m4		-40.94897	34.40814	-1.19	0.234	-108.3911	26.4932
2022m5		-39.38765	11.12681	-3.54	0.000	-61.19691	-17.57838
2022m6		-49.80464	4.359791	-11.42	0.000	-58.35011	-41.25917
2022m7		-39.2255	3.776641	-10.39	0.000	-46.62796	-31.82304

2022m8		-31.39633	3.443128	-9.12	0.000	-38.14509	-24.64758
2022m9		-36.95788	4.052958	-9.12	0.000	-44.90194	-29.01382
2022m10		.8743139	15.45141	0.06	0.955	-29.41143	31.16006
2022m11		-70.71995	54.21428	-1.30	0.192	-176.9834	35.54351
2022m12		-186.6925	83.81713	-2.23	0.026	-350.9795	-22.40556
2023m1		-32.46669	73.33995	-0.44	0.658	-176.2177	111.2843
2023m2		-35.35742	70.16796	-0.50	0.614	-172.8911	102.1763
2023m3		68.5434	55.45969	1.24	0.217	-40.16115	177.248
2023m4		34.73591	20.29277	1.71	0.087	-5.03922	74.51104
2023m5		-21.92282	6.216761	-3.53	0.000	-34.10807	-9.737572
2023m6		-41.61825	3.885885	-10.71	0.000	-49.23483	-34.00166
2023m7		-46.90808	4.362563	-10.75	0.000	-55.45899	-38.35718
2023m8		-47.40853	4.140267	-11.45	0.000	-55.52372	-39.29334
2023m9		-42.66104	4.259509	-10.02	0.000	-51.00995	-34.31213
2023m10		-40.93876	15.70415	-2.61	0.009	-71.71991	-10.15761
2023m11		-16.15787	43.60197	-0.37	0.711	-101.6205	69.30478
2023m12		-47.08386	65.0235	-0.72	0.469	-174.5341	80.36637
2024m1		-455.2233	102.3617	-4.45	0.000	-655.8588	-254.5878
2024m2		51.67574	67.61476	0.76	0.445	-80.85353	184.205
2024m3		56.20798	43.9052	1.28	0.200	-29.84902	142.265
2024m4		7.920638	24.6668	0.32	0.748	-40.42788	56.26915
2024m5		-18.04941	7.534526	-2.40	0.017	-32.81756	-3.281253
2024m6		-39.61002	6.055159	-6.54	0.000	-51.47852	-27.74152
2024m7		-41.14664	4.168139	-9.87	0.000	-49.31646	-32.97682
2024m8		-58.87018	13.09654	-4.50	0.000	-84.54023	-33.20013
2024m9		-56.38989	12.11622	-4.65	0.000	-80.13846	-32.64133
2024m10		-1.193383	14.47255	-0.08	0.934	-29.56052	27.17375
2024m11		49.19579	44.77113	1.10	0.272	-38.5585	136.9501
2024m12		-4.087281	91.75856	-0.04	0.964	-183.9399	175.7654
2025m1		-342.5302	145.0826	-2.36	0.018	-626.9015	-58.15892
2025m2		-56.26554	102.8871	-0.55	0.584	-257.9309	145.3998
2025m3		91.51526	47.77569	1.92	0.055	-2.128161	185.1587
dow							
Monday		-30.75699	1.548959	-19.86	0.000	-33.79305	-27.72093
Tuesday		-27.16581	1.734274	-15.66	0.000	-30.5651	-23.76652
Wednesday		.7305384	1.962761	0.37	0.710	-3.116599	4.577676
Thursday		-18.43554	2.114541	-8.72	0.000	-22.58018	-14.29091
Friday		-6.971644	2.070753	-3.37	0.001	-11.03045	-2.912835

Saturday	29.75789	1.393244	21.36	0.000	27.02704	32.48874
outdoor_humidity	-.6146961	.2581834	-2.38	0.017	-1.120752	-.10864
cdd60	32.07413	.5896759	54.39	0.000	30.91833	33.22993
hdd60	177.5759	2.470093	71.89	0.000	172.7344	182.4174
_cons	-1047.097	46.66085	-22.44	0.000	-1138.555	-955.6386

```

-----
name: LDV_Regressions
log: F:\Projects\Ecobee\2025 CO2 Offsets\Modified Data\05 Output\LDV Regression Output
> .log
log type: text
resumed on: 21 Apr 2025, 16:39:07
heat_pumps, compheat1

```

```

Linear regression
Number of obs      = 29486071
F(155, 23685)      = 650.50
Prob > F            = 0.0000
R-squared           = 0.5516
Root MSE           = 7846.2

```

(Std. err. adjusted for 23,686 clusters in dsa_id)

	Coefficient	Robust std. err.	t	P> t	[95% conf. interval]	
ym						
2021m4	581.9397	67.56595	8.61	0.000	449.5061	714.3732
2021m5	993.4795	88.44357	11.23	0.000	820.1244	1166.835
2021m6	1199.544	95.22819	12.60	0.000	1012.891	1386.198
2021m7	1255.51	96.36395	13.03	0.000	1066.631	1444.39
2021m8	1275.821	96.26953	13.25	0.000	1087.126	1464.515
2021m9	1177.548	96.09191	12.25	0.000	989.2018	1365.894
2021m10	890.3124	92.32413	9.64	0.000	709.3512	1071.274
2021m11	263.1174	120.9167	2.18	0.030	26.11301	500.1218
2021m12	-323.0762	123.8937	-2.61	0.009	-565.9159	-80.23652
2022m1	-1296.227	186.0583	-6.97	0.000	-1660.914	-931.5413
2022m2	742.0067	157.8708	4.70	0.000	432.5697	1051.444
2022m3	93.44204	100.1353	0.93	0.351	-102.8295	289.7136

2022m4		584.0383	94.39288	6.19	0.000	399.0222	769.0544
2022m5		1302.914	94.72003	13.76	0.000	1117.256	1488.571
2022m6		1146.126	96.22571	11.91	0.000	957.5173	1334.734
2022m7		1242.675	96.32449	12.90	0.000	1053.873	1431.477
2022m8		1254.51	96.25419	13.03	0.000	1065.846	1443.175
2022m9		1130.634	96.1144	11.76	0.000	942.2431	1319.024
2022m10		924.0601	97.84918	9.44	0.000	732.2694	1115.851
2022m11		691.001	122.5039	5.64	0.000	450.8855	931.1165
2022m12		860.3068	164.9846	5.21	0.000	536.9263	1183.687
2023m1		287.9509	164.6555	1.75	0.080	-34.78431	610.6862
2023m2		932.0879	143.9237	6.48	0.000	649.9883	1214.188
2023m3		362.1308	120.7276	3.00	0.003	125.497	598.7645
2023m4		787.1981	95.49665	8.24	0.000	600.0185	974.3777
2023m5		1137.517	95.16914	11.95	0.000	950.9799	1324.055
2023m6		1152.615	96.63932	11.93	0.000	963.1961	1342.035
2023m7		1224.841	96.22852	12.73	0.000	1036.227	1413.455
2023m8		1224.333	96.1753	12.73	0.000	1035.823	1412.843
2023m9		1198.405	97.09832	12.34	0.000	1008.086	1388.724
2023m10		825.179	96.90223	8.52	0.000	635.2444	1015.114
2023m11		381.6534	125.2392	3.05	0.002	136.1765	627.1304
2023m12		849.6759	158.9758	5.34	0.000	538.0732	1161.279
2024m1		157.0789	195.7893	0.80	0.422	-226.6806	540.8385
2024m2		1591.639	163.505	9.73	0.000	1271.159	1912.119
2024m3		627.6746	120.7042	5.20	0.000	391.0866	864.2625
2024m4		920.4798	100.6552	9.14	0.000	723.1891	1117.771
2024m5		1175.663	97.38734	12.07	0.000	984.7773	1366.548
2024m6		1143.858	97.15346	11.77	0.000	953.4308	1334.285
2024m7		1247.088	96.66175	12.90	0.000	1057.625	1436.551
2024m8		1237.247	96.47252	12.82	0.000	1048.154	1426.339
2024m9		1202.693	97.54212	12.33	0.000	1011.504	1393.881
2024m10		979.7526	99.61938	9.83	0.000	784.4922	1175.013
2024m11		654.3815	132.5147	4.94	0.000	394.6443	914.1188
2024m12		530.3909	195.6305	2.71	0.007	146.9425	913.8393
2025m1		628.2948	278.1285	2.26	0.024	83.14507	1173.445
2025m2		525.649	201.6381	2.61	0.009	130.4255	920.8726
2025m3		654.0299	130.9986	4.99	0.000	397.2642	910.7956
ym#c.pre_compheat1							
2021m3		.4393512	.0059392	73.98	0.000	.42771	.4509924

2021m4		.4458342	.0103337	43.14	0.000	.4255794	.466089
2021m5		.5493461	.0331946	16.55	0.000	.4842827	.6144096
2021m6		.3228192	.0971913	3.32	0.001	.132318	.5133205
2021m7		.714166	.074442	9.59	0.000	.568255	.860077
2021m8		.2282524	.1380237	1.65	0.098	-.0422829	.4987877
2021m9		.2905747	.0573601	5.07	0.000	.1781452	.4030042
2021m10		.2536451	.0105339	24.08	0.000	.232998	.2742922
2021m11		.4880075	.0067707	72.08	0.000	.4747366	.5012785
2021m12		.4472773	.0061642	72.56	0.000	.4351951	.4593595
2022m1		.6694011	.0074332	90.06	0.000	.6548316	.6839707
2022m2		.7572593	.0103705	73.02	0.000	.7369325	.7775862
2022m3		.4528093	.0064033	70.72	0.000	.4402585	.4653601
2022m4		.5753794	.0131555	43.74	0.000	.5495937	.6011651
2022m5		.5282892	.0541091	9.76	0.000	.4222319	.6343464
2022m6		.2969978	.1046075	2.84	0.005	.0919605	.5020352
2022m7		.481276	.2516671	1.91	0.056	-.0120076	.9745597
2022m8		.250037	.134403	1.86	0.063	-.0134015	.5134754
2022m9		.2080488	.0554233	3.75	0.000	.0994155	.3166821
2022m10		.3881669	.0115549	33.59	0.000	.3655184	.4108153
2022m11		.3952294	.0062273	63.47	0.000	.3830235	.4074353
2022m12		.5152356	.0077561	66.43	0.000	.5000332	.530438
2023m1		.4709845	.0062437	75.43	0.000	.4587464	.4832225
2023m2		.6195408	.009068	68.32	0.000	.6017668	.6373147
2023m3		.4774261	.0072994	65.41	0.000	.4631188	.4917334
2023m4		.3472965	.0107994	32.16	0.000	.3261289	.368464
2023m5		.3959696	.0353547	11.20	0.000	.3266721	.4652671
2023m6		.1977089	.0463491	4.27	0.000	.1068616	.2885562
2023m7		.5204765	.158803	3.28	0.001	.2092125	.8317405
2023m8		.2006817	.1186037	1.69	0.091	-.0317892	.4331525
2023m9		.2500989	.052807	4.74	0.000	.1465938	.353604
2023m10		.2975921	.0115314	25.81	0.000	.2749898	.3201944
2023m11		.3686712	.0066665	55.30	0.000	.3556046	.3817379
2023m12		.4526435	.0071256	63.52	0.000	.4386769	.4666101
2024m1		.5209264	.0071591	72.76	0.000	.5068941	.5349587
2024m2		.5749909	.0096603	59.52	0.000	.5560561	.5939258
2024m3		.3579962	.0067246	53.24	0.000	.3448155	.3711768
2024m4		.3308313	.0106357	31.11	0.000	.3099847	.3516779
2024m5		.3323092	.0373323	8.90	0.000	.2591354	.4054829
2024m6		.3289991	.1124195	2.93	0.003	.1086497	.5493485

2024m7		.7040061	.2365586	2.98	0.003	.240336	1.167676
2024m8		.2001817	.1059087	1.89	0.059	-.0074062	.4077696
2024m9		.1667165	.0456019	3.66	0.000	.0773339	.2560991
2024m10		.2544909	.0106561	23.88	0.000	.2336043	.2753775
2024m11		.2729071	.0058735	46.46	0.000	.2613947	.2844195
2024m12		.4958309	.0083225	59.58	0.000	.4795184	.5121434
2025m1		.5746084	.009271	61.98	0.000	.5564366	.5927801
2025m2		.6342215	.0115531	54.90	0.000	.6115768	.6568663
2025m3		.3289843	.0066834	49.22	0.000	.3158844	.3420843
ym#c.complier							
2021m3		-666.5271	100.9793	-6.60	0.000	-864.453	-468.6013
2021m4		-361.0456	64.07018	-5.64	0.000	-486.6273	-235.4639
2021m5		-181.7627	31.64957	-5.74	0.000	-243.7979	-119.7275
2021m6		-30.45298	13.74713	-2.22	0.027	-57.39825	-3.507719
2021m7		12.2186	8.473768	1.44	0.149	-4.390527	28.82773
2021m8		3.207955	7.664621	0.42	0.676	-11.81519	18.2311
2021m9		-30.58041	11.94995	-2.56	0.011	-54.00307	-7.157751
2021m10		-212.8078	41.84881	-5.09	0.000	-294.8342	-130.7815
2021m11		-814.5297	126.9861	-6.41	0.000	-1063.431	-565.6287
2021m12		-831.5463	134.7808	-6.17	0.000	-1095.725	-567.3672
2022m1		-648.3434	206.0041	-3.15	0.002	-1052.125	-244.5621
2022m2		-593.7215	179.2793	-3.31	0.001	-945.1205	-242.3225
2022m3		-498.9051	108.8554	-4.58	0.000	-712.2686	-285.5415
2022m4		-393.2669	80.45722	-4.89	0.000	-550.9682	-235.5656
2022m5		-305.9469	37.13762	-8.24	0.000	-378.739	-233.1548
2022m6		-36.7771	13.28518	-2.77	0.006	-62.81691	-10.7373
2022m7		-8.683662	8.93032	-0.97	0.331	-26.18766	8.820338
2022m8		2.778571	7.156826	0.39	0.698	-11.24927	16.80641
2022m9		-40.97562	12.4451	-3.29	0.001	-65.36881	-16.58243
2022m10		-324.5808	57.27357	-5.67	0.000	-436.8406	-212.3209
2022m11		-594.6518	122.8651	-4.84	0.000	-835.4753	-353.8284
2022m12		-826.6914	176.5585	-4.68	0.000	-1172.757	-480.6254
2023m1		-684.505	168.8405	-4.05	0.000	-1015.443	-353.5667
2023m2		-680.6118	150.2837	-4.53	0.000	-975.1774	-386.0461
2023m3		-640.9823	126.5014	-5.07	0.000	-888.9332	-393.0314
2023m4		-328.4438	65.51619	-5.01	0.000	-456.8597	-200.0278
2023m5		-143.0315	27.9366	-5.12	0.000	-197.7891	-88.27399
2023m6		-53.87122	17.55532	-3.07	0.002	-88.28077	-19.46166

2023m7		-11.67645	7.964223	-1.47	0.143	-27.28684	3.933939
2023m8		-10.04315	7.581704	-1.32	0.185	-24.90378	4.817472
2023m9		-48.78997	17.60004	-2.77	0.006	-83.28718	-14.29276
2023m10		-127.6843	45.76713	-2.79	0.005	-217.3908	-37.97774
2023m11		-462.0266	120.8466	-3.82	0.000	-698.8937	-225.1595
2023m12		-681.0842	161.9953	-4.20	0.000	-998.6054	-363.563
2024m1		-147.222	202.52	-0.73	0.467	-544.1743	249.7303
2024m2		-739.3354	169.1096	-4.37	0.000	-1070.801	-407.8698
2024m3		-581.6556	115.3398	-5.04	0.000	-807.7289	-355.5822
2024m4		-340.61	68.38492	-4.98	0.000	-474.6488	-206.5711
2024m5		-139.5313	29.56333	-4.72	0.000	-197.4773	-81.58525
2024m6		-4.632098	12.83769	-0.36	0.718	-29.7948	20.5306
2024m7		8.716069	10.24615	0.85	0.395	-11.36704	28.79918
2024m8		-4.866035	10.51582	-0.46	0.644	-25.47772	15.74565
2024m9		-36.68734	15.5658	-2.36	0.018	-67.19731	-6.177379
2024m10		-219.4751	52.51188	-4.18	0.000	-322.4017	-116.5484
2024m11		-528.5097	120.5579	-4.38	0.000	-764.8108	-292.2086
2024m12		-899.3311	198.9094	-4.52	0.000	-1289.206	-509.4559
2025m1		-518.5983	283.2989	-1.83	0.067	-1073.882	36.68564
2025m2		-646.311	206.5981	-3.13	0.002	-1051.257	-241.3654
2025m3		-620.0295	126.1805	-4.91	0.000	-867.3513	-372.7076
dow							
Monday		9.358355	4.625082	2.02	0.043	.2928984	18.42381
Tuesday		-18.17822	5.046817	-3.60	0.000	-28.07031	-8.28614
Wednesday		-68.12643	5.195793	-13.11	0.000	-78.31052	-57.94234
Thursday		-80.50651	5.458335	-14.75	0.000	-91.2052	-69.80783
Friday		-112.136	5.039321	-22.25	0.000	-122.0134	-102.2586
Saturday		-46.4887	3.354646	-13.86	0.000	-53.06402	-39.91338
outdoor_humidity		-17.35631	.6202701	-27.98	0.000	-18.57208	-16.14054
cdd60		-16.55038	1.308282	-12.65	0.000	-19.1147	-13.98606
hdd60		603.8593	6.091191	99.14	0.000	591.9202	615.7985
_cons		359.6621	112.5836	3.19	0.001	138.991	580.3331

APPENDIX 4: <FINDINGS LIST>

CAR1	
Description of CAR/CL/FAR	Regarding ERR CO2 Dashboard"CO2_Dashboard_V2_LowerBound_2025", the sum of emission reduction during the monitoring period (pro-rated for March 2023 and Mar 2025) is 677,280.76 tCO2e which is not consistent with the figures indicated in the MR (Table 1, i.e. 677,316 tCO2e). Please explain the difference.
PP's Response	[ecobee-16-Jul]: We have reviewed the figures and acknowledge minor errors in total emission calculations. When reviewing the latest ERR report ("CO2_Dashboard_V2_LowerBound_0425") which was updated by DSA to include emissions factors eGRID 2022 and eGRID 2023, the total gross emission reduction ("CO2 Saved") is 677,482 mtCO2. This is the outcome of subtracting Total CO2 Project emissions (17,047,191 mtCO2) from Total CO2 Baseline emissions (17,724,683 mtCO2). As our Monitoring Period is March 03 to March 02 and the Dashboard reports monthly emissions, we calculated total emissions as such: in 2023 we added results for the month of March-December, in 2024 we added results for the month of January-December and in 2025 added results for the month of January-February. Please see additional table on Line 34 in "CO2_Dashboard_V2_LowerBound_0425" for calculation explanation.
VVB Assessment	As per the response, the revised "ERR_CO2_Dashboard_V2_LowerBound_0425" is reporting 17,724,683tCO2e as the baseline emissions and 17,047,191tCO2e as the project emissions. However, there is still a mis-match between the indicated monitoring period (i.e. 3 Mar 2023 - 2 Mar 2025) in the MR and the calculation in ERR spreadsheet Mar 2023 - Feb 2025. Please justify If the ERR calculation is accurate for the indicated monitoring period?

PP's Response Round 2	[DSA-15-Aug]: The "08AUG_ERR_CO2_Dashboard_V2_LowerBound_0425_V2" has been shared in the exchange folder and updated to display exact baseline emissions, project emissions and achieved reductions for the indicated monitoring period of 3-Mar-2023 to 02-Mar-2025. Instead of calculating from Mar 2023 to February 2025 as previously done, DSA has updated the calculations to reflect 29 days for March 2023 and 2 days for March 2025, ensuring alignment with the same monitoring period dates. The revised values are now available in the ERR dashboard. See cell D42 of the dashboard for the updated total and D43 with the occupancy adjustment discount applied.
VVB Assessment Round 2	[28-Aug] We noticed that DSA has applied 29 days for Mar 2023 and 2 days for Mar 2025 (column F of "Inputs_LDV" tab). Did DSA run the regression model again with the days adjusted for these 2 months of concern?
PP's Response Round 3	[DSA-05-Sep]: No, we did not re-run the regression models with March 2023 and March 2025 restricted to the days in the monitoring period. This finding was addressed by (a) adjusting the number of days in those two months in the conversions (b) basing the average number of devices on device footprint for just the days in the monitoring period
VVB Assessment Round 3	[15 Sep] By checking the energy dashboard, VVB is able to confirm that DSA had adjusted the number of days for Mar 2023 from 31 days to 29 days; and for Mar 2025 from 31 days to 2 days. The ER calculations are now align with the indicated monitoring period from 3 Mar 2023 - 2 Mar 2025. CAR01 is therefore closed.

CAR2

Description of CAR/CL/FAR	As per p.69 of the MR, it is stated that " no ex-ante GHG emissions reductions and carbon dioxide removals to report in this monitoring period". This is not in line with the guideline of the MR template v4.4, which "For all projects, state the estimated ex-ante GHG emission reductions and carbon dioxide removals and the achieved reductions and removals for the monitoring period. Report the percentage difference and explain any difference. ". Please justify why estimated GHG emission reductions are not reported for this monitoring period.
PP's Response	[ecobee-18-Jul]: The Monitoring Report has been revised to include ex-ante GHG emissions reductions reported in the PDD (Section 1.11). When calculating the ex-ante estimated reductions , ecobee applied real and achieved reductions from first Monitoring Report 2021 to 2023 and used assumptions to develop a model of future estimated reductions for 2023 to 2028. Assumptions included expected total device footprint growth in USA and average emission impact of heat pump and non-heat pump HVAC systems. Subsequent Monitoring Reports provides achieved reductions using real data after conservative approaches are applied which includes taking the lower bound estimates from regressions and applying the occupied dwelling discount. For second Monitoring Report, ecobee is reporting achieved emission reductions of 541,993 mtCO2 for March 2023 to March 2025.
VVB Assessment	As per the response, Section 5.4 of MR has been revised to provide the ex-ante GHG emissions reduction. There is a general description of the assumption involved in the determination of the ex-ante estimation. However, there is no clear explanation for the differences between the achieved emission reduction and the estimations for the indication monitoring period. for example, as for 02 Mar 2023 - 31 Dec 2023, the achieved ER was 35% less than the estimation. Please provide the explanation for the differences per calendar year.
PP's Response Round 2	[ecobee-12-Aug]. The Monitoring Report has been updated to include explanation for difference between ex-ante GHG emissions reductions and achieved emissions per calendar year reported on page 70. Please see Section 5.4 of MR for full details.

VVB Assessment Round 2	[15 Sep] Section 5.4 is revised to provide a description of the difference between ex-ante ER estimation and calculated ER in the indicated monitoring period. However, there is no explanation provided for the difference. It is required by the MR template to explain the difference.
PP's Response Round 3	[ecobee-Oct 07] The explanation for the difference between ex-ante ER estimation and calculated ER have been elaborated in the Monitoring Report. The difference for the ex-ante estimated reductions calculated in 2023 and the achieved reductions calculated was -11% and can be attributed to a few factors: 1) Change in eGRID emission factors 2022 and 2023 2) Change in device footprint and enablement of Adjust For Humidity during the Monitoring Period 3) Change in number of equipment types during the Monitoring Period The difference between achieved reductions and VCUs issued is a result of the occupancy analysis discount of this monitoring period of 20%. Please see updated Monitoring Report "07OCT2025_ecobee_MR_v4.4-VM0008_redline with CAR responses"
VVB Assessment Round 3	[OCT 27] According to the revised MR, the ex-ante ER estimations were based on various assumptions: 1. ecobee device growth; 2. Adjust For Humidity enablement prediction; 3. % furnace Vs % heat pump; 4. eGRID EF; 5. electricity consumption of heatpump and furnace. The verification team considers the justifications for the ex-ante estimation Vs ex-post achievement is reasonably explained. CAR02 is therefore closed.

CL1

Description of CAR/CL/FAR	As per section 1.8 of the MR, there were 3,882,395 ecobee smart thermostat users with eco+ and "Adjust For Humidity" feature on. Please clarify: 1. the cut off date for this statistics of the users. 2. According to p.58 of the MR, there were 2,950,824 "fossil fuel heat" and 1,005,162 "electrci heat" devices recorded as of 02 Mar 2025. It is a total of 3,955,986 ecobee devices. Please explain the difference of the recorded ecobee device reported on p.11 and p.58 of the MR.
PP's Response	[ecobee-18-Jul]: We have reviewed and note an error was made on pg 58 of the MR. The final total of ecobee devices in this monitoring report is 3,882,395 as indicated correctly in section 1.8 of the MR (pg.7). The cut off date is end of February 2025, with a final count of non-heat pump at 2,898,314 and heat pump at 984,081 for a total of 3,882,395.
VVB Assessment	p.58 of the MR is revised as per the response for the consistent no. of non-heatpump and heatpump users. CL1 is therefore closed.

CL2	
Description of CAR/CL/FAR	Is there any occasion where a complier (ecobee smart thermostat user with eco+ and "Adjust For Humidity" feature on) has changed their HVAC system from heat pump to non-heat pump during the monitoring period?
PP's Response	[ecobee-23-Jul]: We performed an analysis to evaluate the percentage of compliers in the heat pump sample group that may have changed their HVAC system from heat pump to non-heat pump (ie. furnance) over the monitoring period. We saw an approx. 3% change per monitoring year of compliers changing their HVAC system from heat pump to non heat pump. This was a result of reviewing telemetry data of the heat pump group and noting an absence of heat pump runtime during the heating season (ie., October to May). Of the compliers heat pump sample group, ~80% have maintained their original HVAC system throughout the monitoring period.

VVB Assessment	For those compliers in the sample group who had switched from heatpump to non-heatpump, please clarify if there are any impacts to the sampling plan (sample size, statistical confidence, etc.), as well as the results the regression model.
PP's Response Round 2	[DSA-15-Aug]: Households that switched from heat pump to non-heat pump systems (or from non-heat pump to heat pump) during the study period do pose a challenge, as their HVAC technology differs from what they had in the pre-treatment period, making direct comparisons of usage less meaningful. However, we do not drop these households from the analysis. The key reason is that a similar proportion of such switches occurred in both the treatment and control groups. This symmetry ensures that any noise or variability introduced by the equipment change is evenly distributed across both groups, preserving the internal validity of our estimates. By keeping these households, we maintain the full sample size and avoid potential selection bias that could arise from selectively excluding participants. While their inclusion may slightly increase variance, it does not bias the regression results, as the treatment effect is still estimated relative to a balanced control group undergoing similar transitions. Importantly, when the expansion of savings from the modeled per-device results to the total project performance happens, that is based on daily snapshots of the number of eco+ enabled devices connected to a given heating system type.
VVB Assessment Round 2	[28-Aug]: Can DSA show the statistics of users switching from heat pump to non-heat pump system, and vice versa, for both treatment group and control group for the monitoring period?

PP's Response Round 3

[DSA-05-Sept]: We do not get a daily snapshot of what type of system each device in the evaluation sample is connected to. We got that information upfront in the sample design phase and used the system type at a point in time (March 2021) to assign devices to the heat pump and non-heat pump groups. Without this information, we cannot conclusively say that a device switched from being connected to a heat pump to a furnace or vice versa. We can make inferences based on the type of runtime observed during winter months, but this is more of a heuristic than a factual data point. While this heuristic suggests that there is movement between system types in both the compliers and deniers (in both directions), we do not adjust the sample. Importantly, the devices in the heat pump group have lag terms (auxheat and compheat) from the pre-period while devices in the non-heat pump group only have the auxheat lag term. If a device switched to a heat pump, the compheat lag term would be missing and cause the device to be omitted from the regression. If a device switched from a heat pump to a non-heat pump, the compheat runtime observed in the pre-period would not be leveraged in the regression model. This "once randomized, always analyzed" philosophy establishes a quasi-experimental design upfront and does not adjust group membership as time goes on unless a denier enables eco+. In that case, they must be removed from the control group. Like most other aspects of this analysis, the treatment and control group were handled the same, so unless we believe that eco+ causes homeowners to change heating fuels at a different rate, the churn in system type in the treatment group should be controlled for by churn amongst the comparison group.

The discussion above is about the regression modeling on the sample. Importantly, in the expansion step from the sample to the population, we are using actual daily counts of devices connected to a given system type by date and state. During the call, we also discussed how the auditor can validate the sample assignments. We've attached the initial sample files from 2023. There are four total (complier HP, complier non-HP, denier HP, and denier HP). In the previously provided files, you have a crosswalk from the hashed device ID to DSA ID. That would allow you to track devices across time in the analysis data sets.

VVB Assessment Round 3	[25 Sep] VVB considers the clarifications reasonable. As discussed in CL12 below, the denier who enabled eco+ would be zeroed out on the day (and onward) when eco+ is switched on, i.e. removing the denier who is no longer eligible for being the control. To further verify the regression model, please indicate relevant lines of the Python script for the following: switched to a heat pump, the compheat lag term would be missing and cause the device to be omitted from the regression;
PP's Response Round 4	[DSA-Oct-02] We do not directly observe cases where non-heat pump units transition to heat pump or vice versa. Therefore, the omission is a hypothetical scenario. The response in question was regarding why we do not attempt to reclassify heating equipment type based on perceived changes inferred from runtime. Regarding the statement that "the compheat lag term would be missing and cause the device to be omitted from the regression" Within the Process_Data function—specifically lines 79–80 of the '02_LDV_Regression.py' script—rows with missing values in the independent variables are dropped before the regression model is fitted. Later in the script, at line 106, Process_Data is called within a loop to subset and clean the runtime data for each group. This ensures the dataset is properly prepared for regression. During the iteration where $i == 1$ and $y == \text{compheat1}$, the function filters out rows with missing values in the pre_compheat1 variable. In the hypothetical case where a non-heat pump device switches to a heat pump, the lag term (pre_compheat1) would be undefined, and the device would be excluded from the compheat1 regression accordingly. However, this does not happen since we do not reclassify equipment types. Each device was either assigned to heat pump or not heat pump based on their configuration at the experimental design stage.

VVB Assessment Round 4	[Oct 27] As demonstrated by the line of 79-80 of the LDV_Regression.py script, those devices which switch from non-heatpump to heatpump would be excluded from the regression model. This is the mechanism by design of the regression model. The verification team consider such exclusion is conservative. CL2 is therefore closed.
------------------------	--

CL3	
Description of CAR/CL/FAR	Please clarify the number (by month) of new PAI added during the monitoring period.
PP's Response	[ecobee-28-Jul]: Please see file "New ecobee devices (By Month) - Monitoring Period (Mar 2023 to Mar 2025)" for monthly breakdown of new ecobee devices added during the monitoring period. On average around 30,000 to 50,000 new devices were added for each month in the monitoring period. An important item to note is that the Engineering team that maintains the device database informed us that between May 2024 and July 2024, the data loading pipeline experienced a technical bug which briefly caused some devices to remove and re-add themselves repeatedly. The bug was eventually fixed and the total monthly device count is considered up to date and accurate.
VVB Assessment	Regarding the technical bugs that caused ecobee devices to remove and re-add themselves repeatedly. 1. Please clarify the timeline of identifying the issues and actions implemented to fixed the issue; 2. how ecobee confirm the accuracy of the number of users after the fixing the bugs 3. whether the removing and re-adding counts would impact the emission reduction calculations.

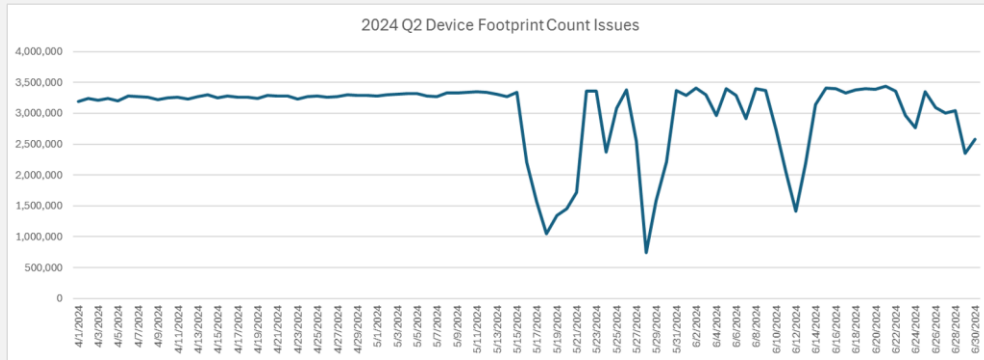
PP's
Response
Round 2

[DSA-16-Aug]: We've updated the counts for March 2023 and March 2025 using monthly averages in the updated ERR file, "08AUG_ERR_CO2_Dashboard_V2_LowerBound_0425_V2.xlsx". For March 2023, the average is based on data from March 03 through March 31 (29 days), and for March 2025, it includes March 01 and 02 (2 days). The device count we use is an AVERAGE number of devices for a given month. For example, it would be inaccurate to just filter to 02/28/2025 to get the device count. You have to first get the number of devices each day in February 2025 and then take an average of those values. The snip to the right shows the math done directly in the file from ecobee (Ryan Crasta) and matches the value in the dashboard. On this topic, we should note that the device footprint counts were artificially lower for several days in Q2 of 2024. See the figure to the right. When we compute the average number of devices per month, we exclude any days where the total device count was less than 2.5 million in order to not bias the project performance downward due to a known data issue. Based on our discussion with ecobee (Ryan Crasta), this is just an artifact of the data they were querying - that is to say, the devices that seemed to have dropped were all still active and had eco+ enable on those days despite the data reporting issues.

Feb	108,707,076		
2/1/2025	3,886,886		
2/2/2025	3,907,344		
2/3/2025	3,738,226		
2/4/2025	3,853,799		
2/5/2025	3,852,967		
2/6/2025	3,868,089	Average 2025-02	
2/7/2025	3,773,351	3,882,396	
2/8/2025	3,895,119		
2/9/2025	3,908,422		
2/10/2025	3,815,346		
2/11/2025	3,877,487		
2/12/2025	3,874,805		
2/13/2025	3,929,384		
2/14/2025	3,884,072		
2/15/2025	3,928,385		
2/16/2025	3,864,344		
2/17/2025	3,895,666		
2/18/2025	3,877,609		
2/19/2025	3,889,874		
2/20/2025	3,929,373		
2/21/2025	3,886,583		
2/22/2025	3,918,514		
2/23/2025	3,925,932		
2/24/2025	3,891,492		
2/25/2025	3,920,943		
2/26/2025	3,918,511		
2/27/2025	3,892,007		
2/28/2025	3,902,546		

[ecobee-19-Aug]

Response for #1: The ecobee Engineering team has clarified that the reporting issue stemmed from a script that runs and makes snapshot of ecobee's production tables. When the script was running normally and completed, the datapoints shows up that match the trendline. However, sometimes the script was timing out before completing the snapshot of the reporting tables, creating the "dip" in the trendline. The team had begun noticing the script timing out around early August 2024 and fixed this by allocating a larger machine type to the snapshot process. The second dip occurred again in Aug-30-2024, and this time the team increased the machine size again. By the time the second dip occurred, the team had put in place better monitoring process to catch the problem sooner.

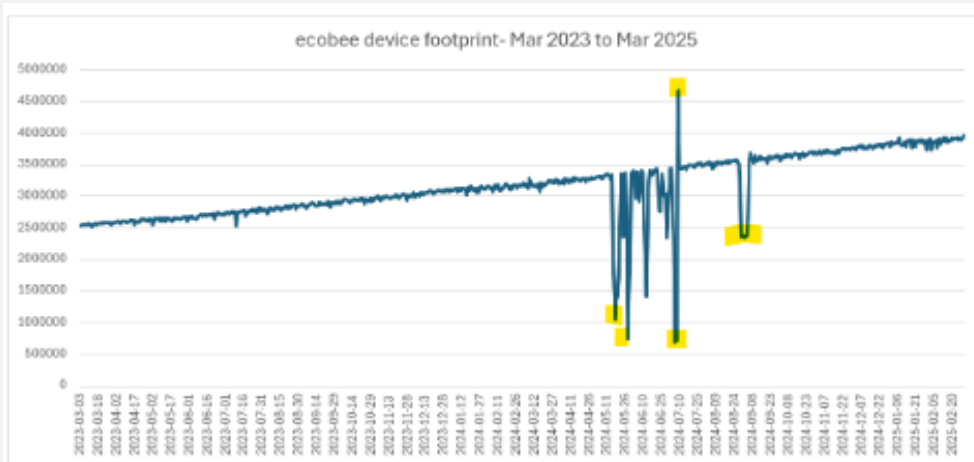


Response for #2: The team can confirm the accuracy because they are taking a snapshot of all device's settings and when the script runs correctly it returns to the stable trendline. When we look at the delta between runs we see the difference being new devices that have recently come online or devices that have been disconnected. This is done with ecobee's admin. portal tools which allows us to inspect each thermostat configuration manually.

Response for #3: Devices dropped and re-added in the dataset table would not impact overall emissions calculations. While it may reduce the sample size if there were missing devices for certain days however it does not add bias or change the integrity of the regression.

VVB
Assessment
Round 2

[15 Sep] VVB confirms that the updated ERR file is consistent with the device count file which show the monthly average number of device per state per type of device (heat-pump/ non-heatpump). It is understood that the dips shown by the file "New ecobee devices (By Month) were due to a technical issue (i.e. insufficient computational power) of the machine that were running the script. Therefore, the snapshot generated by the machine was not reflecting the actual user numbers.



1. The timeline of the incidents were described and explained. No follow up questions.
 2. VVB considers the clarification on the accuracy of user count as reasonable as the number of the user follow the trend after the fix of the script.
 3. VVB considers the explanation of the impact the ER calculations reasonable because the regression model takes monthly average user number to calculate the emissions reduction instead of the snapshot of the user number for a specific month.
- CL3 is therefore closed.

CL4	
Description of CAR/CL/FAR	Please clarify why no measured value reported for the following parameters in Table 4.2 of the MR: 1. Compressor Cooling (Yit in cooling regression) 2. Auxiliary Heatit (Yit in heating regression) 3. Compressor Heatit (Yit in heating regression) 4. Standard Deviation 5. yit-1 6. cddit hddit & hit 7. Number of fuel type

PP's Response	[DSA-16-Jul]: For each of the 7 parameters in Table 4.2, DSA has provided additional details for value applied. The values applied are as such: 1. Compressor Cooling (Yit in cooling regression): This is a measured value with mean of 8,550.07 and standard error of 1.39. 2. Auxiliary Heatit (Yit in heating regression): This is a measured value, with mean of 4,036.6 and standard error of 0.84. 3. Compressor Heatit (Yit in heating regression): This is a measured value with mean of 1,370.58 and standard error of 0.63. 4. Standard Deviation: 95% confidence internal, clustered on household, with means of -204.67 for Compressor coolingit mean of -296.91 for Auxiliary heatit and a mean of -385.95 for Compressor heatit for the second moniting period (11/2023 to 3/2025) 5. yit-1: Measured value with means of 8,118.63 for Compressor coolingit mean of 4,543.93 for Auxiliary heatit and a mean of 1,391.23 for Compressor heatit 6. cddit hddit & hit: Measured values with means of 6.80 for cddit mean of 7.3 for hddit and a mean of 66.94 for hit 7. Number of fuel type: Source: 1 or 0 This section in the MR has been updated to include values applied.
VVB Assessment	Section 4.2 ofthe MR had been revised as per the responses. Please provide the references for measured values of the 7 concerning moniotring parameters for verification.
PP's Response Round 2	[ecobee-08-Aug] DSA is referring to the daily runtime data from the sample group that was shared from ecobee. The same file has been shared with ERM via the SHARED FOLDER > Python Code and Files > dsa_carbon_script.zip > 2025 CO2 Offsets/Original Data/Daily Runtime
VVB Assessment Round 2	[15 Sep] VVB confirms the sources of data. CL4 is therefore close.

Description of CAR/CL/FAR	Regarding parameter "Number of Dwellings in Building Stock b" in Section 4.2, please provide the reference of all the reported figures (non-heat pump cooling, heat pump cooling, ...).
PP's Response	[DSA-16-Jul]: Reference / source to all reported figures came from sample dataset provided by ecobee via Google Cloud Storage. The table in the MR has been updated to include reference/source.
VVB Assessment	The MR is revised to indicate the reference source of the monitoring parameter. Please provide "Summary Statistics of sample provided by ecobee" for verification.
PP's Response Round 2	[ecobee-08-Aug] DSA is referring to the device characteristics file that was shared from ecobee. The same file has been shared with ERM via the SHARED FOLDER > Python Code and Files > dsa_carbon_script.zip > 2023 CO2 Offsets/Original Data/Device Characteristics.
VVB Assessment Round 2	[15 Sep] Referring to the Device Characteristic file shared by ecobee, VVB is able to match the data with the figures reported in the MR. CL5 is therefore closed.

CL6	
Description of CAR/CL/FAR	As the PAI is defined as the ecobee smart thermostat users with eco+ and "Adjust For Humidity" feature on, it is possible that the users turn on and off for the feature "Adjust For Humidity" from time to time. Despite it is not expected such operations in high frequency, please clarify if this behaviour would impose impacts to the sampling plan and to the calculation of emission reduction ?

PP's Response	[DSA-16-Jul]: While it is possible for customers in the treatment to turn on and off the function intermittently, keeping them in the treatment will not bias our results. While it is true that customers toggling off the feature would lower the total savings realized by eco+, their inclusion in the treatment during those times that the feature is off will attenuate our estimate of the treatment in the regression towards zero, which lowers our estimate of the impact of eco+. An alternate way to think of this is that the treatment we are actually measuring is not eco+, but the customers' acceptance of being in the eco+ group. If all customers in the treatment group toggled eco+ off everyday, then we presumably would measure no difference between the treatment and control, and would record no savings. Section 5, subheading "Sampling for Panel Regression Model" of MR has been updated to include this explanation.
VVB Assessment	The same explanation is provided in Section 5 of the MR. When the eco+ users toggle off the feature, the HVAC runtime was no longer governed by the eco+ Adjust For Humidity program. VVB agrees that the HVAC operations then follows the user's manual HVAC settings which are the situations for those in the control group. Please further clarify whether the regression model would take these users out of the treatment group (in case they were being sampled) permanently?

PP's Response Round 2	[DSA-15-Aug]: It is uncommon for users to toggle off the eco+ feature, but when it does happen, their HVAC runtime reverts to manual settings—similar to those in the control group. This behavior introduces downward pressure on the average treatment effect, meaning the true impact of eco+ is likely understated. Despite this, we retain these users in the treatment group within the regression model to preserve the integrity of the quasi-experimental design. Removing them would risk introducing selection bias, whereas keeping them ensures comparability between groups. Importantly, this choice results in a more conservative estimate of the eco+ effect, as the estimate is being diluted by a small number of treatment group devices who were not actually saving. Therefore, users who toggle off eco+ are not permanently or temporarily removed from the treatment group in the model. The prior VVB stressed conservative assumptions in each step of the process and allowing the estimated effect to be lowered by a limited number of devices not actually experiencing the feature leads to understated (conservative) estimates. Importantly, the device footprint totals used for expansion only reflect users with the feature actively on for a given day.
VVB Assessment Round 2	[15 Sep] VVB considers the clarification reasonable. VVB agrees that keep the users from Treatment group with Eco+ feature "off" is conservative. CL6 is therefore closed.

CL7	
Description of CAR/CL/FAR	Figure 7 of the MR shows that number of remaining accounts per each sampled group as of the second monitoring period. Please clarify the reasons for the declined number of accounts per sample group. Please provide the reference for the sample size of each group.

PP's Response	[DSA-16-Jul]: The sample size decreased between monitoring periods for two primary reasons. First, some customers initially assigned to the control group enabled the eco+ feature, leading to their exclusion from the analysis. Second, there was a natural rate of attrition due to customers closing their accounts. This left DSA with 95.8% of the original treatment group and 58.26% of the original control group. The attrition is larger in the control group because of the exclusion of those who turn eco+ on. The original samples were designed to be large enough to absorb this amount of attrition, and since the attrition reflects the reality of the population as a whole opting into eco+ and closing their accounts, this is not expected to introduce any bias. If anything, this may slightly increase the size of the confidence intervals. Since DSA uses the lower bound as their point estimate, the only expected impact is a slight attenuation towards zero of their estimate of the impact of eco+.
VVB Assessment	VVB considers the rationale provided by DSA reasonably explain the reduced number of sample group. According to the applied Methodology VM0008, the minimum sample size shall be the square root of the total number of Dwellings (i.e. ecobee smart thermostat users). At the time of validation, there were 2.5 millions users. The minimum samples for this grouped were 1,581 as per the registered PD. VVB confirms that even with the reduced number of each sampling group, the required sampling size is met. Therefore, CL7 is closed.

CL8	
Description of CAR/CL/FAR	Is it possible to have more than one ecobee thermostats with Eco+ and "Adjust For Humidity" installed in the same home that are connected to the same HVAC system? So that the HVAC runtime are captured by the thermostats repeatedly?

PP's Response	[ecobee-21-Jul]: It is not possible to have two ecobee smart thermostats connected to the same HVAC system as the device is designed to be connected to 1 HVAC system only. Homes that have multiple thermostats have them controlling separate HVAC systems in the home (ie., separate heat systems on different floors or separate air conditioning units).
VVB Assessment	According to the ecobee support page, ecobee smartthermostat can be installed with zoned system. Please clarify if those ecobee smart thermostats installed with zoned system are being identified and treated specifically? https://support.ecobee.com/s/articles/Getting-Started-Installing-your-ecobee-Thermostat##h_01Zoned

PP's Response
Round 2

[ecobee-19-Aug]: In response to this clarification, it could be helpful to 1) elaborate on how residential zoned systems operate with smart thermostats and how run-time telemetry data is collected and 2) clarify how ecobee identifies and treats these use cases for this carbon project activity.

1) Residential zoned systems can typically either have one HVAC system connected to a zone board (per diagram to the right) or one HVAC system per zone. In this instance, there are no runtime overlaps: 1 HVAC system paired with a thermostat. A zone is a region in the home that is temperature controlled via a thermostat (ie., an entire floor, an auxiliary building, a garage, a basement unit etc). If the zones are serviced by the former configuration, then multiple thermostats are connected to one zone board which controls one larger HVAC system with dampers (or flaps) that open/close vents to the specific zones. For example, if there are 4 zones, and 3 out of 4 are calling for cooling, then each of those 3 thermostats will show runtimes until that zone shuts off. When looking at each thermostat we'll see the runtimes for that zone but it is not entirely indicative of how long the HVAC system was running - we would have to overlay the time stamps to identify when other zones were being called for at the same time. All of this is to say that you cannot simply sum up the runtime from your 4-zone, 4-device system. If you do and it shows +/-3h per zone, total 12 hours of runtime, this does not mean the system was running for 12h of the day. It could have, in theory run for as little as 3 hours that day if all zones were on for the same times together.

2) Upon reviewing our sample devices, we were able to identify 2 devices attached to a HVAC system that is controlled by a zone board. Of the 2 devices, one device transmitted normal run-time data used in DSA's emission calculation while the other device's run-time data is NULL, indicating that only the first device recorded runtime data and was used for the calculation of carbon savings. Furthermore, this indicates that a negligibly small percentage of our devices (~0.002%) use zone control and thus, our savings figures remain unchanged.

VVB Assessment Round 2	[15 Sep] Based on the clarification of the zone board operations and the number of identified zone board users. VVB agrees that this is a rare scenario and hence no significant impact to the emission reduction calculations. CL08 is therefore closed.
------------------------	---

CL9	
Description of CAR/CL/FAR	Please provide the reference for "eco+ Heat Pump Customer Share" and "eco+ Non-HP Customer Share" in Appendix C of the MR.
PP's Response	[DSA-16-Jul]: Reference / source for "eco+ Heat Pump Customer Share" and "eco+ Non-HP Customer Share" in Appendix C came from device footprint data provided by ecobee.
VVB Assessment	As per Appendix C of the revised MR, the reference source has been updated. Please provide "Device Footprint File provided by ecobee" for verification.
PP's Response Round 2	[ecobee-07-Aug] Please see file "ecobee footprint by US States_data - Mar 03 2023 to Mar 02_2025_forDSA.xlsx" that has been uploaded to the shared folder.
VVB Assessment Round 2	[15 Sep] Based on the "ecobee footprint by US States_data - Mar 03 2023 to Mar 02_2025_for DSA.xlsx", VVB is able to confirm the % share of Heat pump and non-Heat pump users reported in Appendix C. CL9 is therefore closed.

CL10	
------	--

Description of CAR/CL/FAR	[Copied from e-mail dated 28-Aug]. Dependent variables match second box on slide (Figure 1) Third box on slide says they are grabbing the 'Lower Bound Estimates' but the code seems to be grabbing the upper confidence interval as the lower bound. Is this correct? (Figure 2)
PP's Response	[DSA-05-Sept]: It's the lower bound of the savings, which is the upper bound of the impact estimate since the natural sign of savings is negative runtime. For example if the impact is -100 seconds with a confidence interval from -150 to -50 seconds, that is analogous to SAVINGS of 100 seconds with a confidence interval from 50 to 150 seconds. We want the lower savings estimate (50 seconds), which is the upper bound of the impact (e.g. -50 is greater than -150)
VVB Assessment	[25 Sep] VVB considers the justification reasonable. As shown by the script, it is grabbing the upper bound of the savings. CL10 is therefore closed.

CL11	
Description of CAR/CL/FAR	[Copied from e-mail dated 28-Aug]: <code>_04_Treatment_Switching.py</code> line 51: <code>heat_pump is 1 if has_heat_pump == False?</code> The typical boolean true/false logic is to set false to 0 and true to 1, whereas this seems to set <code>heat_pump</code> to 1 if there is no heat pump. I am wondering if this is mislabeling heat pump vs non-heat-pump in the <code>_02_LDV_Regression.py</code> file.
PP's Response	[DSA-05-Sept]: This is a good catch. This section of code tabulates the number of denier devices that were excluded from the regression because they enabled eco+. The actual exclusion is based on device ID so that is working as intended. This code error means the graph showing proportion of devices excluded and the associated table are labeled backwards. These interim outputs aren't actually part of the final CO2 avoidance estimates. We are happy to provide an updated script for completeness if that would be helpful.

VVB Assessment	[25 Sep] VVB confirms that that this column of data is not used elsewhere in the script. Therefore no impact to the emission reduction calculations. CL11 is therefore closed.
----------------	--

CL12	
Description of CAR/CL/FAR	_01_Prep_Runtime.py line 256: Why is data after the 2025 eco+ enroll user date getting zeroed out?
PP's Response	[DSA-05-Sept]: The 2025 value referenced in this comment is a variable name not an actual date. We received characteristics twice from ecobee. Once in 2023 for the analysis of monitoring period #1 and once in 2025 for the analysis of monitoring period #2. Since we want to store both variables in our data set, we add the year received suffix to the ecoplus_enrolldate variable name. Expanding on the response to CL2 above, the way we use this variable is to exclude deniers from the analysis for all days after they enable eco+. So if Nixon is in the denier group, but enabled eco+ on 7/12/2024, his runtime data would be omitted from the analysis data set for all dates greater or equal to 7/12/2024. This ensures that we don't have any treatment effect in the control group that would bias the estimated savings downward
VVB Assessment	[25 Sep] VVB confirms that that is referring to a variable coming from the denier list which is consistent with the explanation. CL12 is therefore closed.

CL13	
Description of CAR/CL/FAR	It looks like the script is currently written to perform the regression going back a year from 12/2024. Please suggest the modification to run the regression model for 3 Mar - 31 Dec 2023 and 1 Jan - 2 Mar 2025. Source: _02_LDV_Regression.py lines 56-59, 93

PP's Response	[DSA-05-Sept]: The code is set up to run whatever date range the user wishes. For the primary analysis, we run the regressions (in Stata) using the full performance period (monitoring periods #1 and #2). The more months that are included in the regression, the longer it takes to run and the more resource intensive it. To run the regression on just MP2, set the period end (line 93) to 2025-03 and set the number of months backward to include (line 58) to 24. That will run the regression on all 25 month (March 2023 to March 2025). Please note that there will be minor (< 1%) differences in the coefficients for a given month depending on the date range used. This is due to the inclusion of weather terms as independent variables. To match the official results exactly, you'll need to run the full period March 2021 to March 2025. But running on just MP2 should return nearly identical totals
VVB Assessment	[Sep 15]: ERM CVS team intends to run the script for data to include MP1 and MP2 to ensure consistency of the reported data. Please advise if the same approach of period modification should be applied, i.e. set the period end (line 93) to 2025-03 and set the number of months backward to include (line 58) to 48. Regarding to the data reference, should the script point the directory to "2023 CO2 Offsets" folder instead of "2025 CO2 Offsets" folder?
PP's Response Round 2	[DSA-Oct 02]: There are two ways to accomplish this: As previously described Alternative approach: At line 93, set month_end='2025-3' Then, at line 106, modify the function call to: df = Process_Data(i, y, True) At this point in the process, the data referenced from the folder "\$dir2" will include runtime from both the first and second monitoring periods. There's no need to adjust the directory paths—just ensure that all preceding scripts have been executed to populate the necessary data.

VVB Assessment
Round 2

[Oct 27] ERM CVS has executed the regression model that take the dataset covering both MP1 and MP2. The outcome of the regression model is within a reasonable range as compared with the output reported in the ER calculation spreadsheet.
CL13 is therefore closed.