REV Campus Challenge Impact Evaluation

Final Report

Prepared for:

New York State Energy Research and Development Authority
Albany, NY

Dana Nilsson
Senior Project Manager, NYSERDA
Paige Markegard
Product Manager, Michael's Energy
Andrea Salazar
Product Manager, Michael's Energy

Prepared by:

DNV

Corporate Headquarters: Katy, TX

Ben Jones, Vice President, DNV

Alain Tayoun, Sr. Engineer, DNV

Record of Revision

Document Title
REV Campus Challenge Impact Evaluation June 10, 2022

Revision Date	Description of Changes	Revision on Page(s)
June 10, 2022	Original Issue	Original Issue

Notice

This report was prepared by DNV in the course of performing work contracted for and sponsored by the New York State Energy Research and Development Authority (hereafter "NYSERDA"). The opinions expressed in this report do not necessarily reflect those of NYSERDA or the state of New York, and reference to any specific product, service, process, or method does not constitute an implied or expressed recommendation or endorsement of it. Further, NYSERDA, the state of New York, and the contractor make no warranties or representations, expressed or implied, as to the fitness for particular purpose or merchantability of any product, apparatus, or service or the usefulness, completeness, or accuracy of any processes, methods, or other information contained, described, disclosed, or referred to in this report. NYSERDA, the state of New York, and the contractor make no representation that the use of any product, apparatus, process, method, or other information will not infringe on privately owned rights and will assume no liability for any loss, injury, or damage resulting from or occurring in connection with the use of information contained, described, disclosed, or referred to in this report.

NYSERDA makes every effort to provide accurate information about copyright owners and related matters in the reports we publish. Contractors are responsible for determining and satisfying copyright or other use restrictions regarding the content of reports that they write, in compliance with NYSERDA's policies and federal law. If you are the copyright owner and believe a NYSERDA report has not properly attributed your work to you or has used it without permission, please email print@nyserda.ny.gov.

Information contained in this document, such as web page addresses, are current at the time of publication.

Table of Contents

List of Figures

List of Tables

Executive Summary

This report presents results of the REV Campus Challenge (REV CC) impact evaluation, including the evaluated savings, program realization rate, savings as percent of baseline energy consumption, and relative savings per unit ratios (kWh/student).

REV Campus Challenge members include two- and four-year public and private institutions from all regions of New York State. Upon enrollment, campuses self-select a tier based on a questionnaire measuring their progress on setting and achieving carbon reduction goals. In ascending order, these tiers are "Participant," "Achiever," and "Leader." The REV Campus Challenge provides its members with a range of services, including:

- Opportunities to be recognized for clean energy achievements.
- Membership in a network of like-minded institutions from all corners of the State.
- Workshops and opportunities to learn from and engage with peers.
- A library of resources to consult and draw from.

All the above listed support services are designed to enable member institutions to make progress toward their energy efficiency and sustainability goals.

Approach

The evaluation Team built a list of installed measures associated with the program for each participating campus. Measure specifics were collected through in-depth interviews (IDIs) held with campus representatives familiar with the effort. The interviews were supplemented by information gathered through multiple sources, including prior market research surveys, prior NYSERDA program involvement, measures reported to the State University of New York (SUNY) system, and publicly available information about a campus' sustainability efforts (e.g., energy master plan, climate action plan). Out of the 126 colleges in the evaluated population, 37 were recruited and interviewed. Interview respondents were grouped into two different categories depending on whether they completed any projects because of their participation in REV CC or not. The team also requested permission to conduct a site visit at the interviewed schools to collect additional data; however, only two campuses agreed to participate. Therefore, energy savings calculation predominantly relied on information and data collected through the IDIs. Savings were first calculated at a campus level and then extrapolated from the respondent sample to the population to obtain program-level results. One important metric used to estimate progress in achieving program savings is the ratio of evaluated savings to number of students. This approach was used to calculate savings since the number of students per campus was the only "size" characteristic available to the evaluation Team. Other characteristics such as baseline energy usage and

campus area were considered; however, these metrics were not available for all participants and therefore were not used. Finally, the realization rate was calculated as the ratio of evaluated savings to program-reported savings.

Results

This section presents the results and findings from the REV Campus Challenge impact evaluation. The results represent 126 participating campuses. Table ES-1 shows a summary of the outreach efforts.

Table ES-1-1. Summary of outreach efforts

Campus Population	Interviewed Campuses	Campuses with Reported Savings	Campuses with Quantifiable Savings[a]
126	37	26	17

[a] Out of the 26 interviewed colleges that reported savings, the evaluation was able to calculate savings for 17 colleges only. The remaining nine colleges did not provide defined measures or estimates of the energy efficiency project scope.

Table ES-2 summarizes the evaluated program savings.

Table ES-1-2. Evaluated savings

Fuel	Student Population	Evaluated Savings per Student	Evaluated Savings	Evaluated Savings as a Percent of Baseline[a]
Electric (kWh)	933,248	99.14	92,525,305	2.6%
All Fuels (MMBtu)	933,248	0.67	623,378	1.4%

[a] Baseline energy use was not available for all campuses. Total campus baseline energy usage was extrapolated from the information available for the population. As a result, energy savings as a percent of baseline is contingent on the accuracy of the team's assumptions.

The participants have been members of the program for an average of five years. As a result, the savings presented in Table ES-2 were garnered over a five-year period.

The program estimated energy savings by assigning an electric and fuel savings value to each campus based on the campus tier. These savings values were independent of school size. The team calculated the realization rate as the ratio of evaluated to reported savings. Table ES-3 presents the program reported and evaluated savings as well as the realization rate.

Table ES-1-3. Program realization rate

Fuel	Program Reported Savings	Evaluated Savings	Realization Rate
Electric (kWh)	45,245,333	92,525,305	204%
All Fuels (MMBtu)	271,472	623,378	230%

The realization rates are based on a verification build-up from number of students per campus. They are less applicable to future program populations when the number of students per campus deviates from the averages that existed in the current study population. Furthermore, if the mix of Leaders, Achievers, and Participants is widely different than the current study, the RR will also be less applicable since the program claims savings based on participation tier.

The contributing factors to the realization rates are as follows:

1. Program reported savings do not have an explicitly defined timeframe and are a function of participation tier, not campus size. Larger projects, a higher level of influence, and a longer evaluation time frame than the program had assumed are likely drivers of the high realization rate.
2. Savings from respondents that did not definitively assert program influence on decisions were 100% associated with the program (potential high-savings bias).

Findings

The section below outlines the evaluation Team's findings.

Finding 1: Evaluated savings are based on IDIs and available data. This approach presents a risk that some measures were not captured. The team conducted in-depth interviews in an effort to learn about the participating campuses and identify what actions were taken as a result of the program. M&V site visits were meant to supplement previously collected data and capture anything that was missed during the interviews. However, nearly all campuses declined to participate in site visits or became non-responsive after initially agreeing, preventing more comprehensive M&V. Therefore, the conversations with site contacts were the only method available to verify actions associated with the program. This introduces the risk of some program-related actions not being captured through the evaluation, which ultimately presents a potential low-savings bias.

Finding 2: Savings from respondents that did not define program influence were 100% associated with the program. The impact of the REV CC program was found to vary based on the participating campus. Out of the 37 campuses that participated in the interviews, a third reported that REV CC has a direct impact on their energy efficiency efforts, another third indicated that the program had no impact whatsoever on actions they've taken, and the balance did not define program impact. All measures implemented by the final group were considered to be associated with the program. Associating savings from these sites to the program presents a potential high-savings bias.

Finding 3: Program reported savings do not have an explicitly defined timeframe and are a function of participation tier, not campus size. The reported savings are estimated by the program

based on participation tier (participant, achiever, and leader). An electric and fuel energy savings value was applied to participating campuses irrespective of size or baseline consumption. In addition, the reported savings were not bound by a specified timeframe (i.e., whether reported savings were anticipated over the first year of the program or the lifetime of the program). The evaluation team evaluated measures implemented as part of the program since its inception and found that, on average, participants were enrolled for five years. The evaluation team believes that the high realization rate is predominantly attributed to this finding.

Finding 4: Baseline energy use data was incomplete, so population baseline energy use was extrapolated. Savings with respect to baseline is contingent on the accuracy of the evaluation team's assumptions. The program tracking data did not include site-specific characteristics such as baseline energy use or facility square footage. The evaluation team gathered this data from previous market research surveys conducted by the program. The survey data was self-reported by participants and was incomplete since not all campuses reported these values or participated in the survey. The evaluation team calculated the population-level baseline energy usage by extrapolating from campuses with known data to the population. As a result, the evaluated savings as a percent of baseline is an estimate that is contingent on the accuracy of extrapolated baseline energy usage in the absence of actual data.

Finding 5: COVID-19 led to a decrease in measure adoption over the last two years. Through conversations with campus representatives, the interviewers learned that campuses have decreased their energy efficiency and sustainability activities in the last two years. The COVID-19 pandemic diverted the participants' attention to safety and compliance with new health regulations, as such, energy efficiency was not as much of a priority.

Finding 6: Leader schools appear more motivated to implement projects when compared to Achiever and Participant schools. Further analysis on the collected data showed patterns across different participant tiers. For instance, a bigger proportion of Leader schools (63%) were engaged in energy efficiency activities associated with the program than Achiever schools (47%) and Participant schools (40%).

Finding 7: Leader schools saw more fuel savings per student than Achiever and Participant schools. However, Achiever and Participant schools saw more electric savings per student than Leader schools. Further analysis on the collected data also revealed what measure types different participation tiers focus on. Achiever and Participant schools exhibited 134 kWh/student and 96 kWh/student, respectively, compared to 68 kWh/student for Leader schools. The evaluation team hypothesizes that Leader schools likely completed low-cost, high-saving projects, such as lighting, prior to program participation, while Achiever and Participant schools are now in the process of implementing these

measures. This hypothesis is supported by the fact that Leader schools have the highest fuel savings per student, which are typically more costly (Leader – 1 MMBtu/student, Achiever – 0.76 MMBtu/student, Participant – 0.006 MMBtu/ student).

Recommendations

The section below outlines the evaluation team's recommendations.

Recommendation 1: The program should consider a per square foot or per baseline energy usage metric to scale program-reported savings more accurately. The reported savings are estimated by the program based on participation tier (Participant, Achiever, and Leader). An electric and fuel energy savings value was applied to participating campuses irrespective of size or baseline consumption. The program should consider introducing a savings per unit metric (e.g., energy savings per square foot, energy savings as a percent of baseline energy usage) to scale reported energy savings to a campus' size for a given participation tier.

> **NYSERDA Recommendation Response:** Pending. The Program will consider this approach.

Recommendation 2: The program should consider incentivizing campuses to report installed energy efficiency measures. The program does not currently keep track of energy efficiency measures implemented by the participants. Since REV CC does not offer a rebate for measure installation, aside from energy-to-lead (ETL) competition winners, providing participants with an incentive to report measures installed is valuable for two main reasons. First, having a list of measures for each campus facilitates the quantification of savings, and second, it allows for an evaluation with less risk of low-savings bias. This risk is related to respondent recall as well as staff turnover, which, anecdotally, seems to be high with these facility types (based on interviews). This means that the contact at the time of evaluation might not be familiar with the program, or the measures implemented since participation.

> **NYSERDA Recommendation Response:** Rejected. The Program does not have available funds to incentive this. This recommendation will be considered for future endeavors of a similar nature.

Recommendation 3: The program should consider acquiring permission from the customer and collecting two years of pre-participation utility billing data at the time of enrollment for campuses where this is feasible. The program would benefit from having access to the schools' utility and/or POD account information and should acquire permission from the customer to collect two years of pre-participation utility billing data at the time of enrollment. It is important to make this request through electronic data interchange (EDI) promptly, as the data will not be easily accessible later. EDI is a method to securely request and collect utility data information from various utilities within New York State. This would benefit future evaluations, removing the barrier of requesting permission to access utility data at

the time of the evaluation. Having two years of pre- and post- utility billing data allows for more accurate results during evaluation (e.g., using pooled regression analysis, the difference-in-differences method) and reduces uncertainty arising from a large percentage of estimated reads. This recommendation is true for any program for which billing analysis may be a primary evaluation methodology. Note that billing analysis will continue to have complications for evaluation purposes as the transition out of the pandemic continues.

> **NYSERDA Recommendation Response:** Pending. The Program anticipates nine additional colleges signing up to join REV Campus Challenge. Given the possible program cost of a change in process and to participation, this action may not be feasible at this time. This recommendation will be considered for future endeavors of a similar nature.

Recommendation 4: The program should consider collecting basic campus information upon sign-up, such as baseline energy use, building area, and number of students. The program does not currently collect information pertaining to a campus' characteristics such as academic building area, baseline energy usage, or number of students. The evaluation team acquired some of that information either through the in-depth interviews or the market research surveys. Having these metrics will ensure there is more consistent information across participants and will allow for a more streamlined and accurate evaluation.

> **NYSERDA Recommendation Response**: Pending. The Program has historically asked for energy usage information in its annual survey. While useful for qualitative assessment, this data point was not received for a sufficient number of participants and in a manner that would facilitate impact evaluation. The Program will consider collecting this data for the remaining nine members. This recommendation will also be considered for future endeavors of a similar nature.

Recommendation 5: Questions focused on energy savings in market research surveys should be developed in tandem with impact evaluators. The market research survey collects high-level information on energy efficiency actions schools have taken. This information alone cannot inform the impact evaluation, especially for quantification of energy savings and attribution of such. For future market research efforts, questions focused on energy savings should be developed in tandem with impact evaluators to ensure that the information provided is sufficient to accurately associate energy savings to respondents and quantify impacts of the program without unduly burdening respondents.

Recommendation 6: The program should consider adding a benchmarking component (within campuses and/or across campuses) to REV CC. Participants would be able to compare building

performance within their campus and with other campuses. This would also fit with the challenge component of the program and potentially keep schools motivated when compared to others.

NYSERDA Recommendation Response: Rejected. The Program does not have available funds to incentive this for free. Benchmarking is currently available as part of an energy study on a cost-shared basis. This recommendation will be considered for future endeavors of a similar nature.

1 Introduction

This report presents results of the REV Campus Challenge impact evaluation, including the program savings, program realization rate, program as percent of baseline energy consumption, and relative savings per unit ratios (kWh/student).

1.1 Program Description

The REV Campus Challenge[1] launched in fall 2015 with the goal of engaging the broad academic potential of New York State's colleges and universities. Since its launch, the REV Campus Challenge has recognized institutions around the State for clean energy achievements, made available $15 million in funding to support a wide range of clean energy activities, and engaged dozens of institutions around New York in shaping the Challenge's next steps.

REV Campus Challenge members include two- and four-year public and private institutions from all regions of New York State. From community colleges to state research universities to private liberal arts colleges, REV Campus Challenge members represent New York's leaders in institutional sustainability. Upon enrollment, campuses select a tier based on the energy or carbon reductions they have and aim to achieve. In ascending order, these tiers are "Participant," "Achiever," and "Leader."

The REV Campus Challenge provides its members with a range of services, including:

- Support programs to enable member institutions to make progress toward their goals.
- Opportunities to be recognized for clean energy achievements.
- Membership in a network of like-minded institutions from all corners of the State.
- Workshops and opportunities to learn from and engage with peers.
- A library of resources to consult and draw from.

1.2 Evaluation Objectives and Methods

Table 1-1 summarizes the objectives of this study.

[1] REV Campus Challenge https://www.nyserda.ny.gov/All-Programs/Programs/REV-Campus-Challenge

Table 1-1. Study objectives, research questions, and methods

Objective	Purpose	Method
Evaluated gross energy impacts and Verified Gross Savings Realization Rate (VGS RR)	Establish savings-to-date for program participants. Evaluate ratio of evaluated savings to program reported savings.	Phone survey of participants; identification of installed measures; collection of measure-specific information; on-site M&V; engineering calculations; extrapolation of results to population.
Savings over time	Determine the program-specific methodology to evaluated gross energy savings over time. This includes consideration of measure and site lifetime savings, and measure uptake.	Phone survey of participants; investigating multi-year participant sites of a representative sample.
Savings per incentive and/or participant unit of measure	Calculate ratio of evaluated savings to the NYSERDA participant unit of measure (kWh/student) to compare/contrast with other NYSERDA programs.	Utilize campus information and evaluated savings to calculate relevant metrics.
Influential factors to program evaluation and findings	Determine factors that help or hinder the evaluation of the program. Identify factors that future evaluators should take into consideration when reviewing the program.	Investigate the effects data availability have on the findings and the evaluation approach.

2 Findings, Results, and Recommendations

This section presents the results, findings, and recommendations of the REV Campus Challenge impact evaluation.

2.1 Results and Findings

2.1.1 Results

The evaluation population covers REV CC program participants from the program's inception through March 2020. The evaluation population includes 126 campuses with a total of 933,248 students.

The evaluation team attempted to conduct interviews with a census of program participants. The evaluation outreach targeted campus representatives and collected measure-level information where applicable. Table 2-1 summarizes the census effort results on a campus level.

Table 2-1. Summary of census effort on a campus level

Unit	Campus Population	Interviewed Campuses	Campuses with Reported Savings	Campuses with Quantifiable Savings
Campuses	126	37	26	17
Number of Students	933,248	250,751	154,095	76,799

As shown in Table 2-1, out of the 126 campuses in the population, the outreach effort recruited and interviewed 37. Of those 37 campuses, 11 reported not having installed energy efficiency measures or implementing upgrades associated with the REV CC program. On the other hand, 26 campuses reported implementing energy efficiency measures since program enrollment. The evaluation team was successful in evaluating energy savings for 17 out of the 26 campuses that reported savings. The remaining nine sites were not able to provide adequate information to conduct a reliable and accurate engineering calculation of savings. Campus-level measures and savings can be found in Appendix A.

The tracking dataset did not include site characteristics such as building area or baseline energy usage that can be used to extrapolate the savings from the evaluated sites to the population. The number of students per campus was the only site characteristic available; therefore, the evaluation team calculated the savings per student for each of the 17 campuses. To evaluate the program savings, three main metrics were calculated from the sample:

1. **Percent of students at campuses with program activity:** This metric represents the percent of students at campuses within the population that reported installing energy efficiency measures

and are expected to exhibit energy savings. This percent is calculated as the number of students at campuses with program activity to the total number of students in the population.

2. **Energy savings per student in campuses with program activity:** This metric represents the energy savings per student that is expected from campuses that installed energy efficiency measures.
3. **Program savings per student:** This metric is the product of the two above and represents the energy savings per student, that is expected across the population.

The methodology will be further discussed in Section 3.

Table 2-2 shows the evaluated metrics discussed above with absolute and relative precisions.

Table 2-2. Summary of evaluation metrics

Fuel	Percent Students at Campuses with Program Actions	Verified Savings per Student at Campuses with Program Actions	Program Savings per Student	Absolute Precision	Relative Precision
Electric (kWh)	51%	194	99.14	67	67.6%
All Fuels (MMBtu)	51%	1.3	0.67	0.46	68.1%

Since the program did not track baseline energy use information for participating campuses, the evaluation team collected baseline energy usage from prior market research surveys for sites that participated in those studies. The population energy usage was determined by extrapolating baseline energy use from the subset that had available data. While going through the extrapolation exercise, the evaluation team found that medical schools have significantly higher baseline energy usage per student when compared to non-medical campuses. As such, the baseline energy use extrapolation for medical and non-medical campuses was carried out separately. Table 2-3 and Table 2-4 summarize the available baseline energy use and total estimated energy use for electricity and all fuels respectively.

Table 2-3. Baseline electric energy use calculations

Campus Type	Number of Campuses with Available Data	Number of Students in Campuses with Available Data	Baseline Energy Use in Campuses with Available Data (MWh)	Baseline Energy Use per Student at Campuses with Available Data (MWh/student)	Total Number of Students in Population	Population Baseline Energy Use (MWh)
Medical	3	4,115	299,502	73	5,719	416,246
Non-Medical	72	655,784	2,478,732	4	927,529	3,505,874
Total					**933,248**	**3,922,120**

Table 2-4. Baseline fuel energy use calculations

Campus Type	Number of Campuses with Available Data	Number of Students in Campuses with Available Data	Baseline Energy Use in Campuses with Available Data (MMBtu)	Baseline Energy Use per Student at Campuses with Available Data (MMBtu/student)	Total Number of Students in Population	Population Baseline Energy Use (MMBtu)
Medical	3	4,115	873	73	5,719	4,991,141
Non-Medical	72	655,784	48	4	927,529	44,884,112
Total					**933,248**	**49,875,252**

The baseline energy use was estimated by the evaluation team to calculate savings as a percent of baseline. Table 2-5 shows the evaluated energy savings and savings as a percentage of the extrapolated baseline energy usage.

Table 2-5. Summary of evaluated savings

Fuel	Student Population	Evaluated Savings per Student	Evaluated Savings	Total Estimated Baseline Consumption	Evaluated Savings as % of Baseline
Electric (kWh)	933,248	99.14	92,525,305	3,922,120	2.4%
All Fuels (MMBtu)	933,248	0.67	623,378	49,875,252	1.2%

The program estimated energy savings by assigning an electric and fuel savings value based on the campus tier. These savings values were independent of a school size. Table 2-6 shows the program reported savings per tier.

Table 2-6. Program reported savings per tier

Participant Tier	Number of Campuses in Population	Program Reported Savings per Campus		Total Program Reported Savings	
		Electric (kWh)	All Fuels (MMBtu)	Electric (kWh)	All Fuels (MMBtu)
Leader	30	626,667	3,760	18,800,000	112,800
Achiever	38	313,333	1,880	11,906,667	71,440
Participant	58	250,667	1,504	14,538,667	87,232
Total	**126**	**NA**	**NA**	**45,245,333**	**271,472**

The evaluation team calculated the realization rate as the ratio of evaluated to reported savings. Table 2-7 presents the program reported and evaluated savings as well as the realization rate.

Table 2-2-7. Program realization rate

Fuel	Program Reported Savings	Evaluated Savings	Realization Rate
Electric (kWh)	45,245,333	92,525,305	204%
All Fuels (MMBtu)	271,472	623,378	230%

The realization rates are based on a verification build-up from number of students per campus. They are less applicable to future program populations when the number of students per campus deviates from the averages in the current study population. Furthermore, if the mix of Leaders, Achievers, and Participants is widely different than the current study, the RR will also be less applicable since the program claims savings based on participation tier.

The contributing factors to the realization rates are as follows:

1. Program reported savings do not have an explicitly defined timeframe and are a function of participation tier, not campus size. Larger projects, a higher level of influence, and a longer evaluation time frame than the program had assumed are likely drivers of the high realization rate.
2. Savings from respondents that did not definitively assert program influence on decisions were 100% associated with the program (potential high-savings bias).

To put the results into perspective, the evaluation team investigated the average time participants have been involved with the REV CC program. Figure 2-1 shows the number of new campuses enrolled per year.

Figure 2-1. New campuses enrollment by year

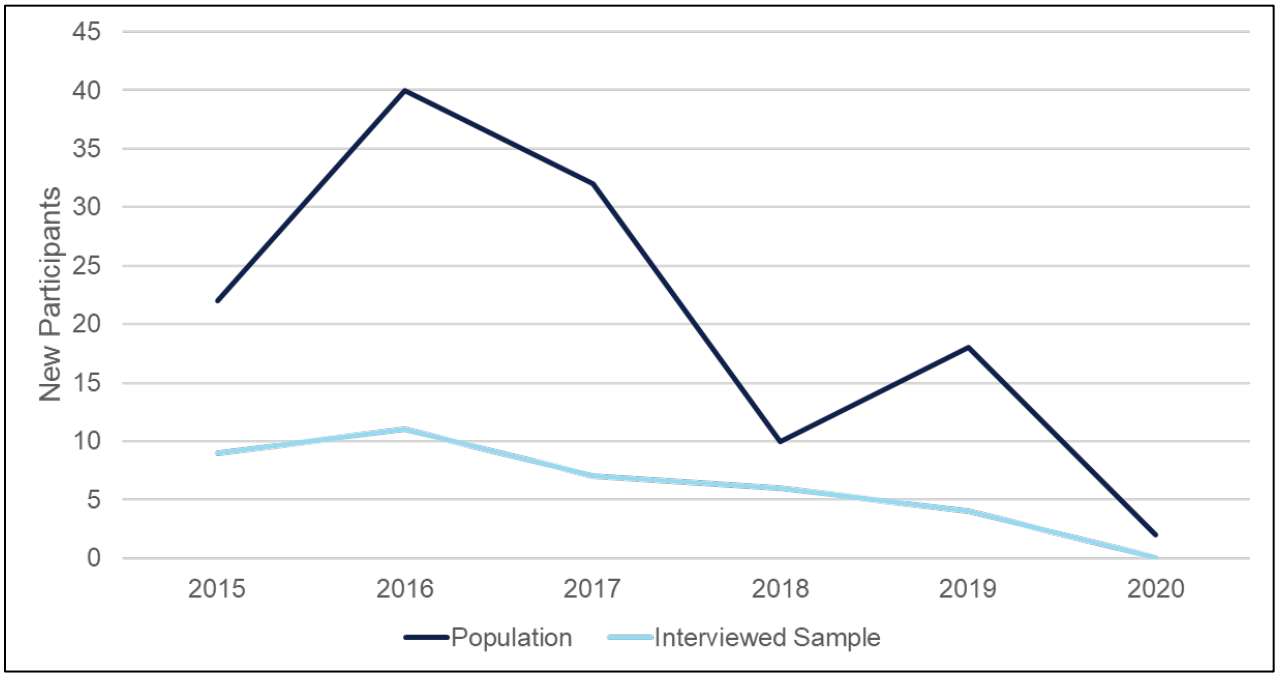


Figure 2-1 shows that the majority of enrollment occurred in the program's early days and that the distribution of campuses in the interviewed sample is similar to the population. On average, the participants have been in the program for a period of 5.5 years (average enrollment year is in mid-2016 to date). As a result, the evaluated savings presented were achieved over a course of 5.5 years.

Finally, the evaluation team calculated the percent baseline energy reduction per year and found that on average, participating campuses are reducing 0.45% and 0.23% of their baseline electric and fuel usage per year, respectively.

2.1.2 Findings

The section below outlines the evaluation team's findings.

Finding 1: Evaluated savings are based on IDIs and available data. This approach presents a risk that some measures were not captured. The evaluation team conducted in-depth interviews in an effort to learn about the participating campuses and identify what actions were taken as a result of the program. M&V site visits were meant to supplement previously collected data and capture anything that was missed during the interviews. However, nearly all campuses declined to participate in site visits or became non-responsive after initially agreeing, preventing more comprehensive M&V. Therefore, the conversations with site contacts were the only method available to verify actions associated with the program. This introduces the risk of some program-related actions not being captured through the evaluation, which ultimately presents a potential low-savings bias.

Finding 2: Savings from respondents that did not define program influence were 100% associated with the program. The impact of the REV CC program was found to vary based on the participating campus. Out of the 37 campuses that participated in the interviews, a third reported that REV CC is directly related to their energy efficiency efforts, another third indicated that the program had no impact whatsoever on actions they've taken, and the balance did not define program impact. All measures implemented by the last group since program enrollment were considered as impacted by the program by the evaluation team. Associating savings from these sites to the program presents a potential high savings bias.

Finding 3: Program reported savings do not have an explicitly defined timeframe and are a function of participation tier, not campus size. The reported savings are estimated by the program based on participation tier (Participant, Achiever, and Leader). An electric and fuel energy savings value was applied to participating campuses irrespective of size or baseline consumption. In addition, the reported savings were not bound by a specified timeframe (i.e., whether reported savings were anticipated over the first year of the program or the lifetime of the program). The evaluation team evaluated measures implemented as part of the program since its inception and found that, on average, participants were enrolled for five years. The evaluation team believes that the high realization rate is predominantly attributed to this finding.

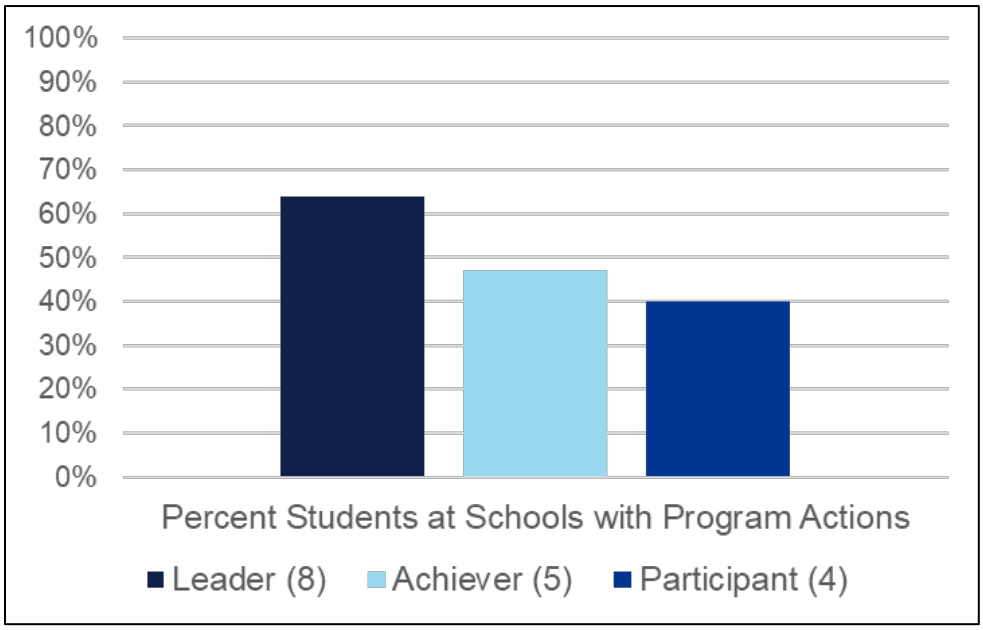
Finding 4: Baseline energy use data was incomplete, so population baseline energy use was extrapolated. Savings with respect to baseline is contingent on the accuracy of the evaluation team's assumptions. The program tracking data did not include site-specific characteristics such as baseline energy use or facility square footage. The evaluation team gathered this data from previous market research surveys conducted by the program. The survey data was self-reported by participants and was incomplete, since not all campuses reported these values or participated in the survey. The evaluation team calculated population-level baseline energy usage by extrapolating from campuses with known data to the population. As a result, the evaluated savings as a percent of baseline is an estimate that is contingent on the accuracy of estimated baseline energy usage in the absence of actual data.

Finding 5: COVID-19 led to a decrease in measure adoption over the last two years. Through conversations with campus representatives, the interviewers learned that campuses have decreased their energy efficiency and sustainability activities in the last two years. The COVID-19 pandemic diverted the participants' attention to safety and compliance with new health regulations, as such, energy efficiency was not a priority.

Finding 6: Leader schools appear more motivated to implement projects than Achiever and Participant schools. Further analysis on the collected data showed patterns across different participant

tiers. For instance, a bigger proportion of Leader schools (63%) were engaged in energy efficiency activities attributed to the program since enrollment compared to Achiever schools (47%) and Participant schools (40%). Figure 2-2 shows the percentage of campuses engaged in REV CC by participation tier along with the sample size of each tier.

Figure 2-2. Campus engagement by participation tier



Finding 7: Leader schools saw more fuel savings per student than Achiever and Participant schools. However, Achiever and Participant schools saw more electric savings per student than Leader schools. Further analysis on the collected data also revealed what measure types different participation tiers focus on. Achiever and Participant schools exhibited 134 kWh/student and 96 kWh/student respectively, compared to 68 kWh/student for Leader schools. This can be explained by the hypothesis that Leader schools likely completed low-cost, high-saving projects, such as lighting, prior to program participation, while Achiever and Participant schools are now in the process of implementing these measures. This hypothesis is further supported by the fact that Leader schools have the highest fuel savings per student, which are typically more costly (Leader – 1 MMBtu/student, Achiever – 0.76 MMBtu/student, Participant – 0.006 MMBtu/ student). Figure 2-3 and Figure 2-4 show the electric and fuel energy savings per student by participation tier.

Figure 2-3. Electricity reduction per student by participation tier

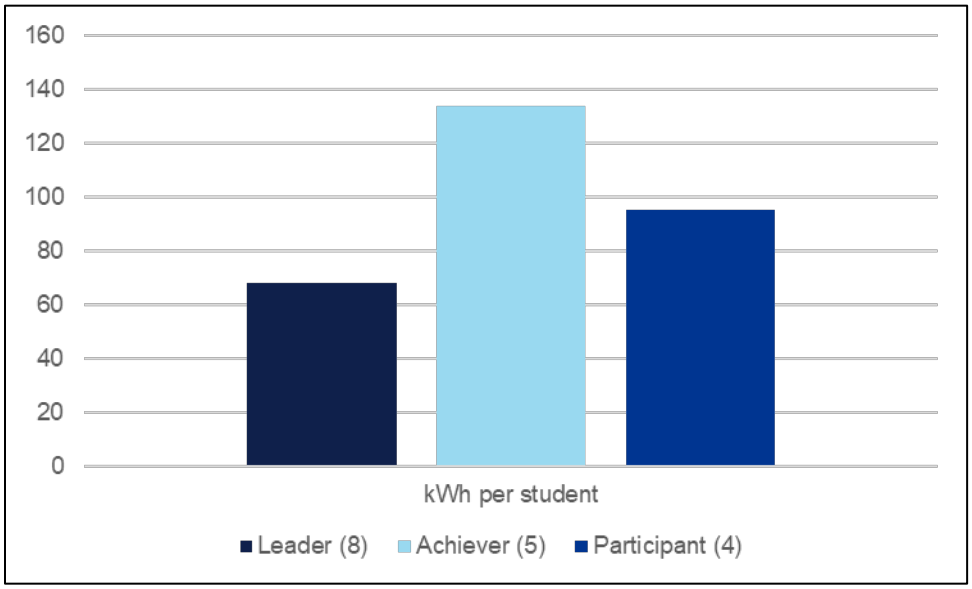
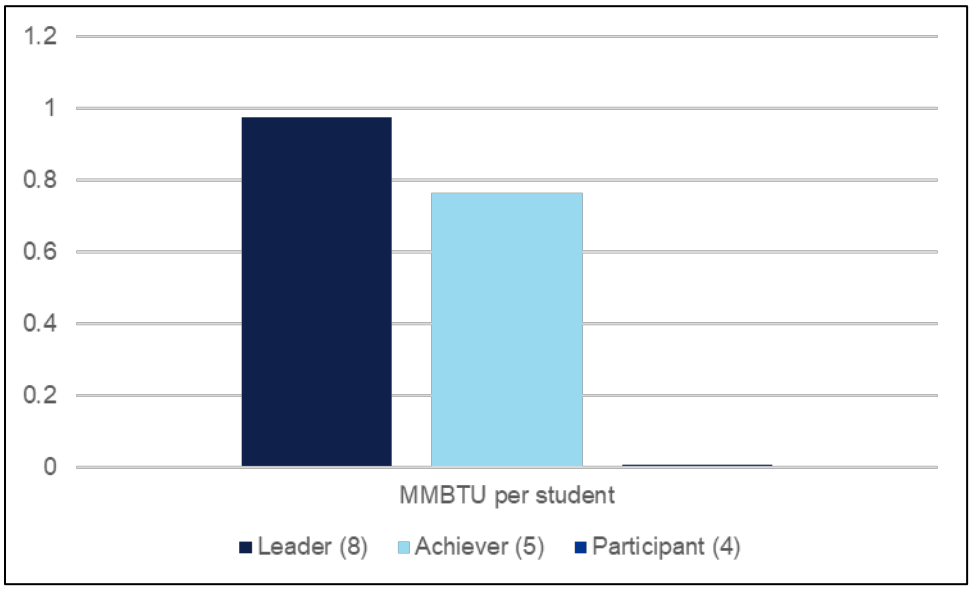


Figure 2-4. Fuel reduction per student by participation tier



2.1.3 Recommendations

The section below outlines the evaluation team's recommendations.

Recommendation 1: The program should consider a per square foot or per baseline energy usage metric to scale program reported savings more accurately. The reported savings are estimated by the program based on participation tier (Participant, Achiever, and Leader). An electric and fuel energy savings value was applied to participating campuses irrespective of size or baseline consumption. The program should consider introducing a savings per unit metric (e.g., energy savings per square foot,

energy savings as a percent of baseline energy usage) to scale reported energy savings to a campus' size for a given participation tier.

NYSERDA Recommendation Response: Pending. The Program will consider this approach.

Recommendation 2: The program should consider incentivizing campuses to report installed energy efficiency measures. The program does not currently keep track of energy efficiency measures implemented by the participants. Since REV CC does not offer a rebate for measure installation, aside from energy-to-lead (ETL) competition winners, providing participants with an incentive to report measures installed is valuable for two main reasons. First, having a list of measures for each campus facilitates the quantification of savings, and second, it allows for an evaluation with less risk of low-savings bias. This risk is related to respondent recall as well as staff turnover, which, anecdotally, seems to be high with these facility types (based on interviews). This means that the contact at the time of evaluation might not be familiar with the program or the measures implemented since participation.

NYSERDA Recommendation Response: Rejected. The Program does not have available funds to incentive this. This recommendation will be considered for future endeavors of a similar nature.

Recommendation 3: The program should consider acquiring permission from the customer and collecting two years of pre-participation utility billing data at the time of enrollment for campuses where this is feasible. The program evaluation would benefit from having access to the schools' utility and/or POD account information and should acquire permission from the customer to collect two years of pre-participation utility billing data at the time of enrollment. It is important to make this request through electronic data interchange (EDI) promptly as the data will not be easily accessible later. EDI is a method to securely request and collect utility data information from various utilities within New York state. This would benefit future evaluations, removing the barrier of requesting permission to access utility data at the time of the evaluation. Having two years of pre- and post- utility billing data allows for more accurate results during evaluation (e.g., using pooled regression analysis, the difference-in-differences method, etc.) and reduces uncertainty arising from a large percentage of estimated reads. This recommendation is true for any program for which billing analysis may be a primary evaluation methodology. Note that billing analysis will continue to have complications for evaluation purposes as the transition out of the pandemic continues.

NYSERDA Recommendation Response: Pending. The Program anticipates nine additional colleges signing up to join REV Campus Challenge. Given the possible program cost of a change in process and to participation, this action may not be feasible at this time. This recommendation will be considered for future endeavors of a similar nature.

Recommendation 4: The program should consider collecting basic campus information upon sign-up such as baseline energy use, building area, and number of students. The program does not currently collect information pertaining to a campus' characteristics such as academic building area, baseline energy usage, or number of students. The evaluation team acquired some of that information through either the in-depth interviews or the market research surveys. Having these metrics will ensure there is more consistent information across participants and allow for a more streamlined and accurate evaluation.

> **NYSERDA Recommendation Response**: Pending. The Program has historically asked for energy usage information in its annual survey. While useful for qualitative assessment, this data point was not received for a sufficient number of participants and in a manner that would facilitate impact evaluation. The Program will consider collecting this data for the remaining nine members. This recommendation will also be considered for future endeavors of a similar nature.

Recommendation 5: Questions focused on energy savings in market research surveys should be developed in tandem with impact evaluators. The market research survey collects high-level information on energy efficiency actions schools have taken. This information alone cannot inform the impact evaluation, especially for quantification of energy savings and attribution of such. For future market research efforts, questions focused on energy savings should be developed in tandem with impact evaluators to ensure that information provided is sufficient to accurately associate energy savings to respondents and quantify impacts of the program without unduly burdening respondents.

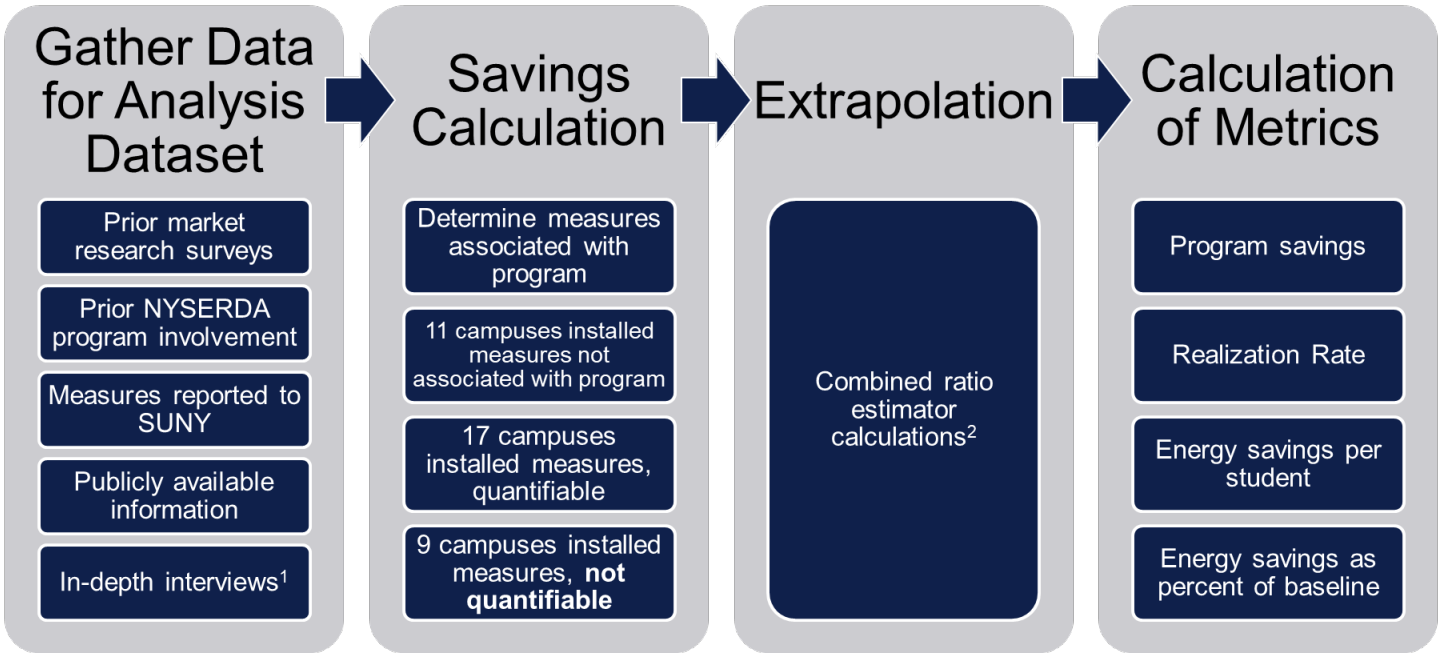
Recommendation 6: The program should consider adding a benchmarking component (within campuses and/or across campuses) to REV CC. Participants would be able to compare building performance within their campus and with other campuses. This would also fit with the challenge component of the program and potentially keep schools motivated when compared to others.

> **NYSERDA Recommendation Response:** Rejected. The Program does not have available funds to incentive this for free. Benchmarking is currently available as part of an energy study on a cost-shared basis. This recommendation will be considered for future endeavors of a similar nature.

3 Methods

The evaluation approach is summarized in Figure 3-1 and explained further in what follows.

Figure 3-1. Summary of analysis approach



[1] An in-depth interview is a qualitative data collection method through which specific information about the interviewee can be collected.

[2] Ratio estimator is a statistical parameter and is defined to be the ratio of means of two random variables. Combined ratio estimator is when two of these ratios are combined to form a representative metric to a certain population. This analytical method is typically utilized when estimating a weighted average of a population from a sample.

3.1 Data Collection and Measure Build-Up

The program offers numerous support programs to enable member institutions to make progress toward their energy efficiency and sustainability goals. The evaluation team conducted in-depth interviews (IDIs) with program participants to get a better understanding of the program's impact and what energy saving measures or actions were implemented. All available documentation was leveraged to inform the conversation with the participants, including the following:

3. **Market research survey response data from 2017, 2018, and 2019:** The market research survey responses identified the actions taken by participating campuses. The information collected from the survey informed the interviews and was intended to prime the interviewees of past projects they took part in.
4. **Information available from previous NYSERDA program involvement:** These records identified what NYSERDA-sponsored programs the campuses took part in as a direct result of their participation in REV CC. Recalling these programs during the interview was intended to

guide the conversation and focus on projects installed due to the impact of REV CC. In addition, project specifics gave the evaluation team more context ahead of the conversation with the participant. Having that information prompted the interviewer to ask targeted questions and retrieve the appropriate information.

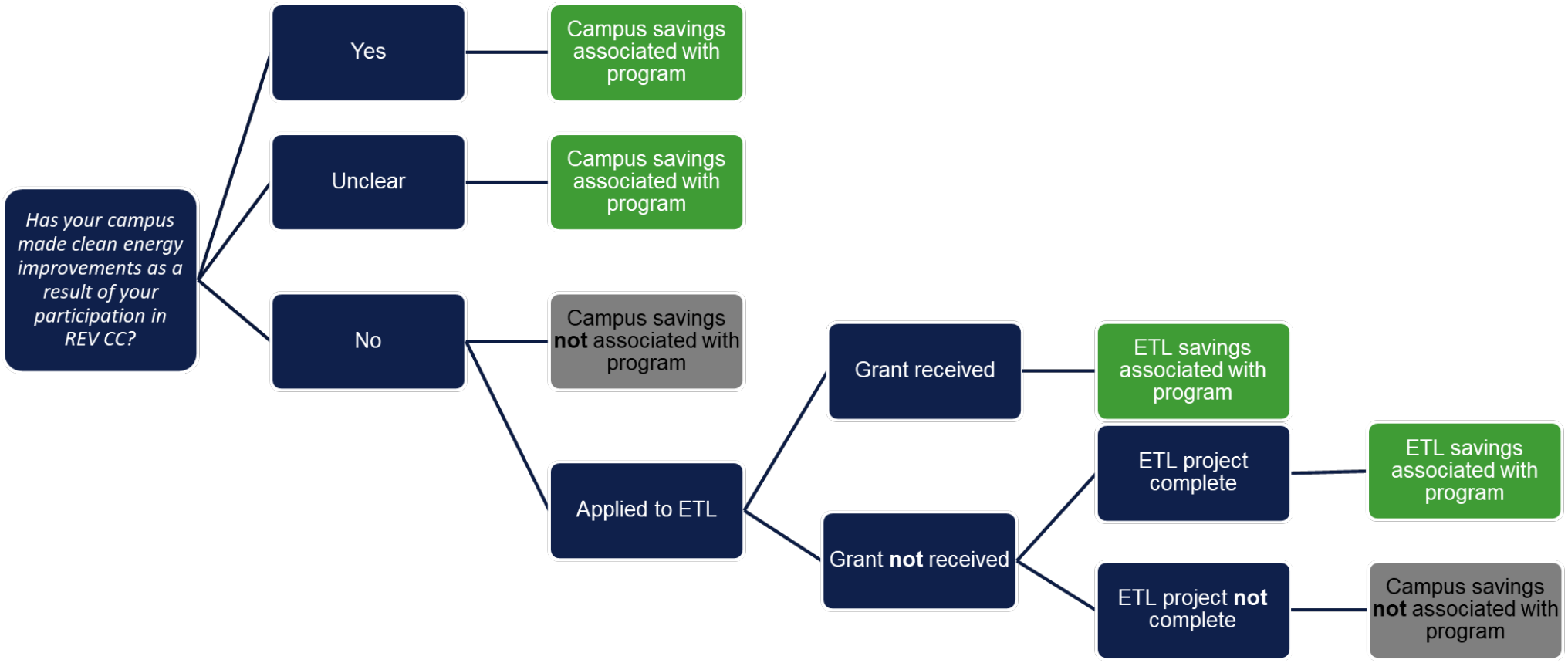
5. **Information provided by State University of New York (SUNY) representatives:** Through the interviews, it was found that SUNY schools have an ongoing initiative through their governing body that requires schools to report implemented energy efficiency projects. The evaluation team requested data that provided more visibility into the progress taking place at SUNY schools and the specific energy efficiency projects implemented.
6. **Publicly available information:** This involved conducting a general web search to learn about a campus' sustainability objectives and goals. In some instances, the evaluation team was able to retrieve a campus' energy master plan or climate action plan, both of which had commitments from the campus that could have been implemented as a result of REV CC participation.

Once the above documentation was reviewed, outreach attempts were made to recruit potential participants for IDIs. To ensure a targeted conversation and maintain consistency across participants, the evaluation team developed an interview guide. The guide primed and prompted the participants to reflect on energy efficiency actions taken because of their participation in the program. It also streamlined measure-specific data collection so that information obtained through the interviews could be easily translated into energy savings calculations. The interview guide is provided in Appendix B.

3.2 Savings Calculations and District-Level Expansion

The interviewer collected information on all energy efficiency actions that the participants had taken or plan on taking. Subsequently, districts were assigned to one of two categories based on their response. Figure 3-2 shows the decision matrix that was used to determine whether actions taken by a campus were associated with REV CC and subsequently had their energy savings counted toward the program.

Figure 3-2. Decision matrix used to determine savings associated with REV CC



After completing the categorization, the data collected on campuses with measures associated with REV CC was synthesized, tabulated, and made ready for analysis. The evaluation team had originally planned to supplement the IDIs with on-site M&V for a sub-sample of sites that have measures associated with the program. However, further inquiries to schedule site visits were unsuccessful due to a shortage of campus facility staff and tightening of school policy on visitors during the pandemic. Ultimately, the evaluation team was able to conduct site visits at two of the participating campuses. For all other schools, an engineering review was conducted to calculate energy savings of measures associated with REV CC and the New York Technical Reference Manual (NY-TRM) version 9 was utilized for methodology and assumptions, where necessary.

Finally, some participants indicated that they had taken action, but were unable to provide enough information to allow the evaluation team to calculate accurate and representative energy savings (e.g., participants indicated that they "replaced fluorescent fixtures with LEDs as they burn out" but could not provide a specific number or percent of total fixtures replaced). Appendix A provides a summary of evaluated measures, the data sources used, and the measure energy savings.

3.3 Final Expansion and Savings Calculations

The evaluation team expanded savings to the population using the method of combined ratio estimation. Two ratios were calculated from the data collected. They were multiplied to produce a ratio of evaluated program savings per student. Number of students was used as a proxy since no other campus-specific metrics were available.

The first ratio (Ratio A) calculated the proportion of students at campuses that reported completion of at least one energy-saving measure associated with the program. This ratio was calculated as:

$$\text{Ratio A} = \frac{\sum_{Sample\ with\ savings} students \times weight}{\sum_{Full\ Sample} students \times weight}$$

Ratio A can be understood as *"Campuses representing A% of the student population installed energy efficiency measures associated with the program."*

The second ratio was calculated from the sample of campuses that both reported having some savings and were able to provide enough information to estimate energy savings. This ratio estimated savings per student for campuses with some energy savings (savings greater than zero).

$$\text{Ratio B} = \frac{\sum_{Sample\ with\ verified\ savings} savings \times weight \times weight\ adjustment}{\sum_{Sample\ with\ verified\ savings} students \times weight \times weight\ adjustment}$$

Ratio B can be understood as *"Campuses that installed measures associated with the program saw a B kWh/student decrease in electric energy usage."*

The final combined ratio estimator is the product of Ratio A and Ratio B. The combined ratio estimator is the savings per student across the full program. One can interpret the final ratio as *"Participating campuses saved (A% x B) kWh/student."*

Annual savings for the program were calculated as a product of the combined ratio estimator and the total student population.

Savings per unit ratios were calculated by dividing the program savings by the estimated baseline energy use.

Appendix A: Interview Guide

Participant Screening and Intro

Thank you for being a member of the REV Campus Challenge. Through this interview, we're interested in learning about the impact of the actions your institution has taken. This interview should take approximately 20 minutes to complete. The information you provide will be kept confidential to the extent permitted by law including but not limited to the Freedom of Information Law (FOIL).

1. Are you the appropriate point of contact for REV Campus Challenge correspondences?
2. What is your role at [School Name]? [Facility manager, Energy manager, etc.]
3. ***[if market research B7.Q9 is yes]*** According to the most recent market research conducted, it was determined that the school has a dedicated staff member assigned to manage clean energy.
   [if not a participant] *Does the school have a dedicated staff member assigned to manage clean energy?*
   [If school has an energy manager and is different than the contact person, collect name and contact info of energy manager for potential follow-up]
4. What is the approximate number of students enrolled in the school?
5. What is the approximate square footage of the campus? How many buildings does the campus have?
6. Does your institution track annual building energy use?
   a. Energy Star Portfolio Manager
   b. *[For SUNY/CUNY]* Energy Cap
   c. Metering Plan
   d. AASHE STARS (sustainability, tracking and rating system)
   e. GRITS
   f. Other: Please Specify
7. If yes, is there a way for us to see or have access to the historical data?
   [If institution does track energy use but won't provide data and *If school* ***DID NOT*** *participate in market research study]*:
   a. In what range does the campus total **electric energy** usage (in MWh) fall in:
      i. <500
      ii. >500 and <1,000
      iii. >1,000
   b. In what range does the campus **total natural gas** usage (in MMBtu) fall in:
      i. <500
      ii. >500 and <1,000
      iii. >1,000

Influence REV CC had on School

8. Have you identified or used any of the following financial assistance programs as a result of your engagement in REV CC?
    a. DSIRE
    b. Dormitory Authority of the State of New York (DASNY)
    c. Energize NY Finance
    d. Energy Savings Performance Contracting
    e. Energy to Lead
    f. Green Revolving Funds
    g. NYCEEC
    h. NYPA
    i. NY Green Bank
9. Has your campus made clean energy improvements since joining the REV CC?
10. Do you know how many buildings on campus were improved as a result of your participation in REV CC? [Collect info below for each building]
    a. Does the institution track the energy usage of individual buildings? If so, can you provide us with historical utility data associated with these building?
    b. What is the square footage of these individual buildings?
    c. What type of buildings are they? (Academic, admin, labs, GYM, dorms, etc.)
    d. What is the major sustainability measure/upgrade at each of those upgraded buildings?
11. ***[if market research B2.Q3 is energy master plan or climate action plan]*** According to the most recent market research conducted, it was determined that the school completed a **[insert plan type]**.
    [if not a participant] Does your school have any of the following: climate action plan or energy master plan?
    a. Does it include a list of energy efficiency measures that you plan to accomplish?
    b. Have you accomplished any items included in that plan? Please elaborate.
    c. Can you provide us with this plan?
12. ***[IF GRITS USER]*** Have you been using GRIT to track your energy efficiency progress?
    a. Consistently
    b. Inconsistently
    c. No
13. ***[If Q11= a or b]***, Can you provide us with access to the information in the GRITS account?
14. Please indicate what has been done. *Use the prompts below.*
    a. Controls
        i. Have you changed set-points?
        ii. Have you changed schedules?
        iii. Any changes in control strategies?
    b. Capital projects
        i. Have you installed any new energy efficient equipment?

ii. Have you replaced any existing equipment with newer efficient ones? Did the old ones fail or was it for EE purposes?
iii. Are there any EE projects in the pipeline?

c. Behavioural (through student/staff engagement etc.)

15. Have you seen any savings due to the actions taken? [estimate % savings]

COVID Impacts

This next section will help us understand the impacts of the COVID-19 shutdowns had on the campus' energy usage.

16. Was the campus shut down during the pandemic? If so, when did the shutdown occur?
17. Were the students residing in dormitories allowed to stay on campus? Did they have access to the school facilities?
18. Were professors/ teachers allowed on campus?
19. Were there changes in operations during the shutdown?
    a. Lighting
    b. HVAC (schedules, ventilation, setback, set points)
20. Are students allowed back in classrooms?
21. Were there changes in operations after classes resumed?
    c. HVAC (more ventilation etc.)
22. Did you install any new equipment for air purification?

On-Site Request/ Close-out

This section is asking for their participation in an on-site

23. Later this year, our team may contact you regarding the next phase of this study, which involves a visit to your campus to inspect the changes discussed in this survey. The purpose of this visit is to better understand the energy savings impacts from this program. Your involvement would not affect incentives already received or any future incentives. Would you be willing to participate in the next phase of this study?
24. To better assess the facility's performance, with your approval, we would like to conduct a consumption data analysis. To do so, we would require the facility's electric and natural gas data. Can you provide us with that data? Alternatively, we can collect that data ourselves, but we would first need your electric and gas account numbers. (If there are multiple account associated with the facility, we would require all of them).
25. Please note that this survey, which requests more detailed information from participants, is separate from the REV Campus Challenge annual survey completed by members each year. The REV Campus Challenge annual survey will be issued later this year and should be completed by each member institution. We appreciate your assistance with both efforts. Are you the correct contact to respond to the annual member survey? **(Yes/No. If no, collect appropriate contact name, email, and telephone number)**

Thank you for your participation in this study and for being a REV CC member.

Appendix B: Direct Impacts Reporting Tables

Table B-1

Parameter (Description of strata)	Realization Rate Analysis Type - Weighted/Unweighted	Realization Rate - by Strata [a]	Evaluated savings as a percent of evaluated consumption baseline (%)	Confidence Interval/ Relative Precision (by strata)	Sample Size (n) (by strata)	Population Size (N) (by strata)
Program Overall - kWh	Weighted	2.04	0.02	0.68	37	126
Program Overall - All Fuels MMBtu	Weighted	2.30	0.01	0.68	37	126

[a] The realization rates are based on a verification buildup from baseline energy consumption. It is less applicable to future program populations when consumption per building deviates from the averages that existed in the current study population.

Table B-2

Parameter (Description of strata)	Type (VGSRR /APRR)	Effective from date (Year Quarter)	Effective until date (Year Quarter)	Electricity Savings Annual MWh (Realization Rate)	Natural Gas Savings Annual MMBtu (Realization Rate)	Heating Oil Savings Annual MMBtu (Realization Rate)	LPG (Propane) Savings Annual MMBtu (Realization Rate)	Other Fuel Savings Annual MMBtu (Realization Rate)	Renewable Energy Generation Annual MWh (Realization Rate)
Program Overall - kWh	VGSRR	2015 Q4	2020 Q1	2.04	NA	NA	NA	NA	NA
Program Overall - All Fuels MMBtu	VGSRR	2015 Q4	2020 Q1	NA	2.30	2.30	2.30	NA	NA

Table B-3

Parameter (Description of strata)	Type (VGSRR/ APRR)	Effective from date (Year Quarter)	Effective until date (Year Quarter)	Con Edison District Steam Savings Annual MMBtu (Realization Rate)	Electricity Usage Annual MWh (Realization Rate)	Natural Gas Usage Annual MMBtu (Realization Rate)	Con Edison District Steam Usage Annual MMBtu (Realization Rate)	Heating Oil Usage Annual MMBtu (Realization Rate)	LPG (Propane) Usage Annual MMBtu (Realization Rate)	Other Fuel Usage Annual MMBtu (Realization Rate)	Peak MW Reduction (Realization Rate)
Program Overall - kWh	VGSRR	2015 Q4	2020 Q1	NA	NA	NA	NA	NA	NA	NA	NA
Program Overall - All Fuels MMBtu	VGSRR	2015 Q4	2020 Q1	NA	NA	NA	NA	NA	NA	NA	NA