P-12 Schools Initiative – Benchmarking Program Impact Evaluation (May 2019 – May 2021)

Final Report

Prepared for:

New York State Energy Research and Development Authority
Albany, NY

Dana Nilsson
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

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Executive Summary

This report presents the results of the P-12 Schools Initiative – Benchmarking Program (P-12) impact evaluation, including the program savings as percent of baseline energy consumption, and relative savings per unit ratios (kWh/ft^2 and kWh/student). Upon enrollment, the P-12 Schools Initiative provides schools with a baseline report. Every six months thereafter, each school receives a benchmarking report to assess how their building is performing over time. After receiving two benchmarking reports, participating schools are eligible for an optional operational assessment which examines their energy systems more closely and recommends targeted energy saving measures. It is anticipated this engagement will help motivate participants to be more proactive with their energy efficiency planning.

Approach

The initial planned evaluation approach involved conducting a pre-post billing analysis using utility billing data. That approach proved infeasible due to less-than-optimal pre-period data and the impact of COVID-19 on school operations that confounded the analysis. As a result, the evaluation team opted to build a list of installed measures associated with the program for each school and district. Measure specifics were collected through in-depth interviews (IDIs) held with district and school representatives familiar with the effort. The interviews were supplemented by review of program benchmarking reports and operational assessments, where completed. Out of the 85 districts in the evaluated population, 56 were successfully recruited and interviewed by the evaluation team. Savings were first calculated at a district 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 was the ratio of evaluated savings to baseline consumption. 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 P-12 Schools Initiative impact evaluation. The results represent 85 participating districts with 352 schools.

Table ES-1. Summary of outreach efforts

District Population	Interviewed Districts	Districts with Reported Savings	Districts with Quantifiable Savings[a]
85	56	34	17

[a] Out of the 34 interviewed districts that reported savings, the evaluation was able to calculate savings for 17 districts only. The remaining 17 districts did not provide defined measures or estimates of the project scope.

Table ES-2. Evaluated savings

Fuel	Participant Baseline Consumption	Evaluated Percent of Baseline Consumption Saved	Verified Gross Savings	Verified Gross Savings per Square Foot	Verified Gross Saving per Student
Electric (kWh)	247,664,465	2.8%	6,934,063	0.18	39.51
Gas (MMBTU)	1,616,848	-0.7%	-11,928	0.00	-0.07
Other Fuels (MMBTU)	219,255	-0.7%	-1,618	0.00	-0.01

The negative gas and fuel savings are due to HVAC interactive effects from lighting measures, which represented most of the efficiency upgrades installed.

The evaluated savings reflect current progress made by early program adopters, as they have had more time to plan and execute projects. The majority of participants are currently planning larger capital projects. Savings from these projects were not captured in this evaluation cycle.

The program reported energy savings by estimating energy savings per building for each participating school and district. Table ES-3 below presents the program reported and evaluated savings as well as the realization rate.

Table ES-3. Program realization rate

Fuel	Energy Savings per Building	Number of Buildings Within Population	Program Reported Savings	Verified Gross Savings	Verified Gross Savings Realization Rate
Electric (kWh)	29,000	352	10,208,000	6,934,063	68%
Gas (MMBTU)	129.2	352	45,478	-11,928	-26%
Other Fuels (MMBTU)	32.3	352	11,370	-1,618	-14%

The negative gas and fuel savings are correlated with the actual electric savings; therefore, it is not recommended that the realization rate be applied to positive gas and fuel savings. Instead, a verified MMBTU usage per verified kWh saved ratio should be considered. 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.

The contributing factors to the realization rates are as follows:

1. The program is still in its early days, and the evaluated savings calculated reflect installations over one to two years.
2. The COVID-19 pandemic diverted the participants' attention to safety and compliance with new health regulations. As such, energy efficiency was not a priority.
3. Evaluated savings are based on the in-depth interviews and the data available. This method risks that some measures were not captured (potential low savings bias).

Findings

The section below outlines the team's findings.

4. **Overall, participants find the program highly valuable**. According to the interviews conducted, schools are using the information provided through the program to plan their capital projects, identify previously overlooked savings opportunities, and monitor their progress. In addition, districts are presenting these findings as evidence to their respective boards to persuade them to invest in energy efficiency.
5. **Most savings are from lighting measures**. More than 95% of savings stem from lighting measures. The other 5% consist of HVAC controls (set-points and setbacks), weatherization, and window replacements.
6. **The program should expect to see operational assessment measure savings in five to ten years.** Through the participant interviews, many respondents indicated that the main barrier to implementing measures is funding. These districts operate on a three-to-five-year capital planning cycle that most are currently undergoing. 87% of districts interviewed indicated that they are in the process of planning for energy efficiency measures. These respondents also indicated that information they've received through the program will be used and integrated into these plans. The estimate of five to ten years allows the majority of districts to finalize their budgets and complete their planned projects.
7. **Including the benchmarking consultant in evaluation outreach was key to high response rates.** The evaluation team attempted to conduct interviews with a census on the P-12 population and was not successful. Having the benchmarking consultants conduct initial outreach to the participants significantly increased the response rate (from 0% to 65%).

Recommendations

The section below outlines the evaluation team's recommendations.

1. **The program should consider incentivizing schools and districts to report installed energy efficiency measures.** The program does not currently keep track of energy efficiency measures implemented by the participating schools beyond the few self-reported measures on the benchmarking platform. Since P-12 does not offer a rebate for measure installation, providing schools with an incentive to report measures installed is valuable for the two main reasons. First, having a list

of measures for schools and districts facilitates the quantification of savings and allows for a more streamlined evaluation. Second, based on recruitment efforts, staff turnover seems to be high with these facility types. As a result, 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 offer is closed. NYSERDA will consider whether funding is available to provide such an incentive in future similar offers.

2. **The program should acquire permission from the customer and collect two years of pre-participation utility billing data at the time of enrollment**. The program has access to utility data that is self-reported by the participant. In most cases, the data dates back to a period up to one year prior to enrollment. The program would benefit from having access to the schools' utility accounts 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 EDI promptly, as the data will not be easily accessible later. This would also benefit future evaluators, 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 (using pooled regression analysis, the difference-in-differences method, etc.). 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: Rejected. The Program offer is closed. NYSERDA will consider this in future similar offers.

3. **Evaluations should include participants enrolled at least two years prior to the impact evaluation.** The team found that some participating schools enrolled in the program within less than two years of the program's impact evaluation. Assessment of a benchmarking program requires more than one year of post-black-out period data. The black-out period is the period during which the benchmarking contractors are collecting data (six months, in the case of the P-12 program) before the first benchmarking report can be generated. Evaluation of programs of this type will not yield reliable results after only one year of program activity since the design of the program, with ongoing reports and comparison to peers, sets the stage for long-term energy planning more than it pushes for immediate installation of measures (though some immediate measures may be implemented).

NYSERDA Recommendation Response: Implemented. Program will review participant counts and timeframes with the evaluation team prior to engaging in an evaluation, to ensure that when there is a relevant population to conduct a statistically significant and informative evaluation.

4. **The program should track operational assessment recommendations to allow for measure adoption rate (MAR) calculations and a more accurate evaluation**. The program should move forward with its plan to keep track of the operational assessment measures, similar to other NYSERDA programs such as FlexTech and Commercial Tenant, as it will facilitate the evaluation of the program and allow future evaluators to calculate a MAR.

   NYSERDA Recommendation Response: Implemented. The Program tracks operational assessment results.

1 Introduction

This report presents results of the P-12 Schools Initiative – Benchmarking Program impact evaluation, including the program savings as percent of baseline energy consumption, and relative savings per unit ratios (kWh/ft^2 and kWh/student).

1.1 Program Description

P-12 is defined as pre-kindergarten through Grade 12 education. The P-12 Schools Initiative encourages schools to lower greenhouse gas emissions, the leading contributor to climate change. There are more than 6,000 public and private schools in New York State. Together, they spend roughly $1 billion in annual energy costs while producing approximately 5.6 million metric tons of carbon dioxide or other harmful greenhouse gases. Working with NYSERDA, P-12 schools can lower both.

The P-12 Schools – Benchmarking Program[1] provides up to three years of free energy benchmarking services to eligible schools. Benchmarking is a mechanism to measure, track, and assess a building's utility, greenhouse gas, cost, and energy metrics over time or comparatively to similar buildings. Benchmarking helps schools better understand their energy use, identify inefficiencies, maximize energy performance, and support financial planning and budgeting.

Participating schools receive ongoing assistance from the Program's Benchmarking Contractors and have their utility data entered in the Program's Benchmarking Tool every six months to determine trends specific to energy usage, water usage, greenhouse gas emissions, and utility costs. Schools receive benchmarking reports outlining these trends through metrics, visuals, and graphics to help them understand how their building performs over time. An optional Operational Assessment is available for eligible schools interested in receiving building-specific energy and cost-saving recommendations.

1.2 Evaluation Objectives and Methods

Table 1-1 summarizes the objectives of this study.

[1] P-12 Schools Initiative – Benchmarking Program (PON 3908). This Program closed on March 31, 2022 https://portal.nyserda.ny.gov/CORE_Solicitation_Detail_Page?SolicitationId=a0rt000000UUvxsAAD

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

Objective	Purpose	Method
Evaluated gross energy impacts	Establish reliable first-year savings for program participants.	Phone survey of participants; identification of installed measures; collection of measure-specific information; engineering calculations; extrapolation of results to population
Savings over time	Determine the program specific methodology to evaluated gross energy savings over time. That 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; kWh/ft^2) to compare/contrast with other NYSERDA programs.	Utilize information from tracking data (district area and number of students per district) 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 while reviewing the program.	Investigate the effects that vendor type, audit consultant and 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 P-12 Schools Initiative – Benchmarking Program impact evaluation.

2.1 Results and Findings

2.1.1 Results

The evaluation population covers P-12 Schools Benchmarking program participants from the program's inception in March 2019 through June 2021. The evaluation population includes 85 districts with 352 schools in total. The population's total weather normalized baseline annual energy consumption, as reported in the benchmarking platform, was 247,664,465 kWh for electric, 1,616,848 MMBtu for gas, and a combined 219,255 MMBtu for fuel oil and propane. Furthermore, the districts include a total of 175,481 students that are housed in 38,041,146 square feet of building area.

As part of the evaluation, the evaluation team attempted to conduct interviews with a census of program participants. The evaluation outreach targeted district representatives and collected information on a school level whenever possible. Since data was not always available for all schools, the evaluation team considered an individual district to be the sample unit in conducting weighting and extrapolation. Table 2-1 summarizes the census effort results on a district and school level.

Table 2-1. Summary of census effort on a district and school level

Unit	District Population	Interviewed Districts	Districts/Schools with Reported Savings	Districts/Schools with Quantifiable Savings[a]
Districts	85	56	34	17
Schools	352	256	132	67
% Energy use with respect to population[a]	100%	77%	37%	19%

[a] The ratios represent combined source energy use (electric and heating fuels)

As shown in Table 2-1, out of the 85 districts in the population, the outreach effort successfully recruited and interviewed 56 districts. Of those 56 districts, 22 reported not having installed energy efficiency measures or implementing upgrades since participating in the P-12 Schools program. On the other hand, 34 districts reported implementing energy efficiency measures since program enrollment. The evaluation team was successful in evaluating energy savings for 17 out of the 34 districts that reported savings. The remaining sites failed to provide adequate information to conduct a reliable and accurate engineering calculation of savings. District-level measures and savings can be found in Appendix A.

To evaluate the program savings, three main metrics were calculated from the sample:

1. **Percent consumption of districts reporting savings:** This metric represents the percent of energy use, within the population of districts, that reported installing energy efficiency measures and is expected to exhibit energy savings.
2. **Percent of consumption saved in districts with reported savings:** This metric represents the percent energy reduction, with respect to the baseline, that is expected from schools that installed energy efficiency measures.
3. **Program percent of total combined district baseline energy consumption saved:** This metric is the product of the two above and represents the percent of energy reduced, with respect to baseline, 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 Consumption of Districts Reporting Savings	Percent of Consumption Saved in Districts with Savings[1]	Evaluated Percent of Total Combined District Baseline Energy Consumption Saved	Absolute Precision	Relative Precision
Electric (kWh)	51.1%	5.5%	2.8%	1.4%	49.7%
Gas (MMBTU)	49.6%	-1.5%	-0.7%	0.4%	53.5%
Other Fuels (MMBTU)	49.6%	-1.5%	-0.7%	0.4%	53.5%

[1] The negative gas and fuel savings are due to HVAC interactive effects from lighting measures which represented the majority of the efficiency upgrades installed.

Table 2-3 shows the evaluated energy savings and savings per unit ratio.

Table 2-3. Summary of evaluated savings

Fuel	Participant Baseline Consumption	Evaluated Percent of Baseline Consumption Saved	Verified Gross Savings	Verified Gross Savings per Square Foot	Verified Gross Saving per Student
Electric (kWh)	247,664,465	2.8%	6,934,063	0.18	39.51
Gas (MMBTU)	1,616,848	-0.7%	-11,928	0.00	-0.07
Other Fuels (MMBTU)	219,255	-0.7%	-1,618	0.00	-0.01

The program reported energy savings by estimating energy savings per building for each participating school and district. Table 2-4 presents the program reported and evaluated savings as well as the realization rate.

Table 2-4. Program realization rate

Fuel	Energy Savings per Building	Number of Buildings Within Population	Program Reported Savings	Verified Gross Savings	Verified Gross Savings Realization Rate
Electric (kWh)	29,000	352	10,208,000	6,934,063	68%

Gas (MMBTU)	129.2	352	45,478	-11,928	-26%
Other Fuels (MMBTU)	32.3	352	11,370	-1,618	-14%

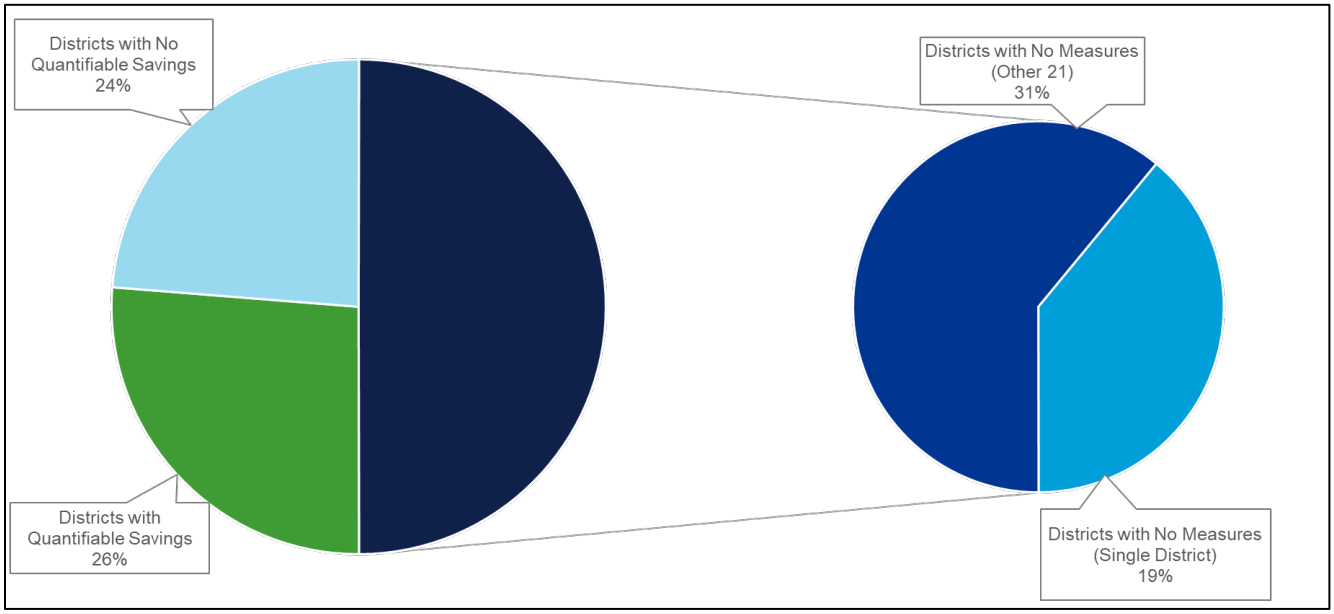
The negative gas and fuel savings are correlated with the actual electric savings; therefore, it is not recommended that the realization rate be applied to positive gas and fuel savings. Instead, a verified MMBTU usage per verified kWh saved ratio should be considered. The realization rates are based 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.

The contributing factors to the realization rates are as follows:

1. The program is still in its early days, and the evaluated savings calculated reflect installations over one to two years.
2. The COVID-19 pandemic diverted the participants' attention toward safety and compliance with new health regulations. As such, energy efficiency was not a priority.
3. Evaluated savings are based on the in-depth interviews and the data available. This method risks that some measures were not captured (potential low savings bias).

To provide more context on the evaluated sample, the evaluation team examined the interviewees to identify and appropriately weight them. Figure 2-1 shows the interview respondent distribution by percent energy consumption.

Figure 2-1. Interview respondent distribution of energy usage



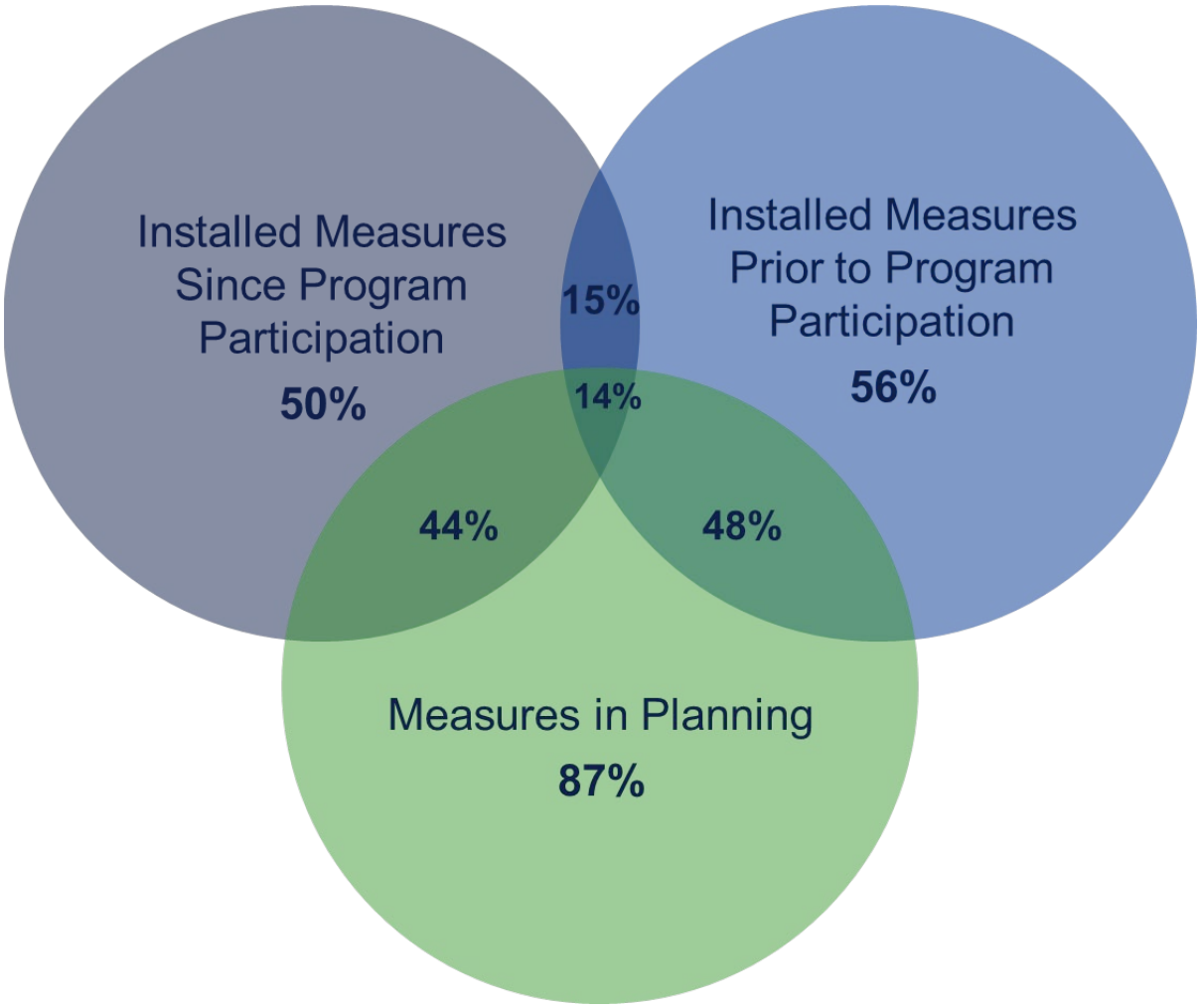
As shown in Figure 2-1, 50% of the total program energy consumption can be attributed to respondents who indicated that they had not installed measures since participating in the P-12 Schools Benchmarking program. A third of this subset's energy consumption is tied to a single school district. The remaining two-thirds of the energy consumption from districts with no measures comprises 21 districts. To ensure that the results were not skewed by a single participant, the evaluation team assigned the large district that represents a third of the energy consumption from districts with no measures to its own stratum during the expansion. This stratification ensures that the large district is only representative of itself and not of other districts.

2.1.2 Findings

The section below outlines the evaluation team's findings.

1. **Overall, participants find the program highly valuable**. According to the interviews conducted, the schools are using the information provided through the program to plan their capital projects, identify previously overlooked savings opportunities, and monitor their progress. In addition, districts are presenting these findings as evidence to their respective boards to persuade them to invest in energy efficiency.
2. **The program should expect to see operational assessment measure savings in five to ten years.** Through the participant interviews, many respondents indicated that the main barrier to implementing measures is funding. These districts operate on a three-to-five-year capital planning cycle, which most are currently undergoing. 87% of districts indicated that they are in the process of planning for energy efficiency measures. These respondents also indicated that information they have received through the program will be used and integrated into these plans. The five to ten years estimate allows the majority of districts to finalize their budgets and complete their planned projects. Figure 2-2 shows a breakdown of previous and future actions taken by participants.

Figure 2-2. Participant breakdown by energy efficiency activity



In addition, most program participants enrolled in the program in late 2020 and early 2021. Even though some early adopters have had more time to plan and execute projects, most participants are currently planning larger capital projects. Savings from these projects were not captured in this evaluation cycle.

1. **Most savings are from lighting measures**. More than 95% of savings stem from lighting measures. The other 5% consist of HVAC controls (set-points and setbacks), weatherization, and window replacements. Since most lighting upgrades are in interior spaces, the program accrued a large heating fuel penalty, which was not offset by gas-saving measures. The evaluation team found that the early adopters have engaged with low-cost, short-payback projects. As mentioned above, schools' budgeting cycles are more likely to capture and include higher-cost energy efficiency measures such as boiler replacements and heating controls. The evaluation team expects gas savings to increase in the next impact evaluation cycle.
2. **Including benchmarking consultant in evaluation outreach was key to high response rates.** The evaluation team attempted to conduct interviews with a census of the P-12 population and was not successful. Initial outreach efforts took place around the 2021 end-of-

year holiday period and proved to be challenging. These difficulties were compounded by the surging COVID-19 variant at the time which led to re-closures of schools. NYSERDA and the Evaluation Team agreed to halt outreach until mid-February of 2022 and to have the benchmarking consultant reach out to participants alerting them to the teams' pending outreach once the efforts resumed. This strategy proved successful and significantly increased the response rate (from 0% to 65%).

2.1.3 Recommendations

The section below outlines the Evaluation Team's recommendations.

1. **The program should incentivize schools and districts to report installed energy efficiency measures.** The program does not currently keep track of energy efficiency measures implemented by the participating schools beyond the few self-reported on the benchmarking platform. Since P-12 does not offer a rebate for measure installation, providing schools with an incentive to report measures installed is valuable for the two main reasons:

   - First, having a list of measures for schools and districts facilitates the quantification of savings and allows for a more streamlined evaluation.
   - Second, based on recruitment efforts, staff turnover seems to be high with these facility types. As a result, 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 offer is closed. NYSERDA will consider whether funding is available to provide such an incentive in future similar offers.

2. **The program should acquire permission from the customer and collect two years of pre-participation utility billing data at the time of enrollment**. The program has access to utility data that is self-reported by the participant. In most cases, the data dates back up to one year prior to enrollment. The program would benefit from having access to the schools' utility accounts 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 EDI promptly as the data will not be easily accessible later. This would also benefit future evaluators, removing the barrier of requesting permission to access utility data when they request 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 (using pooled regression analysis, the difference-in-differences method, etc.). 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: Rejected. The Program offer is closed. NYSERDA will consider this in future similar offers.

3. **Evaluations should include participants enrolled at least two years prior to the impact evaluation.** The Evaluation Team found that some participating schools enrolled in the program within less than two years of the program's impact evaluation. Assessment of a benchmarking program requires more than one year of post-black-out period data. The black-out period is the period during which the benchmarking contractors are collecting data (six months, in the case of the P-12 program) before the first benchmarking report can be generated. Evaluation of programs of this type will not yield reliable results after only one year of program activity since the design of the program, with ongoing reports and comparison to peers, sets the stage for long-term energy planning more than it pushes for immediate installation of measures (though some immediate measures may be implemented).

   NYSERDA Recommendation Response: Implemented. Program will review participant counts and timeframes with the evaluation team prior to engaging in an evaluation, to ensure that when there is a relevant population to conduct a statistically significant and informative evaluation.

4. **The program should track operational assessment recommendations to allow for Measure Adoption Rate (MAR) calculations and a more accurate evaluation**. The program should move forward with its plan to keep track of the operational assessment measures, similar to other NYSERDA programs such as FlexTech and Commercial Tenant, as it will facilitate the evaluation of the program and allow future evaluators to calculate a MAR.

   NYSERDA Recommendation Response: Implemented. The Program tracks operational assessment results.

3 Methods

3.1 Initial Approach

The initial evaluation plan for this program involved applying a statistical model to each school's utility billing data to assess energy savings across the portfolio. The methodology seemed reasonable at the time since school operations are consistent and have little variability from year-to-year, and therefore, energy savings can be easily identified. However, interruptions and closures due to COVID-19 meant that methodologies relying solely on utility data are less likely to present accurate or representative results for the full population.

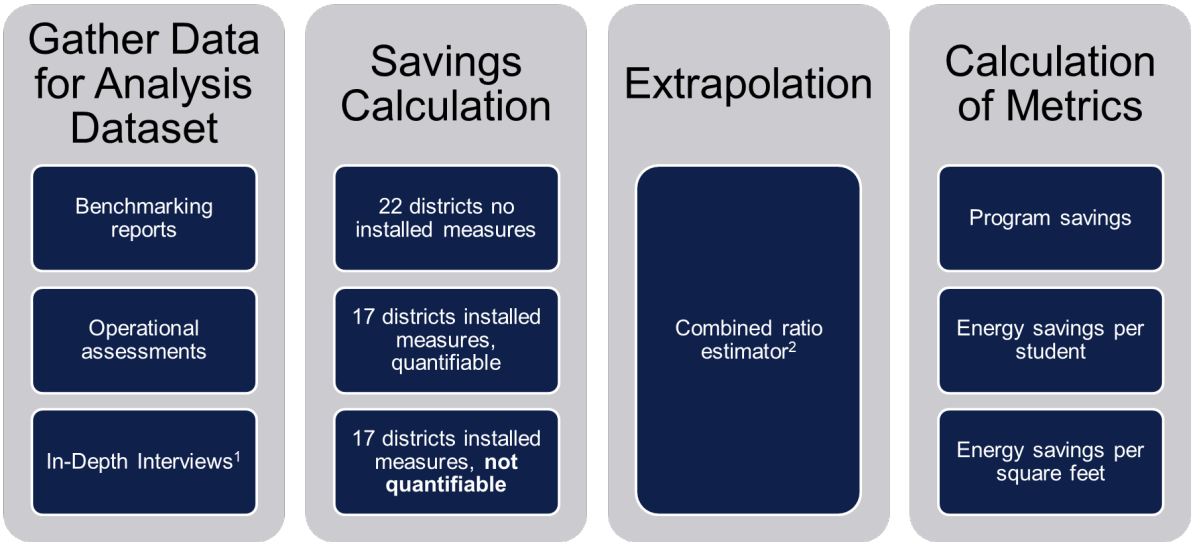
In addition, the program collected utility billing data that dates back to a year prior to enrollment. The data available and the population size would not be sufficient to employ an analytical model that yields high accuracy results given the non-routine events caused by the pandemic.

Consequently, the Evaluation Team elected to pursue a "bottom-up" (i.e., per-measure engineering calculation) approach to account for greater variability at sites.

3.2 Final Approach

The final 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.

3.2.1 Data Collection and Measure Build-Up

The program offers benchmarking and optional operational assessments with the intent that schools take action from this technical assistance. 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 the schools implemented. All available documentation was leveraged to inform the conversation with the participants, including the following:

1. **Benchmarking Reports:** Benchmarking reports helped identify the relative performance of schools within a district and monitor progression through each benchmarking period. This information informed the interviewer of potential changes related to energy consumption, or the lack thereof, and prompted appropriate questions.
2. **Operational Assessments, if available:** Some participating schools partook in an optional operational assessment which identified deficiencies and energy efficiency opportunities. These reports served as an additional data point in guiding the conversation with the participants and to assess whether the participants followed through and implemented any of the measure recommendations.
3. **Other sources:** Additional data sources provided by the customer (e.g., climate action plans, energy master plans, etc.) were reviewed and taken into consideration. As with the operational assessments, interviewees were prompted on measures found in these documents to collect relevant information.

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 C.

3.2.2 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 single or multiple categories based on their responses:

- **Installed measures since participating in the program:** This category was assigned to districts that had taken action at any of their schools since participation when energy savings could be expected due to their actions.
- **Installed measures prior to participation:** This category was assigned to districts that had not installed measures at any of their schools since participation. If any school within that district completed a measure prior to participation, savings from those measures were not attributed to the program. The evaluation team considered attributing savings to the program

from any measure that was in progress and then upgraded to an increased efficiency around the time of participation. However, this situation was never encountered in the IDIs.

- **Plan on installing measures:** This category was assigned to districts that had energy efficiency projects in planning regardless of whether they had already implemented any other measures.

It is important to note that the three categories are not mutually exclusive. Each district had a minimum of one and up to three categories assigned to it. The purpose of this exercise was to identify how many participants had already taken action because of the program and how many were in the planning process.

After completing the categorization, the data collected on districts with installed measures since participation was synthesized, tabulated, and made ready for analysis. The evaluation team conducted an engineering review of the sites and measures installed and attempted to calculate energy savings when possible. Some participants indicated that they had taken action but were unable to provide enough information to calculate energy savings that the evaluation team deemed accurate and representative (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).

For districts that provided enough information, the New York Technical Reference Manual (NY-TRM) version 9 was utilized to estimate energy savings. Since most of the measures reported were lighting, a light power density (LPD) or pre-post approach was conducted based on data availability. Appendix A provides a summary of evaluated measures, the analysis approach used, and the assumptions made as part of the analysis.

In a few instances, the participants were only able to provide information on a sub-set of schools within their district but indicated that similar projects were implemented in others. In those instances, the evaluation team expanded savings from evaluated schools to the entire district. The former was achieved by calculating savings with respect to baseline for evaluated schools and applying that ratio to the district's energy consumption. District-level energy savings can be found in Appendix B.

3.2.3 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 relative to baseline consumption.

The first ratio (Ratio A) calculated the proportion of baseline consumption from districts reporting completion of at least one energy-saving measure or action since participating in the program. This ratio was calculated as:

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

Ratio A can be understood as *"Districts representing A% of population electric energy use installed energy efficiency measures since participation."*

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

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

Ratio B can be understood as *"Districts that installed measures saw an average of B% decrease in baseline electric energy usage."*

The final combined ratio estimator is the product of Ratio A and Ratio B. The combined ratio estimator is the savings as a percent of baseline consumption across the full program. One can interpret the ratio as *"Participating Districts saved (A x B) % of their baseline energy use."*

Annual savings for the program were calculated as a product of the combined ratio estimator and the annual baseline consumption of districts.

Savings per unit ratios were calculated by dividing the program savings by either the number of students or total building square feet.

Appendix A: Interview Guide

1. Participant Screening and Intro

Thank you for being a participant in NYSERDA's P-12 Schools Initiative Benchmarking Program (PON 3908). Through this survey, we're interested in learning about the impact of the actions your institution has taken as it relates to the Benchmarking Program. This survey 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 P-12 schools' correspondences? If not, who is the appropriate contact?
2. What is your role? [District Facilities Director, District Business Official, District Superintendent etc.]
3. Does the district have a dedicated staff member assigned to manage clean energy?

[If yes, and the energy manager is different than the contact person, collect name and contact info of energy manager for potential follow-up]

2. Influence P-12 Schools had on Facilities

4. Have any of the schools in your district received at least one biannual benchmarking report? If yes, how many schools participated?
5. Did your schools use the benchmarking data to assess and compare your energy usage with prior months and/or years?
6. Have you utilized the online benchmarking platform to review available data? (y/n)
    a. (If y) Did your schools use the benchmarking data to assess and compare your energy use relative to other (and comparable) schools? (y/n)
    b. (If y) Did that review motivate you to investigate ways to reduce your energy consumption?
7. Did the benchmarking data/biannual benchmarking report(s) influenced you to implement energy efficiency or clean energy measures? (y/n)
    a. (If y) How many buildings received an upgrade?

   b. (If y) What types of buildings have you upgraded?

8. Did the benchmarking data/biannual benchmarking report(s) result in your schools moving forward with a capital planning, energy assessment or energy master planning project? (y/n)
   a. (If y) What type of analysis did you move forward with?
   b. (If y) Did you use a NYSERDA or utility program to fund the analysis (multiple choice (NYS, util, both))
9. Did your schools use the benchmarking data/biannual benchmarking report(s) to make informed decisions towards the implementation of a clean energy project (e.g., energy efficiency, energy conservation or renewable energy projects)? (y/n)
   a. (If y) What types of project(s) did you implement?
   b. (If y) Did you use the benchmarking data to track energy impacts from implemented projects?
10. Have you made other changes to your building(s) that were influenced by your participation in the Benchmarking Program? If so, what changes and at which building(s)?
11. Have you seen any savings due to the actions taken? [estimate % savings]
12. [for participants that had operational assessments] Did you implement any of the energy efficiency measures recommended to you in the Operational Assessment Report?
13. Did participating in the benchmarking program increase your understanding of the benefits of energy efficiency and/or clean energy at your school district? If yes, please describe.

3. COVID Impacts

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

14. Were the school building(s) participating in the Benchmarking Program closed, open, or open with reduced occupancy during the pandemic? If so, what was the approximate period of the closure or reduced occupancy (i.e., start and end date)?
15. What was the level of occupancy during the closure or reduced occupancy period?

a. 0% occupied
b. <25% occupied
c. 50% occupied
d. 75% occupied
e. No change. 100% occupied

16. Who occupied the school building(s) during this period? (Multiple choice, select all that apply)
    a. Facilities staff
    b. Teachers
    c. Students
    d. Administrators
    e. Other (describe)
17. Were there changes in operations during the closure or reduced occupancy period?
    a. Lighting reductions
    b. HVAC modifications
        i. Clarify between increase/decrease in HVAC operation as it relates to schedule modification, ventilation rates, zoning, outdoor air modulation, etc
        ii. Filtration
    c. Cooking level & kitchen/cafeteria operations
    d. Plug loads (e.g., computers and office equipment)
    e. Space use modifications (e.g., using non-classroom spaces as instructional spaces for student overflow/to account for social distancing & desk spacing)
    f. Building use (e.g., COVID testing centre, meal pick up, etc.)
18. Has/have the building(s) participating in the Benchmarking Program returned to 100% occupancy?
    a. If so, approximately when?

19. Once the building(s) returned to 100% occupancy, were there changes in operations as it relates to:
    a. Lighting
    b. HVAC modifications
        i. Clarify between increase/decrease in HVAC operation as it relates to schedule modification, ventilation rates, zoning, outdoor air modulation, etc)
        ii. Filtration
    c. Cooking level & kitchen/cafeteria operations
    d. Plug loads (e.g., computers and office equipment)
    e. Space use modifications (e.g., using non-classroom spaces as instructional spaces for student overflow/to account for social distancing & desk spacing, expanded kitchen/cafeteria operation to cycle fewer students for lunch over a longer timeframe)
    f. Building use (e.g., COVID testing centre, meal pick up, etc.)?
20. Did you install any new equipment for air purification/air cleaning? (y/n)
    a. (If y) What type of air purification/air cleaning was installed?
    b. (If y) Was this equipment permanently installed or portable?

4. Billing Data Request

This section is asking for utility data release forms

21. 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. We will follow-up with a billing data release form via email. The form grants us access to acquire monthly energy consumption data for the building. To streamline the process the key information we need from you today is the account numbers effected **(over the phone only)** and your permission **(has to be written, cannot be done over the phone)**.

Thank you for your participation in this study and for being a P-12 Schools participant.

Appendix B: Direct Impacts Reporting Tables

Direct impacts reporting tables

Table B-1. Direct impact reporting table

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	0.68	0.03	0.50	56	85
Program Overall - Gas MMBTU	Weighted	-0.26	-0.01	0.53	56	85
Program Overall - Other Fuel MMBTU	Weighted	-0.14	-0.01	0.53	56	85

[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. Direct impact reporting table

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	2019 Q2	2021 Q2	0.68	NA	NA	NA	NA	NA
Program Overall - Gas MMBTU	VGSRR	2019 Q2	2021 Q2	NA	NA	NA	NA	NA	NA
Program Overall - Other Fuel MMBTU	VGSRR	2019 Q2	2021 Q2	NA	NA	NA	NA	NA	NA

Table B-3. Direct impact reporting table

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	2019 Q2	2021 Q2	NA	NA	NA	NA	NA	NA	NA	NA
Program Overall - Gas MMBTU	VGSRR	2019 Q2	2021 Q2	NA	NA	-0.26	NA	NA	NA	NA	NA
Program Overall - Other Fuel MMBTU	VGSRR	2019 Q2	2021 Q2	NA	NA	NA	NA	-0.14	-0.14	NA	NA