Clean Energy Fund Workforce Development (WFD) Program

Market Assessment and Impact Evaluation

Appendix

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Appendix A: BOM Project Narratives

This appendix combines both billing analysis (where applicable) and engineering review for each project. The summary of these findings is noted in the main body of this report.

Site ID: SID-09

Subject: Impact findings for the site SID-09

Details: Training and other organizational activities, tracked and evaluated savings.

Facility type	Downstate multifamily properties
Area served by training (sq ft)	3,440,419
Agreement effective	September 27, 2018
Scorecard status	Encumbered

This training was designed to serve Service Employees International Union Local 32BJ members with training and career planning through NYSERDA-sponsored training in participating properties. The participating properties serve a range of multifamily buildings from income qualified to premium properties. Ultimately, five properties were recruited into the partnership. A labor relations firm was also a partner in the effort.

Table 1 summarizes the evaluated savings. The savings estimates consider all the available evidence including project file documents, consumption data, site interviews, and the results of subsequent analysis. There is evidence of substantial first-year savings in a weather-normalized consumption analysis, although there is no corroborating engineering analysis.

Table 1. **Site Savings Summary**

First Year Savings	Electric (MWh)	Natural Gas (MMBtus)
Scorecard reported savings	1,951	17,387
Evaluated savings	114	6,821
Realization rate	6%	39%
Annual base energy use	14,870	149,571
Tracked savings fraction	13.1%	11.6%
Evaluated savings fraction	0.8%	4.6%

The electric and natural gas savings were estimated using utility billing data consumption. There was no evidence in the files corroborating actions taken by the facility staff to produce the savings.

Events Calendar

Table 28 identifies key events in the history of the project. The table also identifies the months with billing data from either the BOM Report (available in six-month intervals) or utility-provided billing (available in monthly intervals), with a "B" or "P" indicating the month was included in the evaluated baseline or performance period, respectively. The red line indicates records that are hidden to keep the table to a reasonable length.

Month-Year	Events	BOM Billing	Utility Billing	BOM Period
Jan-2017		B Elec, Gas	None	Baseline
Aug-2018		B Elec, Gas	None	Baseline
Sep-2018	Contract effective	B Elec, Gas	None	Baseline
Oct-2018		B Elec, Gas	None	Baseline
Nov-2018		B Elec, Gas	None	Baseline
Dec-2018	First training (trained 28); First Quarterly Report	B Elec, Gas	None	Baseline
Jan-2019		P Elec, Gas	None	Performance
Feb-2019		P Elec, Gas	None	Performance
Mar-2019	Manager workshop; Green Coaching commences	P Elec, Gas	None	Performance
Apr-2019	Super/porter training (trained 15)	P Elec, Gas	None	Performance
May-2019		P Elec, Gas	None	Performance
Jun-2019	Semi-annual Report (Q1-Q2)	P Elec, Gas	None	Performance
Jul-2019		P Elec, Gas	None	Performance
Aug-2019		P Elec, Gas	None	Performance
Sep-2019		P Elec, Gas	None	Performance
Oct-2019		P Elec, Gas	None	Performance
Nov-2019		P Elec, Gas	None	Performance
Dec-2019	Semi-annual Report (Q3-Q4)	P Elec, Gas	None	Performance
Jan-2020		Elec, Gas	None	Performance
Feb-2020		Elec, Gas	None	Performance
Mar-2020	Super/porter training (trained 23)	Elec, Gas	None	Performance
Apr-2020		Elec, Gas	None	Performance
May-2020		Elec, Gas	None	Performance
Jun-2020		Elec, Gas	None	Performance
Jul-2020		Elec, Gas	None	
Aug-2020		Elec, Gas	None	
Sep-2020	Quarterly Report (Q2-Q4)	Elec, Gas	None	
Oct-2020	Nagle Report		None	

Month-Year	Events	BOM Billing	Utility Billing	BOM Period
Nov-2020			None	
Dec-2020	Last Quarterly Report		None	
Jan-2021	50 West Report		None	
Feb-2021	MBD Report; Gramercy Report, Blvd Gardens Report		None	

Description of Training and Related Activities

This description of the training was derived from a review of project file material. An inventory of the project file is included under Data Collection.

The training curriculum described in the scope was to cover basic energy efficiency and to include modules on:

- Building science and envelope
- Lighting and electrical systems
- Service water
- Heating systems
- Ventilation and indoor air quality
- Water efficiency

The curriculum was directed to be in line with BPI BOC certification. Overtime, the curriculum evolved to include more hands-on components, because "We are seeing a greater need for more hands-on training on specific strategies to further promote changes to day-to-day operations."

Recruit and train 250 building service workers including building superintendents, resident managers, and handypersons.

- SOW: Deliver training in two classes across 75 buildings
- Two curricula, one for porters, a second for supervisors

Organizational structures

SOW included:

- Career Services for the trainees including an action plan with recommendations for training, mentoring, career planning, advice on resumes, and interview skills.
    - It appeared that about 20 staff signed up for the services

- Consortium management received an initial assessment and recommendations for training and best practices
- Post training

(SOW) On-site coaching, two follow-up coaching session with building operator to reinforce lessons.

Tracked Savings

The savings for this project were in NYSERDA's Quarter 4 2021 CEF Report (known as the "Scorecard") as "complete" and are summarized in Table 2.

Table 2. Scorecard Reported Savings – Project Status is Encumbered [template]

Building	Electric Savings (MWh)	Gas Savings (MMBtu)
56 buildings, downstate	1,951	17,387
TOTAL		

Table 3 summarizes the square footage of the buildings in the project.

Table 3. Building Area (square footage) [template]

Building	Building Type	Building Area
56 buildings	Multifamily	3,440,419
TOTAL		

Data Collection

Project documentation

The Evaluation Team reviewed Building O&M project documentation provided by NYSERDA program staff. The project files included the following information:

- Agreement, dated September
- Application
- Quarterly Report
  - Reports included details about the training sessions, pictures
- Pre-/post surveys, about 15 unique individuals
- Property Final Report, one for each of five properties

Site interview

A site contact with knowledge of the building operation could not be recruited for an interview.

Consumption data

The Building O&M or BOM report for this site included billing data for an extended base period and for the performance period. The BOM Report billing data is provided in six-month intervals, not monthly. Monthly utility billing data was also acquired for electricity and natural gas.

Table 4. Summary of Billing Data

Bill Type	Fuel	Period	Months	Total for Period	Monthly Average	Units
BOM	Electricity	Jan 2017 to Sep 2020	42	30,087,098	716,359	kWh
BOM	Natural gas	Jan 2017 to Sep 2020	42	3,724,919	88,689	therms
Utility	Electricity - 1 account only	Dec 2017 to Feb 2022	51			

Savings Analysis

The WFD development training is intended to empower individuals and organizations with the skills and the motivation to improve building operations through a combination of low-cost measures and best practices behaviors. Behavior-related impacts are ideally captured using whole billing analytics, since the savings result from an accumulation of smaller measures and the baseline and performance conditions are not easily characterized using an engineering approach. However, it also useful and follows best evaluation practices to verify that the organization implemented the behavioral changes and to corroborate the magnitude of the savings with a high-level engineering analysis.

The saving for this site is based on a billing analysis using the BOM reported consumption data. Data for only one utility account was acquired and it was not incorporated in the analysis. There was limited information included in the project files describing the implementation of any energy conservation measures (ECMs).

Billing Analysis

Defining baseline and performance periods. The billing analysis uses the same baseline and performance period in principle as that specified in the BOM Report. The BOM Report is a NYSERDA-defined form used by the training providers to define the baseline period and to record consumption data every six months as the project progresses. The form calculates savings for each semi-annual interval as the difference between the baseline usage for the same six-month period and the most recent consumption data.

The evaluators do not recommend incorporating a "black-out" period from project start through the end of substantial training for these reasons:

- A black-out period is often applied in billing analysis of "widgets" so that the widget performance can be sharply delineated between the pre and post period. Training's impact is more diffuse and will start with the first day of training and accumulate in an unpredictable way overtime. A black-out period for this project would be eight months to a year in length.
- Since the baseline and performance period are closer in time without a black-out period, there are fewer other building changes impinging on the findings.
- The practice of defining the performance period beginning immediately from project start is observed in other whole-building behavioral programs and evaluations, like California's industrial behavioral program. Host sites can observe the savings and use that for team motivation.
- A very practical reason to not use a black-out period is COVID-19. COVID lockdown happened only a few months after the last training, and a black-out period would eliminate most of the performance period.

Utility Billing Results. The utility billing acquisition yielded only one electric account. Because each property had multiple meters, a single account would provide an incomplete view of energy use changes, so the data was not used.

BOM Billing Results. The normal approach for a site-specific billing analysis is to regress the monthly consumption figures against the heating and cooling degree days (HDD and CDD, respectively). However, the BOM data is provided in six-month intervals, not monthly, reducing the number of data points available and masking their correspondence with weather. In this analysis, the baseline and performance period usages were weather normalized by applying a ratio of the historical to TMY3 HDD (or CDD) for the same period. Once normalized, the performance period usage was subtracted from the baseline period usage to determine weather-normalized savings.

Two of the properties had incomplete BOM data and were excluded from the billing analysis. The savings fraction determined through the billing analysis of the three sites with sufficient billing was applied to average usage of these two buildings and added to the savings.

The BOM included billing data for all fuels for two years prior to the implementation of the program and for 12 months after the training commenced. Table 6 notes the average usage over two years in the base period and one year post period. Billing data was weather normalized using the semi-annual periods since that was the resolution of the consumption data.

Table 5. Consumption Analysis Results

Energy	Base Period Jan 2018 to Dec 2018	Post Period Jan 2019 to Dec 2019	Savings	Units	Savings Fraction
Electricity	3,787,156	3,433,097	354,059	kWh	9.3%
Natural gas	1,418,553	972,673	445,879	therms	31.4%

Engineering analysis

The project files contained no information about implemented measures, nor would the site respond to requests for interviews; therefore, there is no engineering analysis.

Site ID: SID-61

Subject: Impact findings for the site SID-61

Details: Training and other organizational activities, tracked and evaluated savings.

Facility type	K-12 schools
Area served by training (sq ft)	10,351,548
Agreement effective	August 01, 2017
Scorecard status	Complete

Summary

This project was organized through an association of school facilities that offered program sponsored training to its membership. The organization includes 600 schools, of which 81 participated in the training, per the Scorecard, and 80 staff members were trained. The training was conducted at convenient regional locations. Participating schools did not enroll all at once, but were recruited by the organization over time.

Table 1 summarizes the evaluated savings. The savings estimates consider all the available evidence including project file documents, consumption data, site interviews, and the results of subsequent analysis. There is evidence of substantial first-year savings in a weather-normalized consumption analysis, although there is no corroborating engineering analysis. There also no tabulation of the energy consumption of the participating schools. Two incomplete BOM Reports were included in the project files what appears to be two specific schools, hence, the annual base usage was back-calculated from program tracking data.

Table 6. Site Savings Summary

First Year Savings	Electric (MWh)	Natural Gas (MMBtus)
Scorecard reported savings	5,561	49,560
Evaluated savings	1,872	9,313
Realization rate	34%	19%
Annual base energy use	55,613	495,601
Tracked savings fraction	10.0%	10.0%
Evaluated savings fraction	3.4%	1.9%

The electric and natural gas savings were estimated using utility billing data consumption. There was no evidence in the files corroborating actions taken by the facility staff to produce the savings.

Description of Training and Related Activities

This description of the training was derived from a review of project file material. An inventory of the project file is included under Data Collection.

The training curriculum described in the scope of work was intended to include the following elements. Note that no classroom material, like slide decks, detailed classroom descriptions, or syllabi were included in the project files.

SOW: Subcontract with the Northwest Energy Efficiency Council (NEEC) to offer BOC training for 40 to 90 school facility directors and maintenance workers to prepare them for BOC certification

- Leverage: Building Condition Survey data to identify areas of needs and gaps

Topics:

- HVAC controls
  - Lighting/LED upgrades
  - Preventative/predictive maintenance
  - Custodial processes
  - Benchmarking
  - Cooperative energy purchasing/procurement
  - Building envelope improvements
  - Energy efficiency and new technology

Training delivery was described in the scope as follows:

- Provided in half-day sessions over six days.
- In addition, six school facilities staff were selected to be instructor trainees and participated in a full-day train-the-trainers course that delved into both content and pedagogical techniques.

Organizational structures. The scope of work described the following activities. The discussion group occurred during an annual conference.

- Creation of energy discussion group.
- Facilitated web-based energy discussions

Tracked Savings

The savings for this project were in NYSERDA's Quarter 4 2021 CEF Report (known as the "Scorecard") as "complete" and are summarized in Table 2.

Table 7. Scorecard Reported Savings – Project Status is Complete

Building	Electric Savings (MWh)	Gas Savings (MMBtu)
84 schools	5,561	49,560
TOTAL		

Table 3 summarizes the square footage of the buildings in the project.

Table 8. Building Area (square footage) [template]

Building	Building Type	Building Area
81 buildings	K-12 Schools	10,351,548
TOTAL		

Data Collection

Project documentation

The Evaluation Team reviewed Building O&M project documentation provided by NYSERDA program staff. The project files included the following information:

Site interview

A site contact with knowledge of the building operation could not be recruited for an interview.

Savings Analysis

The WFD development training is intended to empower individuals and organizations with the skills and the motivation to improve building operations through a combination of low-cost measures and best practices behaviors. Behavior-related impacts are ideally captured using whole billing analytics, since the savings result from an accumulation of smaller measures and the baseline and performance conditions are not easily characterized using an engineering approach. However, it also useful and follows best evaluation practices to verify that the organization implemented the behavioral changes and to corroborate the magnitude of the savings with a high-level engineering analysis.

The electric and natural gas savings for this site is based on a billing analysis using the monthly utility data. The project files did not include any information describing the implementation of any energy conservation measures (ECMs), so this site relies on the billing analysis alone.

Billing Analysis

Defining baseline and performance periods. The billing analysis uses the same baseline and performance period in principle as that specified in the BOM Report. The BOM Report is a NYSERDA-defined form used by the training providers to define the baseline period and to record consumption data every six months as the project progresses. The form calculates savings for each semi-annual interval as the difference between the baseline usage for the same six-month period and the most recent consumption data.

The evaluators do not recommend incorporating a "black-out" period from project start through the end of substantial training for these reasons:

- A black-out period is often applied in billing analysis of "widgets" so that the widget performance can be sharply delineated between the pre and post period. Training's impact is more diffuse and will start with the first day of training and accumulate in an unpredictable way overtime. A black-out period for this project would be eight months to a year in length.
- Since the baseline and performance period are closer in time without a black-out period, there are fewer other building changes impinging on the findings.
- The practice of defining the performance period beginning immediately from project start is observed in other whole-building behavioral programs and evaluations, like California's industrial behavioral program. Host sites can observe the savings and use that for team motivation.
- A very practical reason to not use a black-out period is COVID-19. COVID lockdown happened only a few months after the last training, and a black-out period would eliminate most of the performance period.

Utility Billing Results. In this analysis, the monthly utility provided billing data was regressed against historical weather data following CalTrack protocols for cleaning and screening data. Data from seven meters were dropped from the analysis, due to anomalies. Table 9 presents the savings fractions for all included 45 electric and 51 gas meters for the first and second 12-month period of the BOM Performance Period and for subsequent calendar years. The savings fraction for 2019 was selected as the most applicable savings fraction aligning with the BOM performance period without overlapping COVID.

Table 9. Utility Billing Analysis Results by Electric and Natural Gas

	Modeled Base	BOM 12 Month Savings	BOM 24 Month Savings	2019 Savings	2020 Savings	2021 Savings
Electric	84,522,070	2.2%	2.9%	2%	3.4%	7.9%
Gas	3,601,349	3.3%	2.7%	1.9%	-0.4%	-16.1%

BOM Billing Results. The BOM reports were not provided for this project.

Engineering analysis

The project files contained no information about implemented measures, nor would the site respond to requests for interviews; therefore, there is no engineering analysis.

Site ID: SID-88

Subject: Impact findings for the site SID-88

Details: Training and other organizational activities, tracked and evaluated savings.

Facility type	Urban medical hospital and research facility
Area served by training (sq ft)	4,581,711
Agreement effective	May 1, 2017
Scorecard status	Complete

Summary

The focus of the training was an apprenticeship program designed to bring in 12 promising new hires and to put them through an 18-month program with about 1,200 hours of in-classroom and on-the-job instruction resulting in certification by the Refrigeration Institute. The organization (staff size of 110) was motivated to sponsor the internship because of pending retirements and employee retention issues. A second part of the project was the piloting of a mid-level operator coaching program with 15 hours of classroom work focused on Building Management Systems (BMS), where the trainees were taught to trend equipment, diagnose operations, and update control sequences. Originally, the plan was to train eight operators through the pilot, but ultimately, 32 were trained.

The organization had a commitment to staff development and actively managing the buildings. Before the WFD project, 75 staff members received Building Operator Certification (BOC) sponsored by the organization. Staff had identified projects with substantial savings. The site contact offered energy efficiency audits of two buildings that were focused on operational improvements as evidence of the kinds of measures staff implement.

Table 10 summarizes the evaluated savings. The savings estimates consider all the available evidence including project file documents, consumption data, site interviews, and the results of subsequent analysis. The site purchased district steam accounting for about 96% of the thermal load, which was not identified in the Scorecard. The natural gas and district steam usage and savings were converted to an equivalent thermal load, which is reported as thermal savings as measures would impact steam usage as well as natural gas.

Table 10. **Site Savings Summary [template]**

First Year Savings	Electric (MWh)	Natural Gas (MMBtus)	District steam – (MMBTUs)
Scorecard reported savings	415	3,695	Not reported
Evaluated savings	1,857	-690	73,221
Realization rate	448%	-19%	NA

Annual base energy use	128,317	33,976	792,938
Tracked savings fraction	0.3%	10.9%	NA
Evaluated savings fraction	1.4%	-2.0%	9.2%
Thermal savings		8.9%	

The consumption analysis was based on the semi-annual usage data provided for the primary fuels in the semi-annual BOM Report. The customer did not authorize release of utility billing data.

There is evidence of substantial first-year savings in the weather-normalized consumption analysis and the building audits provided by the site identify mechanisms for achieving the savings, although there is no direct record of the implemented measures or the staff responsible for that implementation. The training from this program is an integral part of a facility strategy to create an empowered staff able to identify energy savings opportunities and implement them. While the project files do not establish a direct linkage between the specific trainees and the implementation of specific measures, the savings are generated by ongoing operational improvements implemented by facility staff.

Events Calendar

Table 11 identifies key events in the history of the project. The table also identifies the months with billing data from either the BOM Report (available in six-month intervals) or utility, although no utility billing data was acquired. The red line indicates records that are hidden to keep the table to a reasonable length. The table identifies the months identified as baseline or performance periods in the BOM Report.

Table 11. Event and Billing Data Calendar [template]

Month-Year	Events	BOM Billing	Utility Billing	BOM Period
Jan-2016	First month of BOM baseline	Elec, Gas, Steam	None	Baseline
Jul-2016	Audit RCx study published, Building A	Elec, Gas, Steam	None	Baseline
Sep-2016	Audit RCx study published, Building B	Elec, Gas, Steam	None	Baseline
Apr-2017		Elec, Gas, Steam	None	Baseline
May-2017	Agreement effective date	Elec, Gas, Steam	None	Baseline
Oct-2017	Apprenticeship begins	Elec, Gas, Steam	None	Baseline
Nov-2017		Elec, Gas, Steam	None	Baseline
Dec-2017		Elec, Gas, Steam	None	Baseline

Month-Year	Events	BOM Billing	Utility Billing	BOM Period
Jan-2018	Contract executed with training provider	Elec, Gas, Steam	None	Performance
Feb-2018		Elec, Gas, Steam	None	Performance
Mar-2018		Elec, Gas, Steam	None	Performance
Apr-2018	Coaching pilot	Elec, Gas, Steam	None	Performance
May-2018	Coaching pilot	Elec, Gas, Steam	None	Performance
Jun-2018	Coaching pilot	Elec, Gas, Steam	None	Performance
Jul-2018		Elec, Gas, Steam	None	Performance
Aug-2018		Elec, Gas, Steam	None	Performance
Sep-2018		Elec, Gas, Steam	None	Performance
Oct-2018	Coaching Course, 2nd cohort	Elec, Gas, Steam	None	Performance
Nov-2018	Coaching Course, 2nd cohort	Elec, Gas, Steam	None	Performance
Dec-2018	Coaching Course, 2nd cohort	Elec, Gas, Steam	None	Performance
Jan-2019			None	
Feb-2019			None	
Mar-2019			None	
Apr-2019	Coaching Course, 3rd cohort		None	
May-2019	Coaching Course, 3rd cohort		None	
Jun-2019	Coaching Course, 3rd cohort		None	
Jul-2019			None	
Aug-2019	Coaching Course, 4th cohort		None	
Sep-2019	Coaching Course, 4th cohort		None	
Oct-2019	Coaching Course, 4th cohort		None	
Nov-2019				
Jun-2020				
Jul-2020	Last Quarterly Report in file			

Description of Training and Related Activities

This description of the training was derived from a review of project file material. An inventory of the project file is included under Data Collection.

Training included these elements:

- 1,200 hours of classroom and hands-on for an 18-month apprentice program
  - Heavy focus on refrigeration
  - Includes exam prepping for the Refrigeration Systems Operating Engineers exam
- A specialized "Hospital" curriculum focusing on energy efficiency opportunities in a hospital while maintaining the conditions required for surgical suites and other critical functions

Organizational structures. The activities included creating organizational structures to sustain ongoing improvements. The activities included:

- Commitment to maintaining the apprenticeship program to meet staffing needs overtime
- Commitment to providing mid-level training and advancement.

Coaching. The activities included:

- A coaching pilot aimed at mid-level staff who have taken BOC 1, 2, or BRT. Designed to give operators greater insight into their building system performance and encourage analytical system-level thinking and more in-depth use of Building Automation Systems. Thus, operators become better prepared and more likely to use data trending as a way to improve the building's operational energy efficiency.
- Class meets over 8 months to meet in every season. Select four systems from the campus and successively log data and analyze the outcomes to determine more optimum control settings or other fixes.

Tracked Savings

The savings for this project were in NYSERDA's Quarter 4 2021 CEF Report (known as the "Scorecard") as "complete" and are summarized in Table 12.

Table 12. Scorecard Reported Savings – Project Status Is Complete

Building	Building Type	Building Area
1	17	151
2	125	1,117
3	67	596
4	20	179
5	22	192
6	67	600
7	30	265

Building	Building Type	Building Area
8	67	596
TOTAL	415	3,695

This savings fraction shown in Table 10 were calculated using the CEF Reported savings and the weather normalized average baseline energy use.

Table 13 summarizes the square footage of the buildings in the project.

Table 13. Building Area (square footage)

Building	Building Type	Building Area
Campus	Medical facility	4,581,711
TOTAL		

Data Collection

Project documentation

The Evaluation Team reviewed Building O&M project documentation provided by NYSERDA program staff. The project files included the following information:

- Agreement and application
- Trainee surveys from 12 apprentices
- Energy Audit and Retro-commissioning report, July 2016. Focus on certain floors owned by the facility, September 2016
- Energy Audit and Retro-commissioning report. Focus on a single building
- Training rosters – 12 apprentices and 10 for the coaching pilot

Site interview

The site contact refused to be interviewed.

Consumption data

The Building O&M or BOM Report for this site included billing data for a base period and for a performance period. The BOM Report billing data is provided in six-month intervals, not monthly. Table 14 summarizes all the available energy consumption data. The natural gas and district steam usage has been converted to equivalent thermal loads, which illustrates the importance of district steam in providing heating.

Table 14. Summary of Billing Data

Bill Type	Fuel	Period	# of Mnth	Total for Period	Monthly Average	Units	Equiv. Annual Thermal Load
BOM	Electricity	Jan 2016 to Dec 2018	36	401,414,316	11,150,398	kWh	NA
BOM	Natural gas	Jan 2016 to Dec 2018	36	959,340	26,648	therms	4%
BOM	District steam	Jan 2016 to Dec 2018	36	1,260,891	35,025	Mlbs	96%
Total thermal load (MMBTU)							826,913

Savings Analysis

The WFD development training is intended to empower individuals and organizations and provide them with the skills and the motivation to improve building operations through a combination of low-cost measures and best practices behaviors. Behavior-related impacts are ideally captured using whole billing analytics, since the savings result from an accumulation of smaller measures and the baseline and performance conditions are not easily characterized using an engineering approach. However, it also useful and follows best evaluation practices to verify that the organization implemented the behavioral changes and to corroborate the magnitude of the savings with a high-level engineering analysis.

The saving for this site is based on a billing analysis using the BOM reported consumption data corroborated using an engineering based high-level estimates of impacts for measures recorded as implemented by the team in the Opportunity Log.

Corroboration of the billing analysis was made using two energy efficiency audits included in the files that identified operational improvements which could, if implemented, explain the savings observed in the bills. Table 15 compares the billing results and the savings potential identified in the studies.

The electric and natural gas savings for this site is based on a billing analysis using the BOM usage data, corroborated using estimate of impacts for energy conservation measures (ECMs) identified in two energy efficiency audits included in the files that identified operational improvements which could, if implemented, explain the savings observed in the bills. Table 15 compares the billing results and the audit recommendations.

Table 15. Comparison of Billing Analysis and Engineering Analysis Results

Energy	Billing Analysis Savings	Engineering Analysis	Units	Fraction
Electricity	2,531,000	2,698,131	kWh	106%
Thermal Load	72,531	9,983	MMBTU	14%

Billing Analysis

Defining baseline and performance periods. The billing analysis uses the same baseline and performance period as that specified in the BOM Report. The BOM Report is a NYSERDA-defined form used by the training providers to define the baseline period and to record consumption data every six months as the project progresses. The form calculates savings for each semi-annual interval as the difference between the baseline usage for the same six-month period and the most recent consumption data.

The evaluators do not recommend incorporating a "black-out" period from project start through the end of substantial training for these reasons:

- A black-out period is often applied in billing analysis of "widgets" so that the widget performance can be sharply delineated between the pre and post period. Training's impact is more diffuse and will start with the first day of training and accumulate in an unpredictable way overtime. A black-out period for this project would be eight months to a year in length.
- Since the baseline and performance period are closer in time without a black-out period, there are fewer other building changes impinging on the findings.
- The practice of defining the performance period beginning immediately from project start is observed in other whole building behavioral programs and evaluations, like California's industrial behavioral program. Host sites can observe the savings and use that for team motivation.

BOM Report Billing Results. The normal approach for a site-specific billing analysis is to regress the monthly consumption figures against the heating and cooling degree days (HDD and CDD, respectively). However, the BOM data is provided in six-month intervals, not monthly, reducing the number of data points available and masking their correspondence with weather. In this analysis, the baseline and performance period usages were weather normalized by applying a ratio of the historical to TMY3 HDD (or CDD) for the same period. Once normalized, the performance period usage was subtracted from the baseline period usage to determine weather-normalized savings.

The BOM included billing data for all fuels for two years prior to the implementation of the program and for 18 months after the training commenced. Table 16 notes the average usage over two years in the base period and one year post period. The last semi-annual reporting period was not included in the file. Billing data was weather normalized using the semi-annual periods, since that was the resolution of the consumption data.

Table 16. Consumption Analysis Results

Energy	Base Period	Post Period	Savings	Units	Savings Fraction
Electricity	128,316,616	126,459,307	1,857,309	kWh	1.4%
Natural gas	339,756	346,655	(6,899)	therms	-2.0%
District Steam	464,872	421,945	42,927	Mlbs	9.2%
Thermal Load	826,913	754,382	72,531	MMBTUs	8.8%

Engineering analysis

An engineering-based estimate was not possible as the site contact did not respond to requests for interviews nor did the project files identify specific measures that were identified and/or implemented by the trainees. However, there were two energy efficiency audits included in the files that identified operational improvements which could, if implemented, explain the savings observed in the bills. Table 17 presents the retro-commissioning measures recommended in this study that could be implemented by staff.

Table 17. Audit Recommended RCx and Low-Cost Measures

Energy Conservation Measure (ECM)	Building	Electric Savings (kWh)	District steam (Mlbs)	Chiller (ton-hrs)
Steam pressure reset	Building 1		212	
Reduce ventilation rates	Building 1	132,273	1,076	1,038
Air-handling scheduling	Building 1	133,222	529	235,215
Supply static reset	Building 1	30,094		
Supply temperature reset	Building 1	282,818	-46	235,776
OA economizer	Building 1	67,815	1,208	100,585
Compressed air control modifications	Building 1	18,803		
Building 1 Total		665,025	2,767	572,614
Nighttime setback	Building 2	311,403	1175	
Nighttime setback	Building 2	1100714	1515	
AHU Static pressure	Building 2	596870		
Condensate recovery	Building 2		396	
DHW	Building 2	24119		
Building 2 Total		2,033,106	3,086	
TOTAL Building 1 and 2		2,698,131	5,853	572,614

Site ID: SID-44

Subject: Impact findings for the SID-44

Details: Training and other organizational activities, tracked and evaluated savings.

Facility type	Suburban university campus
Area served by training (sq ft)	4,587,261 square feet
Agreement effective	June 1, 2017
Scorecard status	Complete

Summary

For this project, the university created a series of on-line instructional videos for specific O&M procedures and linked them to the university work order system. The purpose of the videos was to improve the timing for completing the associated work order. Three technical videos were produced that addressed cooling tower water testing, condensate receiver water testing, and rebuilding a common water heater. Two administrative videos addressed processes for completing purchase orders. Since none of instructions will produce energy savings and no other training videos were added, there are no savings associated with this activity. Table 1 summarizes the savings findings.

Table 1. Site Savings Summary

First Year Savings	Electric (MWh)	Natural Gas (MMBtus)	# 2 Fuel Oil (MMBtus)
CEF reported savings	2,237	19,932	
Evaluated savings	0	0	0
Realization rate	0%	0%	NA
Annual base energy use	68,585	401,567	6,284
Tracked savings fraction	3.3%	5.0%	NA
Evaluated savings fraction	0%	0%	0%

This is one of the earliest Workforce Development (WFD) projects and is not representative of later projects. The information in the project documentation shows that the tool does not help to develop any energy efficiency measures or to implement them but rather as a guide to fixing failed equipment or maintaining water treatment. The site contact noted benefits of reduced training a new hire and as an aid to help the staff to diagnose failed equipment faster. The site contact confirmed that these were the only modules implemented, although they do plan to implement additional modules in the future.

Since this effort does not results in energy savings the evaluated savings is zero.

Events Calendar

Table 2 identifies key events in the history of the project. The table also identifies the months with billing data from either the BOM Report (available in six months intervals) or utility provided billing, which in this case there is no utility data. The red line indicates records that are hidden to keep the table to a reasonable length. Table 2 also identifies the baseline and performance period months that match the correspond baseline and performance periods defined in the BOM Report.

Table 2. Event and Billing Data Calendar

Month-Year	Events	BOM Billing	Utility Billing	Period
Jan-2017	BOM Report starts baseline data	Elec, Gas, #2 oil	NA	Baseline
Feb-2017		Elec, Gas, #2 oil	NA	Baseline
Mar-2017		Elec, Gas, #2 oil	NA	Baseline
Apr-2017		Elec, Gas, #2 oil	NA	Baseline
May-2017		Elec, Gas, #2 oil	NA	Baseline
Jun-2017	Contract effective date	Elec, Gas, #2 oil	NA	Baseline
Jul-2017		Elec, Gas, #2 oil	NA	Baseline
Aug-2017		Elec, Gas, #2 oil	NA	Baseline
Dec-2018		Elec, Gas, #2 oil	NA	Baseline
Jan-2019	Cooling tower water treatment released	Elec, Gas, #2 oil	NA	Performance
Feb-2019		Elec, Gas, #2 oil	NA	Performance
Mar-2019		Elec, Gas, #2 oil	NA	Performance
Apr-2019		Elec, Gas, #2 oil	NA	Performance
May-2019		Elec, Gas, #2 oil	NA	Performance
Jun-2019	Water heater rebuild video released	Elec, Gas, #2 oil	NA	Performance
Jul-2019		Elec, Gas, #2 oil	NA	Performance
Aug-2019		Elec, Gas, #2 oil	NA	Performance
Sep-2019	Condensate receiver video released	Elec, Gas, #2 oil	NA	Performance
Oct-2019		Elec, Gas, #2 oil	NA	Performance
Nov-2019		Elec, Gas, #2 oil	NA	Performance

Dec-2019	Purchase order video released	Elec, Gas, #2 oil	NA	Performance
Jan-2020	Web usage analytics	None	NA	
Feb-2020		None	NA	
Mar-2020	COVID Lockdown	None	NA	
Apr-2020		None	NA	
May-2020		None	NA	
Jun-2020	Contract end date	None	NA	

Training Description

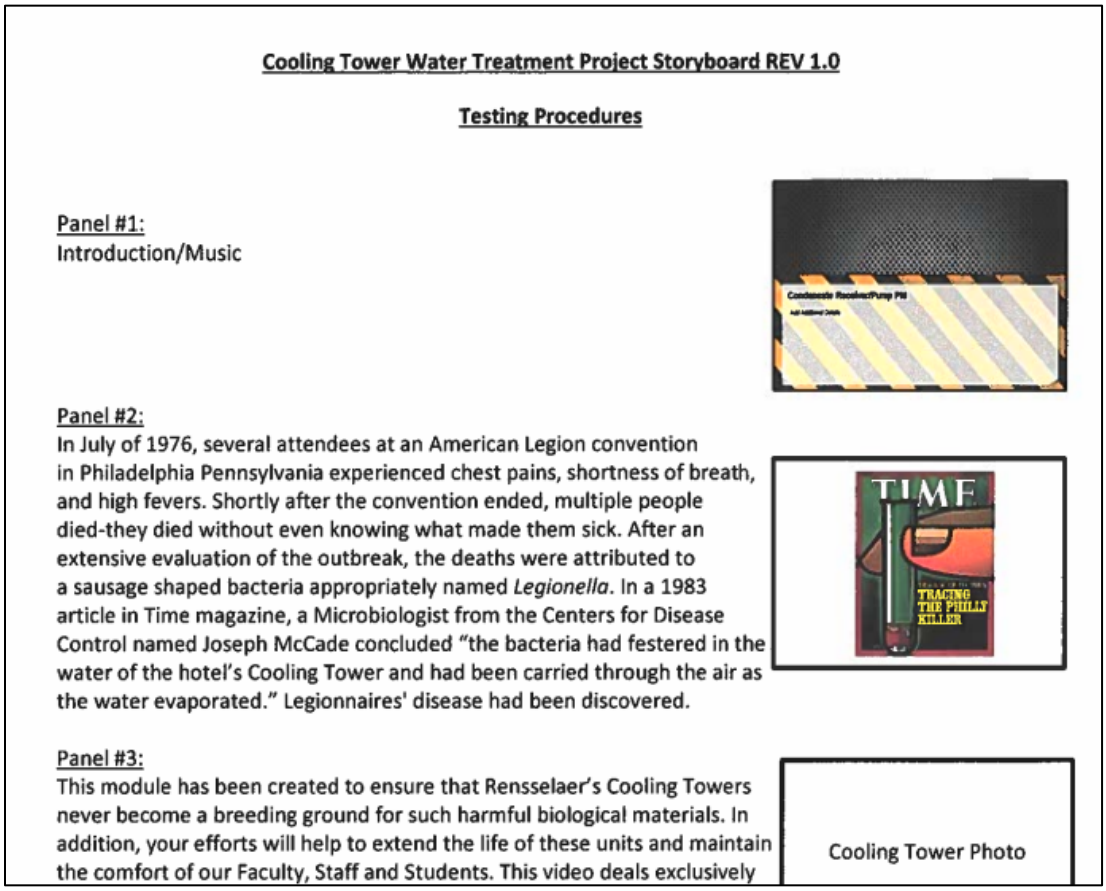
This site was an early participating site. The effort consisted of developing a tool called Personal Support Tool which included training modules for a specific piece of equipment or functions. The tool was built to integrate with the current work order system (that is used to identify faulty equipment and create work order to fix them) to improve the timing for each work order. The videos provide detailed steps to diagnose problems for the specific equipment and describe the steps for conducting the O&M task. The project records specifically describe these three technical modules:

- Cooling Tower module: focused on water testing
- Condensate receiver module: focused on water treatment
- Water-heater rebuild module: diagnose and repair when there is a no hot water call

There were two other modules for conducting administrative functions to create a purchase order. The documentation makes clear that there were no other modules produces as part of this project. The modules equipment modules provide step by step instructions in conducting a specific O&M task with an expected outcome and that outcome is not to improve the efficiency of the equipment.

The project files documented the development and deployment of each of the modules. This example is for the cooling tower water treatment. The project files include a “storyboard” for each module indicates the sequences of scenes and scripting that will occur in the video. A screenshot of the 27-page storyboard for the cooling tower is illustrated Figure 1.

Figure 1. Storyboard for the cooling tower video



Cooling Tower Water Treatment Project Storyboard REV 1.0

Testing Procedures

Panel #1:
Introduction/Music

Panel #2:
In July of 1976, several attendees at an American Legion convention in Philadelphia Pennsylvania experienced chest pains, shortness of breath, and high fevers. Shortly after the convention ended, multiple people died-they died without even knowing what made them sick. After an extensive evaluation of the outbreak, the deaths were attributed to a sausage shaped bacteria appropriately named *Legionella*. In a 1983 article in Time magazine, a Microbiologist from the Centers for Disease Control named Joseph McCade concluded "the bacteria had festered in the water of the hotel's Cooling Tower and had been carried through the air as the water evaporated." Legionnaires' disease had been discovered.

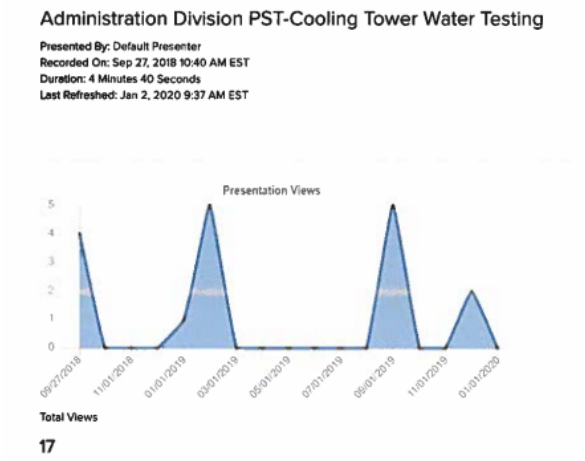
Panel #3:
This module has been created to ensure that Rensselaer's Cooling Towers never become a breeding ground for such harmful biological materials. In addition, your efforts will help to extend the life of these units and maintain the comfort of our Faculty, Staff and Students. This video deals exclusively

Cooling Tower Photo

It appears the storyboard was reviewed and commented on by staff and ultimate used to produce the finished video, which can be viewed here: Cooling Tower Video

The project files also include web analytics, which indicated how often the video had been viewed, as shown in Figure 2.

Figure 2. Web analytics showing frequency of use



Tracked savings

The savings for this project were in NYSERDA's Quarter 4 2021 CEF Report (known as the 'Scorecard') as "completed" and are summarized in Table 3.

Table 3. Scorecard Reported Savings – Project Status is Completed

Building	Electric Savings (MWh)	Gas Savings (MMBtu)
Building 1	17	151
Building 2	125	1,117
Building 3	67	596
Building 4	20	179
Building 5	22	192
Building 6	67	600
Building 7	30	265
Building 8	67	596
TOTAL	415	3,695

Data Collection

Project documentation

The evaluators reviewed the project documentation from the NYSERDA program staff. The project documentation consisted of the details of the training and other support services, which included the following information:

- BOM Report which contains quarterly reporting of all energy use (9/10/2019)
- Module analytics showing access metrics
- NYSERDA agreement dated June 2017
- Application
- Module storyboards and viewing metrics reports for each module
- Training Metric Quarterly Reporting (6) within: 1/1/2019-12/31/2019

Site interview

The Manager was interviewed for the market study but was also asked about the training. His comments on the activities sponsored by NYSERDA are as follows:

- Not all staff use these tools. Challenge from the beginning, more of at the point of application, use the tool. Someone may need 20 sec to answer question. It is intended for everyone to use. But not all use it. For example, cooling towers, only 1% or small fraction of our employees handle cooling towers. Could look at IP address to try to estimate who is looking at tool, but people share computers/machine, tracking is not that good. Really looks at views and if it is still used, which it is.

- The whole purpose of the tool [the videos} is to reduce onboard time on the front end with new staff.
- The tool is intended to serve the whole campus.
- We plan to develop more tools HVAC but have not formally started.
- Campus was shut down due to COVID with scaled back heating and cooling. 2020 was full remote, sprinkling back in 2021 in hybrid mix of in-class and on-line. This fall 2021 students are back in-person on campus close to full occupancy.
- For safety protocols, following CDC guidelines. Whatever is required for ventilation.

Billing data

The BOM report included billing data for an extended base period and for a performance period. The evaluation team was not able to obtain consent to request utility data. Table 4 summarizes the billing data that was available.

Table 4. Summary of Billing Data

Bill Type	Fuel	Period	Months	Total for Period	Monthly Average	Units
BOM	Electric	01/01/2017 – 12/31/2019	36	136,118,174	3,781,060	kWh
BOM	NG	01/01/2017 – 12/31/2019	36	7,707,070	214,085	therms
BOM	#2 Oil	01/01/2017 – 12/31/2019	36	98,148	2,726	gallons
Utility		No Utility Data				

Savings Analysis

The evaluators confirmed that the project consisted of developing O&M training modules with the interviewee and that the modules did not have any energy efficiency Impacts, nor were they designed to do so. There is no mechanism to produce savings so there are no claimable savings for this project.

No billing analysis or engineering analysis was because the training activities are not intended to produce energy savings.

Site ID: SID-28

Subject: Impact findings for the site SID-28

Details: Training and other organizational activities, tracked and evaluated savings.

Facility type	Update state university campus
Area served by training (sq ft)	2,750,846
Agreement effective	January 1, 2018
Scorecard status	Encumbered

Summary

The training and related activities were executed in part through a "strategic partnership" between the training provider – a New York higher education metering platform provider (NYEM) – and an engineering consultant acting as the "on-site energy manager" with the responsibility to identify energy efficiency improvements and conduct on-site training. The training provider was responsible for training the staff, training the trainers, and coaching. The training provider also appeared to be coordinating efforts overall and reported on all activities in the quarterly reports.

This partnership helped foster organizational changes to instill practices of continuous improvements. The activities at this site had many elements of "Strategic Energy Management," which is designed to create organizational changes fostering ongoing energy reductions. In addition to the multiple training sessions offered to diverse trades and staff levels, the program initiated organizational structures (an Energy Review Board) and coaching.

Table 18 summarizes the evaluated savings. The savings estimates consider all the available evidence including project file documents, consumption data, site interviews and the results of subsequent analysis. There is evidence of substantial first year savings in a weather-normalized consumption analysis which is corroborated by the engineering analysis. There is evidence of substantial first year savings in the billing analysis using the monthly utility billing data provided, and to some degree in the engineering analysis. The evaluated first-year savings are based on the billing analysis.

Table 18. **Site Savings Summary**

First Year Savings	Electric (MWh)	Natural Gas (MMBtus)
CEF reported savings	2,785	16,297
Evaluated savings	2,531	5,650
Realization rate	90.9%	35%
Annual base energy use	25,453	172,157
Tracked savings fraction	9.9%	3.3%
Evaluated savings fraction	2,785	16,297

Events Calendar

Table 19 identifies key events in the history of the project. The table also identifies the months with billing data from either the BOM Report (available in six-month intervals) or utility-provided billing (available in monthly intervals). The table identifies those months as baseline or performance period months in the billing analysis.

The red line indicates records that are hidden to keep the table to a reasonable length.

Table 19. Event and Billing Data Calendar [correct for 117766]

Month-Year	Events	BOM Billing	Utility Billing	Period
Apr-2016	First month of BOM baseline data	B Elec, Gas	B Elec, Gas	Baseline
Dec-2017		B Elec, Gas	B Elec, Gas	Baseline
Jan-2018	Contract executed	Elec, Gas	B Elec, Gas	Baseline
Feb-2018	Early activities appear to be contracting	Elec, Gas	B Elec, Gas	Baseline
Mar-2018		Elec, Gas	B Elec, Gas	Baseline
Apr-2018		Elec, Gas	B Elec, Gas	Performance
May-2018	Formal project kick-off	Elec, Gas	B Elec, Gas	Performance
Jun-2018		Elec, Gas	B Elec, Gas	Performance
Jul-2018		Elec, Gas	B Elec, Gas	Performance
Aug-2018		Elec, Gas	B Elec, Gas	Performance
Sep-2018	Strategic partner contracts effective	Elec, Gas	B Elec, Gas	Performance
Oct-2018		P Elec, Gas	P Elec, Gas	Performance
Nov-2018	GPRO Training	P Elec, Gas	P Elec, Gas	Performance
Dec-2018	GPRO Exam	P Elec, Gas	P Elec, Gas	Performance
Jan-2019		P Elec, Gas	P Elec, Gas	Performance
Feb-2019		P Elec, Gas	P Elec, Gas	Performance
Mar-2019	NYEM Manager training	P Elec, Gas	P Elec, Gas	Performance
Apr-2019	On-site coaching	P Elec, Gas	P Elec, Gas	Performance
May-2019	On-site coaching	P Elec, Gas	P Elec, Gas	Performance
Jun-2019	On-site coaching, Primary training ended	P Elec, Gas	P Elec, Gas	Performance
Jul-2019		P Elec, Gas	P Elec, Gas	Performance
Aug-2019		P Elec, Gas	P Elec, Gas	Performance
Sep-2019	Opportunity Log included in file	P Elec, Gas	P Elec, Gas	Performance
Oct-2019	Final training provider report	Elec, Gas	Elec, Gas	Performance
Nov-2019		Elec, Gas	Elec, Gas	Performance
Dec-2019		Elec, Gas	Elec, Gas	Performance
Jan-2020	Opportunity Log included in file	Elec, Gas	Elec, Gas	Performance
Feb-2020		Elec, Gas	Elec, Gas	Performance
Mar-2020	COVID Lockdown	Elec, Gas	Elec, Gas	Performance

Month-Year	Events	BOM Billing	Utility Billing	Period
Apr-2020		Elec, Gas	Elec, Gas	

Training and related activities description

This description of the training was derived from a review of project file material. An inventory of the project file is included under Data Collection.

The training and related activities were executed in part through a "strategic partnership" of the training provider – a New York higher education metering platform provider (NYEM) – and an engineering consultant acting as the "on-site energy manager," with responsibility to identify energy efficiency improvements and conduct on-site training. The training provider was responsible for training staff, training the trainers, and coaching. The training provider also appeared to be coordinating efforts overall and reported on all activities in the quarterly reports.

Training included these elements:

- Building science Green Professional Operations and Maintenance (GPRO) core curriculum conducted in November 2018 with exams following in December. Of the 24 students that took the exam, 23 passed.
- On-Site/On-the-Job Training, 35 days in total.
- Training in energy analytics including techniques for graphing, EUIs, and weather normalization.
- This course work was described, but no training materials were included in the project file.

Organizational structures. The activities included creating organizational structures to sustain ongoing improvements. The activities included:

- Identify actionable EEMs and potential projects that can be further advanced to aid in prioritizing them.
- Support of the establishment of an Energy Review Board that meets every other Monday and has adopted the ECM process.
- Developed an energy improvement/opportunity template (for use by staff) that includes existing conditions, recommended actions, estimated energy savings and calculation methodology (e.g., spreadsheet analysis, weather bin, building modeling, guidance documentation), estimated costs (e.g., vendor quotes, RS Means, spreadsheet cost estimating), simple payback analysis, O&M improvements, and low cost/no cost measures.

Coaching. The activities included coaching. Coaching was described as:

- Assist the university with measuring and verifying energy and non-energy benefits associated with the Workforce Training program.

Tracked savings

The savings for this project were in NYSERDA's Quarter 4 2021 CEF Report (known as the "Scorecard") as "completed" and are summarized in Table 20.

Table 20. Scorecard Reported Savings – Project Status is Encumbered [Correct for 117766]

Building	*Electric Savings (MWh)*	*Gas Savings (MMBtu)*
1	2,785	16,297
TOTAL	2,785	16,297

Table 21 summarizes the square footage of the buildings in the project.

Table 21. Building Area (square footage) [Correct for 117766]

Building	Building Type	Building Area
1	Campus	2,750,846
TOTAL		

Data Collection

Project documentation

The Evaluation Team reviewed Building O&M project documentation provided by NYSERDA program staff. The project files included the following information:

- Note of award, but not the actual agreement. Scope was inferred from other documents
- Quarterly Reports (Q1-2018 to Q3-2021)
- Building operation and maintenance (BOM) report with a total of four years of billing data: two years pre and post, plus six months during COVID lockdown
- Opportunity logs dated 09/30/2019 and 01/17/2020. Identified about 100 opportunities and implemented seven of them, as noted in the log
- Billing authorization and account lists
- Pre-post surveys of about 10 people
- GPRO exam score documents (with 23 of 24 passing)

Site Interviews

A site contact with knowledge of the building operation could not be recruited for an interview.

Billing data

The Building O&M or BOM Report for this site included billing data for an extended base period and for the performance period. The BOM Report billing data is provided in six-month intervals, not monthly.

Monthly utility billing data was also acquired for electricity and natural gas. Table 22 summarizes all billing data that was available.

Table 22. Summary of Billing Data

Bill Type	Fuel	Period	Months	Total for Period	Monthly Average	Units
BOM	Electric	Apr 2016 to Mar 2020	48	108,467,536	2,259,740	kWh
BOM	NG	Apr 2016 to Mar 2020	48	6,534,404	136,133	therms
Utility	Electric	Dec 2014 to Feb 2022	87			
Utility	NG	Dec 2014 to Feb 2023	87			

Savings Analysis

The WFD development training is intended to empower individuals and organizations by providing the skills and the motivation to improve building operations through a combination of low-cost measures and best practices behaviors. Behavior-related impacts are ideally captured using whole billing analytics, since the savings result from an accumulation of smaller measures and the baseline and performance conditions are not easily characterized using an engineering approach. However, it is also useful and follows best evaluation practices to verify that the organization implemented the behavioral changes and to corroborate the magnitude of the savings with a high-level engineering analysis.

The electric and natural gas savings for this site is based on a billing analysis using the monthly utility data, corroborated using an engineering-based high-level estimate of impacts for energy conservation measures (ECMs) recorded as implemented in an Opportunity Log. Savings estimates were provided in the Opportunity Log. Table 15 compares the billing results and the supporting engineering analysis.

Table 23. Comparison of billing analysis and engineering analysis results

Energy	Billing Analysis Savings	Engineering Analysis	Units	Fraction
Electricity	2,531,000	528,000	kWh	21%
Natural Gas	5,650	4,700	therms	83%

Billing Analysis

Defining baseline and performance periods. The billing analysis uses the same baseline and performance period as that specified in the BOM Report. The BOM Report is a NYSERDA-defined form used by the training providers to define the baseline period and to record consumption data every six months as the project progresses. The form calculates savings for each semi-annual interval as the difference between the baseline usage for the same six-month period and the most recent consumption data.

The evaluators do not recommend incorporating a "black-out" period from project start through the end of substantial training for these reasons:

- A black-out period is often applied in billing analysis of "widgets" so that the widget performance can be sharply delineated between the pre and post period. Training's impact is more diffuse and will start with the first day of training and accumulate in an unpredictable way overtime. A black-out period for this project would be eight months to a year in length.
- Since the baseline and performance period are closer in time without a black-out period, there are fewer other building changes impinging on the findings.
- The practice of defining the performance period beginning immediately from project start is observed in other whole-building behavioral programs and evaluations, like California's industrial behavioral program. Host sites can observe the savings and use that for team motivation.
- A very practical reason to not use a black-out period is COVID-19. COVID lockdown happened only a few months after the last training, and a black-out period would eliminate most of the performance period.

Utility Billing Results. In this analysis, the monthly utility provided billing data was regressed against historical weather data following CalTrack protocols for cleaning and screening data. Table 24 presents the savings fractions for all seven electric and fourteen gas meters. The savings fraction for 2019 was selected as the most applicable savings fraction aligning with the BOM performance period and the available data, and without overlapping COVID.

Table 24. Utility Billing Analysis Results by Electric and Natural Gas

	Modeled Base	BOM 12 Month Savings	BOM 24 Month Savings	2019 Savings	2020 Savings	2021 Savings
Electric	111,706,188	2.2%	8.8%	9.9%	30.8%	16.1%
Gas	6,675,256	2.2%	5.5%	3.3%	20.1%	12.0%

BOM Billing Results. The normal approach for a site-specific billing analysis is to regress the monthly consumption figures against the heating and cooling degree days (HDD and CDD, respectively). However, the BOM data is provided in six-month intervals, not monthly, reducing the number of data points available and masking their correspondence with weather. In this analysis, the baseline and performance period usages were weather normalized by applying a ratio of the historical to TMY3 HDD (or CDD) for the same period. Once normalized, the performance period usage was subtracted from the baseline period usage to determine weather-normalized savings.

The BOM included billing data for all fuels for two years prior to the implementation of the program and for 18 months after the training commenced. Table 25 notes the average usage over two years in the base

period and one year post period. The last semi-annual reporting period was dropped because it overlapped the first COVID-19 pandemic lockdown when gas usage increased dramatically. Billing data was weather normalized using the semi-annual periods since that was the resolution of the consumption data.

Table 25. BOM Consumption Analysis Results

Energy	Base Period 4/01/2016 to 3/31/2018	Post Period 10/1/2018 to 9/31/2019	Savings	Units	Savings Fraction
Electricity	25,452,703	23,756,765	1,695,938	kWh	6.7%
Natural gas	1,721,566	1,737,432	(15,866)	therms	-0.9%

Engineering Analysis

This project record demonstrates that the university was taking concrete actions during the performance period. The engineering analysis is based on the implementation of ECMs noted in the project record.

The project files contained a list of potential ECMs that were logged in the Opportunities Lists (Sept 2019 and Jan 2020) included in the project files. The engineering analysis was based on the seven projects listed in the Opportunity Log as completed or at the time of the Log's last update of 01/17/2020. Approximately 100 different opportunities were included in the log. Table 26 lists those ECMs that were noted as completed in the Lists. Each of the completed ECMs included an estimate of energy savings that is noted in the table and were used to corroborate billing analysis findings.

Table 26. ECMs Noted as Completed in the Opportunity Lists

Energy Conservation Measure (ECM)	Current Practice / Notes	Actions	Electric Savings (kWh)	NG Savings (therms)
Accelerate conversion from pneumatic to DDC	Phase out as labor is available.	Main equipment converted to DDC, a few minor remain on as pneumatics	57,000	
Repair lighting controls. Initiated repair on two floors and verified with meters	Lights had been 24x7	Initiated controls, two of floors fixed and confirmed with meters	207,000	
Lighting controls opportunity	Install controls		20,000	
RCx to ice rink dehumidify units were running while rinks were offline		Turned off and modify occupied controls		
Chillers are running in the summer when AHUs are off.	Chillers running, but not AHUs	Increased effort to reduce schedule	240,000	
Replace 2 speed tower fans with VFDs		VFD, new premium motors	4,000	

Control snow melt system. Systems do not incorporate snow sensors and run when temps are over 34F		Revise controls to have an idle and active melt phase with manual intervention process		4,700
			528,000	4,700

Site ID: SID-99

Subject: Impact findings for the site SID-99

Details: Training and other organizational activities, tracked and evaluated savings.

Facility type	Urban technical college campus
Area served by training (sqft)	419,000
Agreement effective	October 1, 2017
Scorecard status	Complete

Summary

This project included staff technical training, development of system manuals, and infrastructure for a building knowledge repository. About half of the facility staff attended multiple training sessions. The manuals were tailored to the site with actual site equipment featured rather than generic equipment. Dashboards were developed to track energy usage and potential energy efficiency measures. In addition to facility staff, two of the academic faculty were trained and used the material and experience to develop an academic class offering that enrolled 25 students.

Table 1 summarizes the evaluated savings. The savings estimates consider all the available evidence including project file documents, consumption data, site interviews and the results of subsequent analysis. There is evidence of substantial first year savings in the billing analysis using the billing data provided in the project's semi-annual Building O&M Reports (BOM Reports). The evaluated first year savings are based on a billing analysis.

Table 1. Site Savings Summary

First Year Savings	Electric (MWh)	Natural Gas (MMBtus)
CEF reported savings	598	4,715
Evaluated savings	392	5,069
Realization rate	65%	108%
Annual base energy use	5,726	50,542
Tracked savings fraction	10.5%	9.3%
Evaluated savings fraction	6.8%	10.0%

The consumption analysis was based on the semi-annual consumption data provided for the primary fuels in the semi-annual BOM report. While the evaluator was unable to conduct an engineering analysis, there were other facility documents that identified O&M measures implemented on campus with estimates of savings similar to the billing analysis. The customer did not authorize release of utility billing data.

This site also participated in the NYSERDA Campus Energy Challenge. The study provider for the Challenge was the same as the WFD training provider. These two activities were well coordinated. The Challenge produced three detailed audits identifying savings opportunities and it appeared that trained

staff participated in the implementation of them, although there is not direct linkage. It is likely that the savings reported by the Challenge program overlap those observed during the performance period, thus there could be double counted.

Events Calendar

Table 2 identifies key events in the history of the project. The table also identifies the months with billing data from either the BOM Report (available in six months intervals). Utility billing data was not provided. The red line indicates records that are hidden to keep the table to a reasonable length. The table identifies those months identified as baseline or performance periods in the BOM Report. Note that the billing analysis excluded the last six months of the BOM Report defined performance period due to the failure of a CHP unit.

Table 2. Event and Billing Data Calendar

Month-Year	Events	BOM Billing	Utility Billing	BOM Period
Jan-16	Beginning of BOM Report baseline	Elec, Gas	NA	Baseline
		Elec, Gas	NA	Baseline
Sep-17		Elec, Gas	NA	Baseline
Oct-17	Effective date of agreement	Elec, Gas	NA	Baseline
Nov-17	Training begins	Elec, Gas	NA	Baseline
Dec-17	Chiller training and chiller primer	Elec, Gas	NA	Baseline
Jan-18	Terminal unit controls for labs	Elec, Gas	NA	Performance
Feb-18		Elec, Gas	NA	Performance
Mar-18	Lab ACH optimization implemented	Elec, Gas	NA	Performance
Apr-18	Spring Term Academic class offering; coaching	Elec, Gas	NA	Performance
May-18	Coaching	Elec, Gas	NA	Performance
Jun-18	EMS optimization project implemented; Operator Trainings; Coaching	Elec, Gas	NA	Performance
Jul-18	On-going training	Elec, Gas	NA	Performance
Aug-18	EMS training by EMS vendor (WFD sponsored)	Elec, Gas	NA	Performance
Sep-18	Primers published - AHU, DHW & Lab ventilation	Elec, Gas	NA	Performance
Oct-18	Primer published - EMS	Elec, Gas	NA	Performance
Nov-18	Equipment based skills O&M training focused on labs; Rev campus Challenge Building 1 Report	Elec, Gas	NA	Performance
Dec-18	Rev campus Challenge Building 2 Report	Elec, Gas	NA	Performance
Jan-19		Elec, Gas	NA	Performance
Feb-19		Elec, Gas	NA	Performance
Mar-19		Elec, Gas	NA	Performance
Apr-19	Spring Term Academic class offering	Elec, Gas	NA	Performance
May-19		Elec, Gas	NA	Performance

Jun-19	CHP system failed. Rev campus Challenge Building 3 Report	Elec, Gas	NA	Performance
Jul-19		Elec, Gas	NA	
Nov-19		Elec, Gas	NA	
Dec-19	End of reporting	Elec, Gas	NA	
Jan-20			NA	
Feb-20			NA	
Mar-20	COVID Lockdown		NA	

Training Description

The application notes that there are 19 O&M staff members and that about 25 people would be trained. The final report in the record, the 2019 Q4 metric report reported that there were 10 facility staff trained, 25 students, and 2 faculty.

The training focused on providing fundamental concepts about HVAC systems specific to the facility and the O&M staff serving the university. Training addressed the following systems:

1. Central Plant (Hot water system and Chiller plant)
2. Air Handling Units
3. Laboratory Ventilation and Exhaust Fans
4. Cogeneration Operation and Heat Recovery
5. Building Management Systems
6. Energy Management and Analytics

The actual training materials was scoped to include the following:

- PowerPoint slide decks for each equipment subset
- Five building primer documents designed to supplement PowerPoint decks for engineering students
- A diagram explaining the organizational data structure of the knowledge repositories
- Preventative Maintenance materials
  - PowerPoint deck for each equipment sub-set
  - Online tool for PM
- Off-site BMS training for staff on the facility's system

Training was scoped to include both classroom and field components.

Sustaining the training: continued development of courses and programs, distribution of training materials, and training the trainer effort.

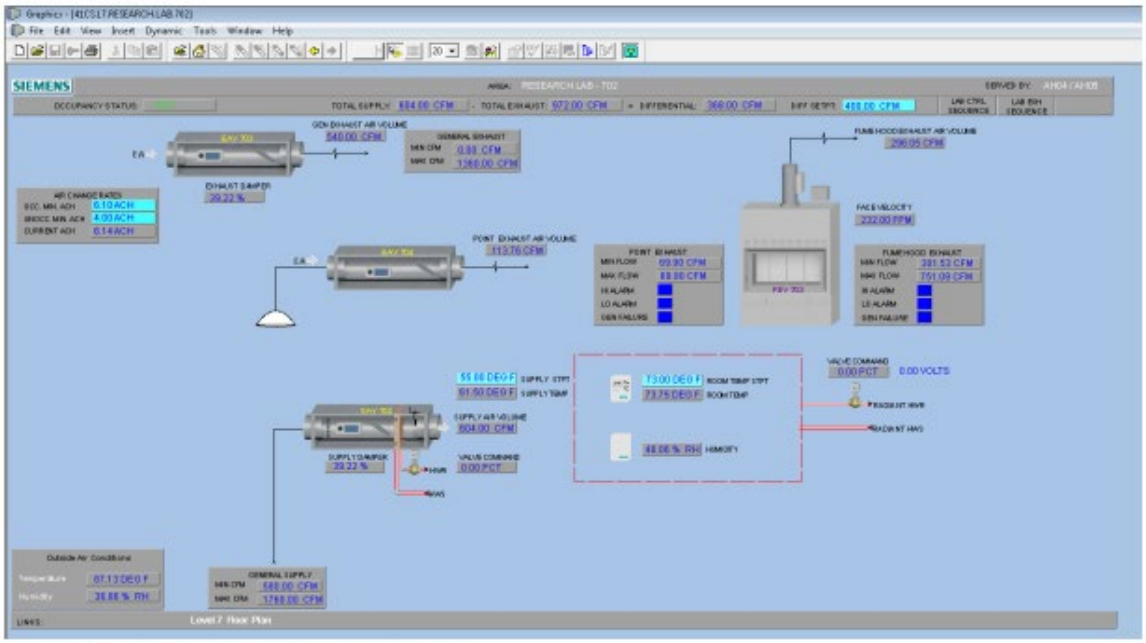
In addition, the training developed a dashboard platform to present energy consumption of the impacted buildings on a real-time basis. The dashboard is equipped with machine learning algorithm to calculate normalized energy consumption and automatically calibrate the model as new data become available.

An academic course was sponsored as one of the activities taught by faculty entitled “Energy Efficient Building Systems Course” attended by 25 students.

Example training material:

The project record included seven primers. As an example, the AHU Primer was 44 pages long and was specific to the building with equipment photos and schematics from the building as shown in Figure 1. It also included fan and pump curves with equations, control sequences from the BMS, savings strategies,

Figure 1. Example of Figures in the AHU Primer



3. VAV + Radiant Panels (2363)
    - Office / Classrooms

Coaching was described as follows:

“The team has met weekly (approximately) for past 8 months with facilities engineers for 1-3 hours per visit discussing all manners of building operations and dynamics. We have collaboratively performed a variety of improvements including troubleshooting controls hardware, identifying mechanical efficiencies, etc.”

Tracked savings

The savings for this project were in NYSERDA's Quarter 4 2021 CEF Report (known as the 'Scorecard') as "encumbered" and are summarized in Table 3.

Table 3. Scorecard Reported Savings – Project Status is Encumbered

Building	Electric Savings (MWh)	Gas Savings (MMBtu)
1	87	683
2	253	1,993
3	259	2,039
TOTAL	599	4,715

This savings fraction shown in Table 1 were calculated using the CEF Reported savings and the weather normalized average baseline energy use.

Table 4. summarizes the square-footage of the buildings in the project.

Table 4. Building Area (square-footage)

Building	Building Type	Building Area
1	Laboratory	180,000
2	Academic building	179,000
3	Academic building	60,000
TOTAL		419,000

Data Collection

Project documentation

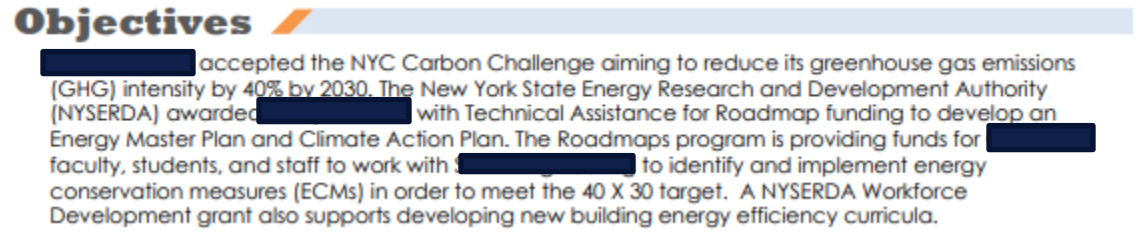
The Evaluation Team reviewed Building O&M project documentation provided by NYSERDA program staff. The project files included the following information:

- Agreements and applications
- In-depth introduction of chilled water and hot water system presentation
- Overview and pictures of the dashboard analytics platform
- Capstone project report from students who attended the training
- Energy conservation measures developed as an outcome of the training
- Training quarterly report
- Building operation and maintenance (BOM) report
- Pre/post training surveys from about 25 people

- NYSERDA Rev Campus Challenge Feasibility study reports (provided subsequently by interviewed staff)
- BOM Reporting with a total of four years of billing data, two years pre and post.

In 2019, the University began an audit process to identify specific energy efficiency measures to be implemented in the three buildings identified as part of the WFD, described at a high level in Figure 2, It is assumed this is the same initiate as the NYSERDA Campus Energy Challenge.

Figure 2. Challenge Goals



Interviews

The evaluators also conducted an interview of a knowledgeable staff person and obtained the feasibility study reports that the organization is using as a reference to implementing energy savings measures. The contact confirmed the following:

- The primary focus of the work is the LEED Platinum academic building. This building is a unique architectural design and is about 30% lab space. This building was a focus of the Rev Campus Challenge audit, which was completed at the end of 2019. In June of 2019, the buildings 250 kW CHP system failed.
- Two other buildings served by the training include the Residence Hall and an academic building focused on the arts.
- Total square-footage of the three buildings is 419,000 although the addresses do not totally agree with those listed in the CEF Report.
- The CHP system in the primary academic and lab building failed in June of 2019.

Billing data

The Building O&M or BOM report for this site included billing data for an extended base period and for the performance period. The BOM Report billing data is provided in six-month intervals, not monthly. Utility billing data was not acquired for this site.

Table 5 summarizes the billing data that was provided by period and source. Note, this data has not been weather normalized in this table.

Table 5. Summary of Billing Data

Bill Type	Fuel	Period	Months	Total for Period	Monthly Average	Units
BOM	Electric	Jan 2016– Dec 2020	48	22,950,800	478,142	kWh
BOM	NG	Jan 2016– Dec 2020	48	1,778,131	37,044	therms
Utility		None				

Savings Analysis

The WFD development training is intended to empower individuals and organizations with the skills and the motivation to improve building operations through a combination of low-cost measures and best practices behaviors. Behavior related impacts are ideally captured using whole billing analytics, since the savings result from an accumulation of smaller measures and the baseline and performance conditions are not easily characterized using an engineering approach. However, it also useful and follows best evaluation practices to verify that the organization implemented the behavioral changes and to corroborate the magnitude of the savings with a high-level engineering analysis.

The saving for this site is based on an energy consumption analysis using the BOM Reported consumption data and corroborated based on the savings associated with measures reported as installed in various facility communications.

Billing Analysis

The normal approach for a site-specific billing analysis is to regress the monthly consumption figures against the heating and cooling degree days (HDD and CDD, respectively). However, the BOM data is provided in six-month intervals not monthly, reducing the number of data points available and masking their correspondence with weather. In this analysis, the baseline and performance period energy consumptions were weather normalized by applying a ratio of the historical to TMY3 HDD (or CDD) for the same period. Once normalized, the performance period usage was subtracted from the baseline period usage to determine weather-normalized savings.

Defining baseline and performance periods. The consumption analysis uses the same baseline and performance period as that specified in the BOM Report, excluding the last six-month period due to the failure of a combined heat and power (CHP) system. The BOM Report is a NYSERDA defined form used by the training providers to define the baseline period and to record consumption data every six months as the project progresses. The form calculates savings for each semi-annual interval as the difference between the baseline usage for the same six-month period and the most recent consumption data.

Based on the discussion with NYSERDA program staff and contact at the university, the combined heat and power (CHP) plant serving one of the impacted buildings failed and thus impacted the energy consumption at the impacted buildings. However, the site contact noted that the system failed in June of 2019 or 18 months after the training had commenced. Other documents in the project file confirm the CHP units were operating through the performance period used in this analysis.

In the evaluator billing analysis, the training period was not 'blacked out' from the performance period for these reasons:

- The billing analysis lines up with how the customer and training providers were reporting the baseline and performance period.
- The practice of defining the performance period beginning immediately from project start is observed in other whole building behavioral programs and evaluations, like California's industrial behavioral program.
- A blackout period is often applied in billing analysis of 'widgets' because the installation can be defined within a few months and it allows for the widget performance to be sharply delineated between the pre and post period. Training's impact is more diffuse and will start with the first day of training and accumulate in an unpredictable way overtime.
- A blackout period for this project would be about a year in length. This prolonged period allows more building changes to accumulate impinging making comparisons with the baseline period less certain.
- A very practical reason to not use a blackout period was the CHP failure. The failure happened only a few months after the last training and a black-out period would eliminate most of the performance period.

The BOM data is reported in semi-annual periods, not monthly. The following table notes the average usage over two years in the base period and 18-months post period (excluding the period when the CHP failed). Billing data was weather normalized using the semi-annual periods since that was the resolution of the usage data.

Table 6. Consumption Analysis Results

Energy	Base Period 01/01/2016 to 12/31/2017	Post Period 01/01/2018 to 06/30/2019	Savings Difference in Pre and Post Periods	Units	Savings Fraction
Electricity	5,725,604	5,333,600	392,004	kWh	6.8%
Natural gas	505,421	454,733	50,688	therms	10.0%

Engineering Analysis

The training provider records did not include any direct engineering-based estimates of savings nor were there specific new measures linked to training activities. However, the university reported progress to meeting energy and carbon reduction in 2018 that are summarized in Table 7. The installed measures included BMS controls revisions and lab ventilation improvements, areas of focus in the training provided to staff. The savings claims were provided in facility documents.

Table 7. Measures identified as installed

Measure	Source of info	Date of Install	Electric Savings MWH	NG Savings MMBTUs	
BMS recommissioning	Roadmap 40x30 Summary	Spring 2018	619		
Lab air changes optimization and damper repair	Roadmap 40x30 Summary	Spring 2018		4,902	
Total			619	4,902	

This project record demonstrates that the university was taking concrete actions that should yield energy savings of the magnitude seen in the billing analysis.

Table 8. Comparison of billing analysis and engineering analysis results

Energy	Billing Analysis Savings	Engineering Analysis	Units	Fraction
Electricity	392,000	619,000	kWh	63%
Natural Gas	5,069	4,902	MMBtu	103%

Site ID: SID-78

Subject: Impact findings for the site SID-78

Details: Training and other organizational activities, tracked and evaluated savings.

Facility type	Portfolio of 19 buildings serving the homeless and AIDS community
Area served by training (sq ft)	118,763
Agreement effective	April 4, 2018
Scorecard status	Complete

Summary

This customer is a community of people living with and affected by HIV/AIDS whose mission is to end the dual crises of homelessness and AIDS through advocacy, provision of lifesaving services, and entrepreneurial businesses that sustain these efforts. The organization operates out of 19 buildings in an urban setting. The primary training consisted of two courses. The Green Basic course included two days of classroom instruction and one day of building walk-throughs and was designed to provide an overview of energy efficiency, its benefits, and an introduction to systems. It was offered to property managers and resident staff. A more in-depth five-day course was offered to the central staff responsible for maintenance and managing contractors.

Table 1 summarizes the evaluated savings which is based on a billing analysis. The project files did not include any information describing actions taken by staff that may have produced savings nor would the site contact agree to an interview so there is no corroboration of the billing data.

Table 1. Site Savings Summary

First Year Savings	Electric (MWh)	Natural Gas (MMBtus)
Scorecard reported savings	127	674
Evaluated savings	-183	1,456
Realization rate	-144%	216%
Annual base energy use	2,318	15,022
Tracked savings fraction	5.5%	4.5%
Evaluated savings fraction	-7.9%	9.7%

The consumption analysis was based on the semi-annual usage data provided for the electricity and natural gas in the semi-annual BOM Report.

Events Calendar

Table 2 identifies key events in the history of the project. The table also identifies the months with billing data from the BOM Report (available in six-month intervals). Utility data was not available. The red line indicates records that are hidden to keep the table to a reasonable length. The table identifies those months identified as baseline or performance periods in the BOM Report.

Table 2. Event and Billing Data Calendar [template]

Month-Year	Events	BOM Billing	Utility Billing	BOM Period
Jan-2017	First month of BOM baseline	Elec, Gas	None	Baseline
Feb-2017		Elec, Gas	None	Baseline
Mar-2018		Elec, Gas	None	Baseline
Apr-2018	Agreement effective	Elec, Gas	None	Baseline
May-2018		Elec, Gas	None	Baseline
Jan-2019		Elec, Gas	None	Performance
Feb-2019	Training - GBOM	Elec, Gas	None	Performance
Mar-2019	Quarterly Report	Elec, Gas	None	Performance
Apr-2019		Elec, Gas	None	Performance
May-2019	Training - GPRO	Elec, Gas	None	Performance
Jun-2019		Elec, Gas	None	Performance
Jul-2019		Elec, Gas	None	Performance
Aug-2019		Elec, Gas	None	Performance
Sep-2019	Training - GBOM Spanish; PV course; Quarterly Report	Elec, Gas	None	Performance
Oct-2019		Elec, Gas	None	Performance
Nov-2019		Elec, Gas	None	Performance
Dec-2019	Quarterly Report	Elec, Gas	None	Performance
Jan-2020		Elec, Gas	None	Performance
Feb-2020		Elec, Gas	None	Performance
Mar-2020	Quarterly Report	Elec, Gas	None	Performance
Apr-2020		Elec, Gas	None	Performance
May-2020		Elec, Gas	None	Performance
Jun-2020		Elec, Gas	None	Performance
Jul-2020		Elec, Gas	None	Performance
Aug-2020	Final Quarterly Report	Elec, Gas	None	Performance
Sep-2020		Elec, Gas	None	Performance

Description of Training and Related Activities

This description of the training was derived from a review of project file material. An inventory of the project file is included under Data Collection.

Training included these elements:

The curriculum and other related activities described in the scope of work was intended to include these elements:

- Basic Green Building Operations and Maintenance (GBOM). Boiler maintenances and diagnostics, heating distribution systems, building science (air movement/ventilation) and air sealing, water conservation and plumbing, electrical efficiency, recycling, and indoor air quality
- GPRO O&M training
- PV and renewables
- Tip sheets – ten one-page summaries
- Train the trainer for two to three select individuals

Tip sheets. The scope included ten tip sheets for building operations and maintenance staff based on training content for trained staff to use on the job. These were intended to be one-page summaries to guide maintenance staff. Five examples were included in the project file. Each was quite brief and consisted of high-level instructions like "Heating pipes, hot and cold water should all be insulated," "Check to be sure that proper caulking/spray foam has been installed," and "Inspect and clean filters regularly. After cleaning, do not reinstall until dry."

Training delivery. The following description was provided in a four-page syllabus outlining the delivery for all three training courses. There were no materials from the training, like slide sets, included in the project file.

For property managers and other site staff (23), the syllabus outlined 12 hours of classroom training and one day for conducting walk-throughs of three buildings. This appears to be the GBOM training, with topics as follows:

- Causes of climate change and benefits of green buildings
- Understanding LEED and compliance with codes and standards
- Building metrics
- Strategies for efficient and cost-effective heating and cooling systems
- Managing lighting and indoor air quality
- Reducing waste and understanding NYC audit and RCx requirements

For the building supers and construction team (15 staff), the syllabus outlined five days of training, which appear to be based on the GPRO as follows:

- Day 1: Introduction to heat and moisture flow in buildings and its influence in infiltration. Green building topics: cleaners, recycling signage, air filters.
- Day 2: Carpentry: blueprint analysis, wall structures, methods (screwing, drilling, etc.), demolition
- Day 3: Electricity: Safety, Ohms Law, circuits, using an amp meter; energy calculations, code requirements.
- Day 4: Plumbing: Safety, DHW systems, clearing drains, hands-on toilet and faucet repair
- Day 5: Walk-through: Heating systems, apartment, roof, envelope. Includes three buildings.

The third course was a separate one-day PV classroom training with an introduction to solar PV systems. It appears that this course was not offered.

Organizational structures. The activities included creating organizational structures to sustain ongoing improvements. The activities included:

- In the scope, the customer was responsible for developing four internships each of four weeks duration recruited from the population served by the organization. The interns have priority for permanent positions. The final report indicated one intern was trained.
- The final report noted that a training video was produced based on the curriculum and that it was to be viewed by new hires.

Coaching. The project did not include coaching.

Tracked Savings

The savings for this project were in NYSERDA's Quarter 4 2021 CEF Report (known as the 'Scorecard') as "complete" and are summarized in Table 3.

Table 3. Scorecard Reported Savings – Project Status is Encumbered [template]

Building	Electric Savings (MWh)	Gas Savings (MMBtu)
1	12	61
2	12	61
3	12	61
4	12	61
5	12	61
6	12	61
7	12	61
8	12	61
9	12	61
10	12	61
11	12	61
TOTAL	127	674

This savings fraction shown in Table 1 were calculated using the Scorecard reported savings and the weather normalized average baseline energy use.

Table 4 summarizes the square-footage of the buildings in the project. Individual buildings were described as ranging between 2,000 to 24,000 square-feet.

Table 4. Building Area (square-footage)

Building	Building Type	Building Area
1	Housing and office.	118,763
TOTAL		118,763

Data Collection

Project documentation

The Evaluation Team reviewed Building O&M project documentation provided by NYSERDA program staff. The project files included the following information:

- Agreement with scope of work
- Quarterly Reports (2018: Q4; 2019: Q1-Q2, Q3, Q4; 2020: Q1)
- Sign-in sheets from four sessions of the first course
- BOM Reports with semi-annual consumption data (three in total)
- Syllabus

Site interview

The site could not be recruited for an interview.

Consumption data

Table 5 summarizes the available billing data for this project. The Building O&M or BOM Report for this site included billing data for an extended base period and for the performance period. The BOM Report billing data is provided in six-month intervals, not monthly. The customer did not authorize release of utility billing data, hence, there is only BOM consumption data.

Table 5. Summary of Billing Data

Bill Type	Fuel	Period	Months	Total for Period	Monthly Average	Units
BOM	Electricity	Jan 2017 to Sep 2020	45	9,367,139	208,159	kWh
BOM	Natural gas	Jan 2017 to Sep 2020	45	489,117	10,869	therms

Savings Analysis

The WFD development training is intended to empower individuals and organizations with the skills and the motivation to improve building operations through a combination of low-cost measures and best practices behaviors. Behavior-related impacts are ideally captured using whole billing analytics, since the savings result from an accumulation of smaller measures and the baseline and performance conditions are not easily characterized using an engineering approach. However, it also useful and follows best evaluation practices to verify that the organization implemented the behavioral changes and to corroborate the magnitude of the savings with a high-level engineering analysis.

The saving for this site is based on a billing analysis using the BOM reported consumption data. There was no information included in the project files describing the implementation of any energy conservation measures (ECMs), so this site relies on the billing analysis alone.

Billing Analysis

The normal approach for a site-specific billing analysis is to regress the monthly consumption figures against the heating and cooling degree days (HDD and CDD, respectively). However, the BOM data is provided in six-month intervals not monthly, reducing the number of data points available and masking their correspondence with weather. In this analysis, the baseline and performance period usages were weather normalized by applying a ratio of the historical to TMY3 HDD (or CDD) for the same period. Once normalized, the performance period usage was subtracted from the baseline period usage to determine weather-normalized savings.

Defining baseline and performance periods. The billing analysis uses the same baseline and performance period as that specified in the BOM Report. The BOM Report is a NYSERDA-defined form used by the training providers to define the baseline period and to record consumption data every six months as the project progresses. The form calculates savings for each semi-annual interval as the difference between the baseline usage for the same six-month period and the most recent consumption data.

The evaluators do not recommend incorporating a "black-out" period from project start through the end of substantial training for these reasons:

- A black-out period is often applied in billing analysis of "widgets" so that the widget performance can be sharply delineated between the pre and post period. Training's impact is more diffuse and will start with the first day of training and accumulate in an unpredictable way overtime. A black-out period for this project would be eight months to a year in length.

- Since the baseline and performance period are closer in time without a black-out period, there are fewer other building changes impinging on the findings.
- The practice of defining the performance period beginning immediately from project start is observed in other whole building behavioral programs and evaluations, like California's industrial behavioral program. Host sites can observe the savings and use that for team motivation.
- A very practical reason to not use a black-out period is COVID-19. COVID lockdown happened only a few months after the last training, and a black-out period would eliminate most of the performance period.

Billing analysis

Weather-Normalized Results. The BOM included billing data for all fuels for two years prior to the implementation of the program and for 12 months after the training commenced. Table 6 notes the weather-normalized average usage over two years in the base period and one year post period. Since the second post period was incomplete and it overlapped with the first COVID-19 pandemic lockdown, the billing analysis included only the first 12 months of the performance period in the billing analysis. Billing data was weather normalized using the semi-annual periods since that was the resolution of the consumption data.

Table 6. Consumption Analysis Results [template]

Energy	Base Period	Post Period	Savings	Units	Savings Fraction
Electricity	2,373,510	2,524,083	(150,573)	kWh	-6.3%
Natural gas	138,675	133,333	5,341	therms	3.9%

Engineering analysis

The project files contained no information about implemented measures nor would the site respond to requests for interviews; therefore, there is no engineering analysis.

Site ID: SID-18

Subject: Impact findings for Site SID-18

Details: Training and other organizational activities, tracked and evaluated savings.

Facility type	Residential properties (high- and low-rise, single family) in three different locations within New York
Area served by training (sq ft)	Over 8 million
Agreement effective	July 11, 2018
Scorecard status	Complete

Summary

This project included portfolios of low-income and military housing in widely separated locations: upstate in the east, upstate in the west, and Downstate. The properties are owned and managed by the same property management firm. The training focused on training for "apartment maintenance technicians" and was developed in partnership with a national non-profit, National Apartment Association Education Institute (NAAEI). The initial phase of the training was provided by boiler and control manufacturers for specific equipment found at the properties. This was followed by the NAAEI curriculum called CAMT with content addressing operation and maintenance (O&M) of systems found at the properties. The project also included two additional training designed to foster leadership and energy advocacy.

Table 1 summarizes the evaluated savings for the project. The savings estimates consider all the available evidence including project file documents, consumption data, and the results of subsequent analysis. There is no evidence of first-year savings in a weather-normalized consumption analysis. The training provider came to a similar conclusion, noting "… the overall goal was to reduce energy … 5% to 7% … achievement of the goal is not supported by data."

Table 1. Site Savings Summary

First-Year Savings	Electric (MWh)	Natural Gas (MMBtus)
Scorecard reported savings	945	8,421
Evaluated savings	-336	-23,781
Realization rate	-36%	-282%
Annual base energy use	56,408	658,180
Tracked savings fraction	3.6%	2.9%
Evaluated savings fraction	-0.6%	-3.6%

The consumption analysis was based on the semi-annual usage data provided for electricity and natural gas in the semi-annual BOM Report for Upstate East only. Since the BOM reported usage was combined in the other two locations, it was not possible to weather normalize. A site contact could not be recruited

for an interview or to release utility bills. The project files did not include any record of the implementation of specific measures because of the training.

The trainings appear to have been well designed to meet the needs of the facility. Instructions included both specific equipment training provided by manufacturer representatives and more general O&M practices appropriate for the buildings being served. The final training components were designed to promote energy efficiency advocacy and leadership to sustain and encourage efficiency practices. The trainees were very positive about the training in surveys. While the curriculum was successfully delivered, the last course occurred in March 2020, just as COVID lockdown was implemented. The downstate properties were downsized by about 50%, partly in response to COVID.

Events Calendar

Table 2 identifies key events in the history of the project. The table also identifies the months with billing data from the BOM Report (available in six-month intervals). Utility data was not available. The red line indicates records that are hidden to keep the table to a reasonable length. The table identifies those months identified as baseline or performance periods in the BOM Report.

Table 2. Event and Billing Data Calendar

Month-Year	Events	BOM Billing	Utility Billing	BOM Period
Jan-2017	First month of BOM baseline	Elec, Gas	None	Baseline
Feb-2017		Elec, Gas	None	Baseline
Jun-2018		Elec, Gas	None	Baseline
Jul-2018	Agreement in effect	Elec, Gas	None	Baseline
Aug-2018		Elec, Gas	None	Baseline
Sep-2018		Elec, Gas	None	Baseline
Oct-2018	Kick-off meeting	Elec, Gas	None	Baseline
Nov-2018		Elec, Gas	None	Baseline
Dec-2018	Quarterly Report	Elec, Gas	None	Baseline
Jan-2019	Vendor equipment training	Elec, Gas	None	Performance
Feb-2019	Vendor equipment training	Elec, Gas	None	Performance
Mar-2019		Elec, Gas	None	Performance
Apr-2019		Elec, Gas	None	Performance
May-2019	CAMT training; Covey Training	Elec, Gas	None	Performance
Jun-2019	Quarterly Report (197 seats total); CAMT training	Elec, Gas	None	Performance
Jul-2019	CAMT training	Elec, Gas	None	Performance
Aug-2019	CAMT training; English Spanish	Elec, Gas	None	Performance
Sep-2019	Quarterly Report	Elec, Gas	None	Performance
Oct-2019		Elec, Gas	None	Performance

Month-Year	Events	BOM Billing	Utility Billing	BOM Period
Nov-2019		Elec, Gas	None	Performance
Dec-2019	Quarterly Report (222 seats total)	Elec, Gas	None	Performance
Jan-2020	Capstone Project Course; Putting It All Together Pilot	Elec, Gas	None	Performance
Feb-2020	CAMT+E online course	Elec, Gas	None	Performance
Mar-2020	Quarterly Report; Second Capstone Putting It Together COVID Lockdown	Elec, Gas	None	Performance
Apr-2020		Elec, Gas	None	Performance
May-2020		Elec, Gas	None	Performance
Jun-2020	Quarterly Report	Elec, Gas	None	Performance
Jul-2020			None	
Aug-2020			None	
Sep-2020	Quarterly Report		None	
Oct-2020			None	
Nov-2020			None	
Dec-2020	Final Quarterly Report		None	

Description of Training and Related Activities

This description of the training was derived from a review of project file material. An inventory of the project file is included under Data Collection.

The Scope of Work described the following curricula that were to be included in the project:

- Equipment-specific training for boilers and controls provided by an equipment manufacturer representative
- Certified Apartment Maintenance Technician (CAMT) classroom training and certification. Covers a broad range of topics, including repairs and services of a variety of equipment, not just HVAC; preventative maintenance; reporting and documentation; and professional behavior.
    - Standard curriculum modified to include collecting and interpreting energy data, identification of ECMs, and installation or oversight of measures.
- CAMT+E, an online course focused on collecting and interpreting energy use data, identification of energy conservation measures (ECMs), and installing or overseeing their installation.
- Franklin Covey Leadership Training – for management staff to develop leadership skills for effective and sustainable energy efficiency efforts.
- Capstone Course – a customized course that helps trainees translate the technical topics they have learned into day-to-day operations and to provide tools and scenarios to work with residents and other employees to gain commitment to energy efficient behavior. This was coupled with:

- Putting It All Together - Ensure that the technical and soft skills training deployed throughout the project results in measurable operational and company culture results.

Training delivery was described in the scope and corroborated in other reporting as follows.

- Boiler training downstate – Six one-day classes with two groups of 25, with focus on making changes to controls. Sessions are at a site with a boiler. Provided by boiler equipment vendors.
- Boiler training upstate – One half-day class and two two-day classes, with a group, with focus on complete teardown and troubleshooting of equipment. Sessions are at a site with a boiler. Provided by boiler equipment vendors.
- Six CAMT training events
- Six Franklin Covey training events
- Combined Capstone Course and Putting It All Together. Two events.

Organizational structures. The activities included creating organizational structures to sustain ongoing improvements. The activities included:

- Putting It All Together Course – ensure that the technical and soft skills training deployed throughout the project results in measurable operational and company culture results. Course attendees shall work with facilitators and peers to engage in scenario-based learning to identify specific strategies to work with residents on energy efficiency and to develop building-specific processes to incorporate energy efficiency into daily operations.
- Capstone Course – help trainees translate learning to improve efficiency
- Franklin Covey Leadership Training – offer to 25 management staff with a focus on sustainable energy efficiency

Tracked Savings

The savings for this project were in NYSERDA's Quarter 4 2021 CEF Report (known as the "Scorecard") as "complete" and are summarized in Table 3.

Table 3. Scorecard Reported Savings – Project Status is Encumbered [template]

Building	Number of Addresses	Electric Savings (MWh)	Gas Savings (MMBtu)
Upstate East	1	558	4,974
Downstate	37	30	270
Downstate	3	18	161
Downstate	10	45	399
Downstate	1	-	-
Downstate	58	79	702
Downstate	9	58	520
Upstate West	5	157	1,395
TOTAL	124	945	8,421

Table 4 summarizes the square footage of the buildings in the project. Building area estimates were provided for three of the properties, but not for Upstate East's portfolio of single-family homes. Upstate East's area estimate assumes 1,000 sq ft per unit average for each of the 2,500 homes.

Table 4. Building Area (square-footage) [template]

Building	Building Type	Building Area
Downstate	Residential	2,750,000
Upstate west	Residential	2,100,000
Upstate east	3500 SF homes. Estimated sq ft	3,500,000
TOTAL		8.5 million

Data Collection

Project documentation

The Evaluation Team reviewed Building O&M project documentation provided by NYSERDA program staff. The project files included the following information:

- Agreement with scope of work
- Final Report (129 pages)
- Quarterly Reports (for a total of eight)
- BOM Reports and associated spreadsheets with energy data
- Photos of class instructions

Site interview

A site contact could not be recruited for an interview.

Consumption data

Table 5 summarizes the available billing data for this project. The Building O&M or BOM Report for this site included billing data for an extended base period and for the performance period. The BOM Report billing data is provided in six-month intervals, not monthly. Monthly utility billing data was also acquired for electricity, but was not available for all fuels or for the full baseline period.

Table 5. Summary of Billing Data [template]

Bill Type	Fuel	Period	Months	Total for Period	Monthly Average	Units
BOM	Upstate East	Jan 2017 to Jun 2020	42	93,300,158	2,221,432	kWh
BOM	Upstate East	Jan 2017 to Jun 2020	42	10,357,581	246,609	therms

Bill Type	Fuel	Period	Months	Total for Period	Monthly Average	Units
BOM	Upstate West and NYC	Jan 2017 to Jun 2020	42	105,706,185	2,516,814	kWh
BOM	Upstate West and NYC	Jan 2017 to Jun 2020	42	12,866,492	306,345	therms

Savings Analysis

The WFD training is intended to empower individuals and organizations with the skills and the motivation to improve building operations through a combination of low-cost measures and best practices behaviors. Behavior-related impacts are ideally captured using whole billing analytics, since the savings result from an accumulation of smaller measures and the baseline and performance conditions are not easily characterized using an engineering approach. However, it also useful and follows best evaluation practices to verify that the organization implemented the behavioral changes and to corroborate the magnitude of the savings with a high-level engineering analysis.

The saving for this site is based on a billing analysis using the BOM Reported consumption data. There was no information included in the project files describing the implementation of any energy conservation measures (ECMs), so this site relies on the billing analysis alone.

Billing Analysis

The normal approach for a site-specific billing analysis is to regress the monthly consumption figures against the heating and cooling degree days (HDD and CDD, respectively). However, the BOM data is provided in six-month intervals, not monthly, reducing the number of data points available and masking their correspondence with weather. In this analysis, the baseline and performance period usages were weather normalized by applying a ratio of the historical to TMY3 HDD (or CDD) for the same period. Once normalized, the performance period usage was subtracted from the baseline period usage to determine weather-normalized savings.

Defining baseline and performance periods. The billing analysis uses the same baseline and performance period as that specified in the BOM Report. The BOM Report is a NYSERDA defined form used by the training providers to define the baseline period and to record consumption data every six months as the project progresses. The form calculates savings for each semi-annual interval as the difference between the baseline usage for the same six-month period and the most recent consumption data.

The evaluators do not recommend incorporating a “black-out” period from project start through the end of substantial training for these reasons:

- A black-out period is often applied in billing analysis of "widgets" so that the widget performance can be sharply delineated between the pre and post period. Training's impact is more diffuse and will start with the first day of training and accumulate in an unpredictable way overtime. A black-out period for this project would be eight months to a year in length.
- Since the baseline and performance period are closer in time without a black-out period, there are fewer other building changes impinging on the findings.
- The practice of defining the performance period beginning immediately from project start is observed in other whole building behavioral programs and evaluations, like California's industrial behavioral program. Host sites can observe the savings and use that for team motivation.
- A very practical reason to not use a black-out period is COVID-19. COVID lockdown happened just as the last training component was being conducted.

Weather-Normalized Results. The BOM included billing data for electricity and natural gas for two years prior to the implementation of the program and for 18 months after the training commenced for all three properties. The billing data for two of the properties (Upstate West and Downstate) were merged, and because the weather in the locations is sufficiently different, no billing analysis was attempted. Table 6 notes the weather-normalized average usage over two years in the base period and one year post period. Since the second post period was incomplete and it overlapped with the first COVID-19 pandemic lockdown, the billing analysis included only the first 12 months of the performance period in the billing analysis. Billing data was weather normalized using the semi-annual periods since that was the resolution of the consumption data. Table 6 summarizes the results of the billing analysis for the Upstate East consumption.

Table 6. Consumption Analysis Results for Upstate East

Energy	Base Period	Post Period	Savings	Units	Savings Fraction
Electricity	26,206,338	26,362,429	(156,090)	kWh	-0.6%
Natural gas	2,905,660	3,010,647	(104,987)	therms	-3.6%

The savings fraction determined for Upstate East was applied to the usage of the other two properties to estimate total impact for the project.

Engineering analysis

The project files contained no information about implemented measures, nor would the site respond to requests for interviews; therefore, there is no engineering analysis.

Site ID: SID-17

Subject: Impact findings for the site SID-17

Details: Training and other organizational activities, tracked and evaluated savings.

Facility type	Downstate residential multifamily properties
Area served by training (sq ft)	7,764,345
Agreement effective	November 1, 2017
Scorecard status	Complete

Summary

The customer is a developer/owner/manager of residential properties in NYC. The properties include a mix of affordable and market rate units. The curriculum was developed in partnership with the City of New York Building Performance Lab –which delivered the courses and designed and assisted in the implementation of a coaching mentorship program. The trainees staff twenty-three different properties distributed through-out New York City. About half of the staff targeted for training are classified as "handypersons" with several assigned to each individual property. Each property also has a residential manager and a general manager. Skilled trade staff (engineers) are centralized.

Table 1 summarizes the evaluated savings. The savings estimates consider all the available evidence including project file documents, consumption data, site interviews and the results of subsequent analysis. There is evidence of substantial first year savings in a weather-normalized consumption analysis which is corroborated by the engineering analysis.

Table 1. Site Savings Summary [template]

First Year Savings	Electric (MWh)	Natural Gas (MMBtus)
Scorecard reported savings	1,721	15,340
Evaluated savings	-4,023	-29,654
Realization rate	-234%	-193%
Annual base energy use	76,987	481,970
Tracked savings fraction	2.2%	3.2%
Evaluated savings fraction	-5.2%	-6.2%

A site contact could not be recruited for an interview or to release utility bills. The project files did not include any record of the implementation of specific measures because of the training.

The training implemented in this project was based on the Building Operator Certification training which is oriented towards individual certification. The training content was delivered through 60 hours of in classroom lectures. About 90% of the of buildings staff, including 'handypersons' (just over half of the

staff), engineers, and site managers took at least one class (average attendance rate of 57%). Only about 10% of the expected trainees participated in the follow-on BRT training. The mentorship coaching was dropped for lack of interest. In explaining the disinterest in the training, the trainer provider noted the energy champion had taken another job, that there was a low initial base knowledge of HVAC systems among staff, and that staff did not have permission to adjust equipment, including building management systems (BMS) without calling a contractor. None of the organizational change features (coaching, bi-annual audits, a sustainability plan) were implemented as part of the contract. The evaluator concludes that while some individuals benefited from the training based on the surveys and a description of classroom projects, that the property management organization did not leverage the training to improve building performance. The organization, for example, did not allow the trainees the autonomy to implement their learnings by adjusting the equipment. The diminishing interest in the training may reflect trainees being forced to take the course and seeing no real value was demonstrated to them. Example of the importance of fostering organizational changes.

Events Calendar

Table 2 identifies key events in the history of the project. The table also identifies the months with billing data from either the BOM Report (available in six months intervals) or utility provided billing (available in monthly intervals). The red line indicates records that are hidden to keep the table to a reasonable length. The table identifies those months identified as baseline or performance periods in the BOM Report.

Table 2. Event and Billing Data Calendar [template]

Month-Year	Events	BOM Billing	Utility Billing	Period
Jan-2017	BOM Report starts baseline data	Elec, Gas, #2 oil	NA	Baseline
Feb-2017		Elec, Gas, #2 oil	NA	Baseline
Mar-2017		Elec, Gas, #2 oil	NA	Baseline

Description of Training and Related Activities

This description of the training was derived from a review of project file material. An inventory of the project file is included under Data Collection.

Training population – included the following:

- 5 central engineering staff, 23 general managers, 2 Local 94 engineers, we 23 resident managers, 57 handypersons

The training was described in the scope and that was ultimately delivered is described as follows:

- Building Operator Certification (BOC) tailored for the properties served
  - Content focused on
    - Boiler/Hot water/steam systems
    - DHW
    - HVAC scheduling and space temperatures
  - CIJNY BPL delivers a version of the course, approved by NEEC (developed the original curriculum), which was customized for the properties.
  - 60 hours of classroom over 20 classes meeting once a week.
  - Required completing four homework assignments related to a building served by the student.
  - Targeted attendance of 103, 75 attended at least once with a 57% average attendance.
  - Curriculum content was based on BOC training
  - Administered pre/post surveys
- Building Re-tuning (BRT) based on a curriculum developed by Pacific Northwest National Labs to leverage the building automation systems to maximize building performance
  - Targeted audience of 47, 12 attended (target 47)
- Incorporate hands-on training at properties which host the training
- Project 'homework was included in the curriculum and lead to identification of five ECMs

Organizational structures. The scope of work included creating organizational structures to sustain ongoing improvements. The activities included:

- Contractor will develop a sustainability plan for creating and sharing knowledge among staff.
  - It appears that instead the property manager will develop the plan
- Contractor will conduct bi-annual audit (winter, summer) to track performance to score each building. One output is an action plan.

Coaching. Coaching was in the original scope but was canceled.

- These activities were scoped **but canceled** due to low participation rates and interest.
  - Intention is provide operators with greater insight into their building's performance
  - Pilot: Create a pairing between staff to identify mentors and mentees.
  - Coaches to conduct 5 three-hour group discussions
  - Phased approach to train mentors over three phases preparing them for independent mentoring

Outcomes. Final report noted that the energy champion had left and that staff did not have autonomy to make adjustments in buildings.

Tracked Savings

The savings for this project were in NYSERDA's Quarter 4 2021 CEF Report (known as the 'Scorecard') as "complete" and are summarized in Table 3.

Table 3. Scorecard Reported Savings – Project Status is Complete

Building	Electric Savings (MWh)	Gas Savings (MMBtu)
1	75	667
2	75	667
3	75	667
34	75	667
5	75	667
6	75	667
7	75	667
8	75	667
9	75	667
10	75	667
11	75	667
12	75	667
13	75	667
14	75	667
15	75	667
16	75	667
17	75	667
18	75	667
19	75	667
20	75	667
21	75	667
22	75	667
23	75	667
TOTAL	1,721	15,340

Table 4 summarizes the square-footage of the buildings in the project.

Table 4. Building Area (square-footage) [template]

Building	Building Type	Building Area
1	Portfolio of buildings	7,764,345
TOTAL		

Data Collection

Project documentation

The Evaluation Team reviewed Building O&M project documentation provided by NYSERDA program staff. The project files included the following information:

- Contract agreement between the end-use customer, the training provider, and NYSERDA
- Training attendance rosters
- Trainee surveys and analysis
- Quarterly Training Reports, January 2019 through
- Draft Final Report (November 2020)

Site interview

A site contact with knowledge of the building operation could not be recruited for an interview.

Consumption data

Table 5 summarizes the available billing data for this project. The Building O&M or BOM report for this site included billing data for an extended base period and for the performance period. The BOM Report billing data is provided in six-month intervals, not monthly. Monthly utility billing data was also acquired for electricity, but was not available for all fuels or for the full baseline period.

Table 5. Summary of Billing Data [template]

Bill Type	Fuel	Period	Months	Total for Period	Monthly Average	Units
BOM	Electricity	Jan 2016 to Dec 2020, less 6 months	54	354,885,818	6,571,960	kWh
BOM	Natural gas	Jan 2016 to Dec 2020, less 6 months	54	19,222,482	355,972	therms

Savings Analysis

The WFD development training is intended to empower individuals and organizations with the skills and the motivation to improve building operations through a combination of low cost measures and best practices behaviors. Behavior related impacts are ideally captured using whole billing analytics, since the savings result from an accumulation of smaller measures and the baseline and performance conditions are not easily characterized using an engineering approach. However, it also useful and follows best

evaluation practices to verify that the organization implemented the behavioral changes and to corroborate the magnitude of the savings with a high-level engineering analysis.

The saving for this site is based on a billing analysis using the BOM Reported consumption data. There was no information included in the project files describing the implementation of any energy conservation measures (ECMs), so this site relies on the billing analysis alone.

Billing Analysis

Defining baseline and performance periods. The billing analysis uses the same baseline and performance period as that specified in the BOM Report. The BOM Report is a NYSERDA defined form used by the training providers to define the baseline period and to record consumption data every six months as the project progresses. The form calculates savings for each semi-annual interval as the difference between the baseline usage for the same six-month period and the most recent consumption data.

The evaluators do not recommend incorporating a 'black-out' period from project start through the end of substantial training for these reasons:

- A black-out period is often applied in billing analysis of 'widgets' so that the widget performance can be sharply delineated between the pre and post period. Training's impact is more diffuse and will start with the first day of training and accumulate in an unpredictable way overtime. A black-out period for this project would be eight months to a year in length.
- Since the baseline and performance period are closer in time without a black-out period, there are fewer other building changes impinging on the findings.
- The practice of defining the performance period beginning immediately from project start is observed in other whole building behavioral programs and evaluations, like California's industrial behavioral program. Host sites can observe the savings and use that for team motivation.
- A very practical reason to not use a black-out period is COVID. COVID lockdown happened only a few months after the last training and a black-out period would eliminate most of the performance period.

BOM Report Billing Results. The normal approach for a site-specific billing analysis is to regress the monthly consumption figures against the heating and cooling degree days (HDD and CDD, respectively). However, the BOM data is provided in six-month intervals not monthly, reducing the number of data points available and masking their correspondence with weather. In this analysis, the baseline and performance period usages were weather normalized by applying a ratio of the historical to TMY3 HDD (or CDD) for the same period. Once normalized, the performance period usage was subtracted from the baseline period usage to determine weather-normalized savings.

The BOM included billing data for all fuels for two years prior to the implementation of the program and for 18 months after the training commenced. Table 6 notes the average usage over two years in the base period and one year post period. The last semi-annual reporting period was dropped because it overlapped the first COVID-19 pandemic lockdown when gas usage increased dramatically. Billing data was weather normalized using the semi-annual periods since that was the resolution of the consumption data.

Table 6. Consumption Analysis Results [template]

Energy	Base Period	Post Period	Savings	Units	Savings Fraction
Electricity					
Natural gas					
#2 fuel oil					

Engineering analysis

The project files contained no information about implemented measures, nor would the site respond to requests for interviews; therefore, there is no engineering analysis. However, the training provider did note several factors that would likely impact negative savings as follows:

> ***Student Access/ Control over BMS Systems was Limited****. The BRT curriculum's emphasis on real time building data was an attempt at an innovative and forward-thinking approach to classroom teaching. Student's ability to access or adjust building control parameters was generally limited. Improved coordination with ownership is required to ensure curriculum reflects student's day to day responsibilities and can result in actual operational changes.*

Site ID: SID-29

Subject: Impact findings for the site SID-29

Details: Training and other organizational activities, tracked and evaluated savings.

Facility type	Urban research facility and medical school
Area served by training (sq ft)	1,788,931
Agreement effective	March 2018
Scorecard status	Complete

Summary

This is research facility and medical school located in an urban setting downstate. This facility includes complex and specialized equipment including lab hood ventilation systems, a sophisticated building automation system, and advanced lighting controls integrated with automated shades. The training was designed to address the specific issues at the facility. A Learning Lab was built on campus to facilitate hands-on training with equipment and system interfaces that the staff encounters in their real world. The training included training provided by the BMS and advanced lighting controls vendors. The facility systems and controls are complex serving laboratories and well as other HVAC needs. The facility imports chilled water and district steam from a sister campus.

To increase the focus on energy efficiency, the organization integrated training goals into the annual review cycle and created a training program for new hires. A learning repository was created to house the training material and other building information resources.

Table 1 summarizes the evaluated savings. The savings estimates consider all the available evidence including project file documents, consumption data, site interviews and the results of subsequent analysis. There is evidence of first year electric savings in a weather-normalized consumption analysis, while the total thermal energy use shows an increase. District steam accounts for about 97% of the thermal load compared to 3% supplied by natural gas; together these fuels showed an 8.5% increase in thermal consumption. Chilled water usage also shows an increase in usage but was not factored into this analysis.

Table 1. Site Savings Summary

First Year Savings	Natural Gas (MMBtus)	District Steam (MMBTUs)	Electric (MWh)	Chilled Water (ton-hrs)
Scorecard reported savings	11,363	Not reported in scorecard	1,276	Not reported in scorecard
Evaluated savings	977	-40,077	2,734	-2,400,207
Realization rate	9%	NA	214%	NA
Annual base energy use	12,211	448,193	68,237	9,651,239

First Year Savings	Natural Gas (MMBtus)	District Steam (MMBTUs)	Electric (MWh)	Chilled Water (ton-hrs)
Tracked savings fraction	93.1%	NA	1.9%	NA
Evaluated savings fraction	8.0%	-8.9%	4.0%	-24.9%
Thermal load reduction	-8.5%			

*Purchased steam from an adjacent facility which is combined with natural gas on an equivalent BTU basis to com and thermal savings fraction.

The electric and natural gas savings was estimated using utility billing data consumption analysis while the chilled water and district steam used the semi-annual usage data in the semi-annual BOM.

The by site contact reported that a number of measures were implemented by trained staff that had been identified in an audit of one of the buildings and support the electricity findings.

Events Calendar

Table 2 identifies key events in the history of the project. The table also identifies the months with billing data from either the BOM Report (available in six months intervals) or utility provided billing (available in monthly intervals) with a "B" or "P" indicating the month was included in the evaluated baseline or performance period, respectively. The red line indicates records that are hidden to keep the table to a reasonable length.

According to the project file records, training started before the official commencement of the performance period.

Table 2. Event and Billing Data Calendar

Month-Year	Events	BOM Billing	Utility Billing	BOM Period
Sep-2016	First month of the baseline	Elec, Gas, CW, Steam	B Elec, Gas	Baseline
Mar-2018	Contract effective date	Elec, Gas, CW, Steam	B Elec, Gas	Baseline
Apr-2018		Elec, Gas, CW, Steam	B Elec, Gas	Baseline
May-2018		Elec, Gas, CW, Steam	B Elec, Gas	Baseline
Jun-2018	GPRO training (date?)	Elec, Gas, CW, Steam	B Elec, Gas	Baseline
Jul-2018	BMS training (date?)	Elec, Gas, CW, Steam	B Elec, Gas	Baseline
Aug-2018	Energy Code training (date?)	Elec, Gas, CW, Steam	B Elec, Gas	Baseline
Sep-2018	Coaching: 2 sessions; Consultant recommended controls improvements	Elec, Gas, CW, Steam	Elec, Gas	Performance
Oct-2018	Coaching: 2 sessions	Elec, Gas, CW, Steam	Elec, Gas	Performance
Nov-2018	Coaching: 1 session	Elec, Gas, CW, Steam	Elec, Gas	Performance
Dec-2018	Coaching: 1 session	Elec, Gas, CW, Steam	Elec, Gas	Performance
Jan-2019	First Quarterly Report in the files	Elec, Gas, CW, Steam	P Elec, Gas	Performance

Month-Year	Events	BOM Billing	Utility Billing	BOM Period
Feb-2019		Elec, Gas, CW, Steam	P Elec, Gas	Performance
Mar-2019	Advanced lighting control training (date?)	P Elec, Gas, CW, Steam	P Elec, Gas	Performance
Apr-2019		P Elec, Gas, CW, Steam	P Elec, Gas	Performance
May-2019		P Elec, Gas, CW, Steam	P Elec, Gas	Performance
Jun-2019	Coaching: 2 sessions	P Elec, Gas, CW, Steam	P Elec, Gas	Performance
Jul-2019	Coaching: 1 session; Learning Lab complete	P Elec, Gas, CW, Steam	P Elec, Gas	Performance
Aug-2019	Coaching: 1 session	P Elec, Gas, CW, Steam	P Elec, Gas	Performance
Sep-2019		P Elec, Gas, CW, Steam	P Elec, Gas	Performance
Oct-2019		P Elec, Gas, CW, Steam	P Elec, Gas	Performance
Nov-2019		P Elec, Gas, CW, Steam	P Elec, Gas	Performance
Dec-2019	Coaching: design next custom training	P Elec, Gas, CW, Steam	P Elec, Gas	Performance
Jan-2020		P Elec, Gas, CW, Steam	Elec, Gas	Performance
Feb-2020	Coaching: design next custom training	P Elec, Gas, CW, Steam	Elec, Gas	Performance
Mar-2020		P Elec, Gas, CW, Steam	Elec, Gas	Performance
Aug-2020		Elec, Gas, CW, Steam	Elec, Gas	Performance
Sep-2020		Elec, Gas, CW, Steam	Elec, Gas	Additional data
Oct-2020	Steam training (date?)	Elec, Gas, CW, Steam	Elec, Gas	Additional data
Nov-2020	Drain clog training (date?)	Elec, Gas, CW, Steam	Elec, Gas	Additional data
Dec-2020		Elec, Gas, CW, Steam	Elec, Gas	Additional data
Aug-2021		Elec, Gas, CW, Steam	Elec, Gas	Additional data

Training description

The periods during which training occurred could be deduced from the record although there were no attendance rosters or other pre/post surveys included in the project files.

Training. The training included the following topics as referenced in the project files:

- Building science Green Professional Operations and Maintenance (GPRO) core curriculum conducted in GPRO – training provider's building fundamental energy curriculum
- Conquer the Energy Code training

- As part of the WFD contract, subcontracted to the BMS vendor to provide training. Additional curriculum developed by WFD vendor to allow staff to conduct day-to-day BMS activities
- As part of the WFD contract, subcontracted to an advanced lighting controls vendor
- On-line courses offered: Steam systems training.
- In-house Drina Clog Training

Learning Lab. Creation of a Learning Lab for hands on practice

- A dedicated space well equipped with hands on systems similar to what is found at the center
- Access to the two building control systems (HVAC and lighting)
- Equipped with representative HVAC components including a fully operating VAV system and associated controls
- BMS interface for practice
- A function lab hood for lab hood training
- Advanced lighting system
- Seen as a tool for "reinforcing culture of training"

Organizational structures. The activities included creating organizational structures to sustain ongoing improvements. The activities included

- Dedicated space for learning labs which include hands-on HVAC, lighting, BMS and hood exhaust systems in the room.
- Sustain training
  - Organized training with a recommended training path for new hires
  - Incorporate training goals in annual reviews
  - Process to reduce recurring issues
  - Online repository for training material
- Energy reductions –the scope identified the following, but not it was not confirmed in Quarterly Reports
  - Identify an Energy Team
  - Develop a Green Plan
  - Track progress

Coaching. The coaching activities were focused on ensuring that training was embedded in the organization rather than in operating the buildings better. The coaching was characterized as:

- Helped model and implement team-wide staff discussion format for cross-system repair

- Helped model 1:1 session between staff and supervisors to track progress of training goals.
- Led the Energy Team through the development and implementation of Training Plan

Tracked savings

The savings for this project were in NYSERDA's Quarter 4 2021 CEF Report (known as the 'Scorecard') as "encumbered" and are summarized in Table 3.

Table 3. Scorecard Reported Savings – Project Status is Complete

Building	*Electric Savings (MWh)*	*Gas Savings (MMBtu)*
1	408	3,636
2	325	2,893
3	204	1,819
4	160	1,427
5	73	647
6	64	570
7	42	371
TOTAL	1,276	11,363

Table 4 summarizes the square-footage of the buildings in the project.

Table 4. Building Area (square-footage)

Building	Building Type	Building Area
1	Medical school and research lab	1,788,931
TOTAL		1,788,931

Data Collection

Project documentation

The Evaluation Team reviewed Building O&M project documentation provided by NYSERDA program staff. The project files included the following information:

- Agreement with NYSERA (Revised 12/21/2020) describes these functions are in scope
  - GPRO course
  - Ancillary course development for BMS with practice sessions for students, Lutron Lighting to manage the lighting controls.
  - Energy coaching to include identify an Energy Team and develop a Green Plan. Monthly Energy Team meets monthly.
  - Development of HVAC and Lighting Controls labs. HVAC lab includes a fume hood and BMS interface for re-enforcing BMS lessons.
  - Supplementary on-line courses in steam systems

- Includes a customer service training for dealing with tenants
- Overview of training and labs – Powerpoint
  - Collaborative resolution of recurring problems
- BOM reports for includes utility reporting for five years of usage
- Quarterly Reports covering the period of Q4-2018 through Q4-2021 with a few gaps.
- Pre/post surveys of students – represents about a dozen individuals
- A recommissioning audit study report

Site Interview

The site contact confirmed that the training was completed, and that trained staff served all of the buildings listed in the CEF report. The functions in the facility include offices and laboratory space. As a result of the program a wide range of control strategies were implemented with appropriate repairs of associated control components and included occupancy controls with set-back/forward during unoccupied hours, installation of DCV controls, statis pressure and temperature reset, recalibration of VAV units and reduction in air-change rates in overventilated spaces.

During the COVID lock-down, occupancy was reduced by about 50% until late 2020. In response to the pandemic controls were modified to increase ventilation.

Consumption data

The Building O&M or BOM report for this site included billing data for an extended base period and for the performance period for electricity, natural gas, district steam and district chilled water. The BOM Report billing data is provided in six-month intervals, not monthly. Monthly utility billing data was also acquired for electricity and natural gas not available for all fuels or for the full baseline period.

Table 5. Summary of Billing Data

Bill Type	Fuel	Period	Months	Total for Period	Monthly Average	Units
BOM	Electricity	Sep 2016 to Aug 2021	60	337,026,828	5,617,114	kWh
BOM	Natural gas	Sep 2016 to Aug 2021	60	591,203	9,853	therms
BOM	Chilled water	Sep 2016 to Aug 2021	60	52,714,177	878,570	ton-hrs
BOM	District steam	Sep 2016 to Aug 2021	60	1,129,005	18,817	Mlbs
Utility	Electricity	Dec 2017 to Feb 2022	50	264,579,200	5,243,856	kWh

Bill Type	Fuel	Period	Months	Total for Period	Monthly Average	Units
Utility	Natural gas	Dec 2017 to Feb 2022	50	494,390	9,732	therms

Savings Analysis

The WFD development training is intended to empower individuals and organizations with the skills and the motivation to improve building operations through a combination of low cost measures and best practices behaviors. Behavior related impacts are ideally captured using whole billing analytics, since the savings result from an accumulation of smaller measures and the baseline and performance conditions are not easily characterized using an engineering approach. However, it also useful and follows best evaluation practices to verify that the organization implemented the behavioral changes and to corroborate the magnitude of the savings with a high-level engineering analysis.

The electric and natural gas saving for this site is based on a billing analysis using the monthly utility data. Chilled water and natural gas savings were calculated using a consumption analysis of the BOM Reported consumption data. The results were corroborated using an engineering based high-level estimates of impacts for measures noted as implemented in the project files and as reported during the staff interview.

Billing Analysis

Defining baseline and performance periods. The billing analysis uses the same baseline and performance period in principle as that specified in the BOM Report. The BOM Report is a NYSERDA defined form used by the training providers to define the baseline period and to record consumption data every six months as the project progresses. The form calculates savings for each semi-annual interval as the difference between the baseline usage for the same six-month period and the most recent consumption data.

The evaluators do not recommend incorporating a 'black-out' period from project start through the end of substantial training for these reasons:

- A black-out period is often applied in billing analysis of 'widgets' so that the widget performance can be sharply delineated between the pre and post period. Training's impact is more diffuse and will start with the first day of training and accumulate in an unpredictable way overtime. A black-out period for this project would be eight months to a year in length.
- Since the baseline and performance period are closer in time without a black-out period, there are fewer other building changes impinging on the findings.

- The practice of defining the performance period beginning immediately from project start is observed in other whole building behavioral programs and evaluations, like California's industrial behavioral program. Host sites can observe the savings and use that for team motivation.
- A very practical reason to not use a black-out period is COVID. COVID lockdown happened only a few months after the last training and a black-out period would eliminate most of the performance period.

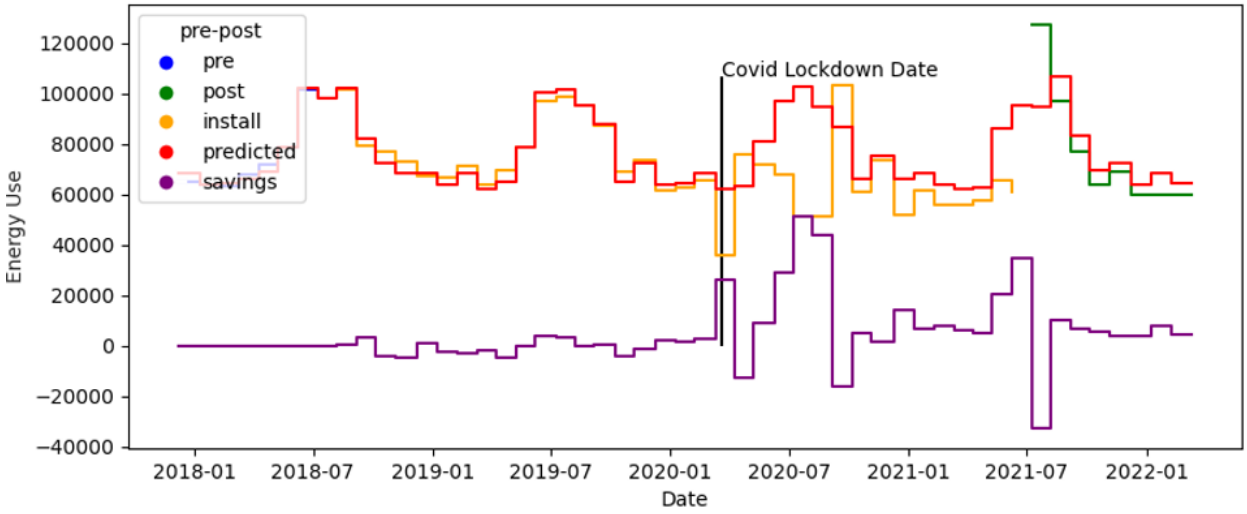
Utility Billing Results. In this analysis, the monthly utility provided billing data was regressed against historical weather data following CalTrack protocols for cleaning and screening data. Data from two electric meters at an isolated building were dropped from the analysis, due to billing anomalies in one of the meters. Table 6 presents the savings fractions by electric meter for the first and second 12-month period of the BOM Performance Period and for subsequent calendar years. The savings fraction for 2019 was selected as the most applicable savings fraction aligning with the BOM performance period without overlapping COVID.

Table 6. Utility Billing Analysis Results by Meter

	Modelled Base	BOM 12 Month Savings	BOM 24 Month Savings	2019 Savings	2020 Savings	2021 Savings
E-0	80,088,189	4%	5%	4%	6%	12%
E-4	3,010,602	-1%	-1%	-1%	-1%	0%
E-5	83,099,172	4%	6%	7%	9%	7%
E-6	31,173,114	-1%	3%	1%	9%	14%
E-7	19,691,030	-2%	-1%	-1%	2%	3%
E-8	5,830,496	-6%	0%	-3%	6%	11%
E Total	222,892,603	2.44%	4.35%	4.01%	7.09%	9.43%
G-2	431,771	8%	7%	8%	8%	13%

Figure 1 illustrates the results of the analysis for one of the electric meters accounting for about one-third of the facility wide usage. The impact of COVID can clearly be seen in the bills.

Figure 1. Billing Regression Results for a Selected Account



BOM Billing Results. The normal approach for a site-specific billing analysis is to regress the monthly consumption figures against the heating and cooling degree days (HDD and CDD, respectively). However, the BOM data is provided in six-month intervals not monthly, reducing the number of data points available and masking their correspondence with weather. In this analysis, the baseline and performance period usages were weather normalized by applying a ratio of the historical to TMY3 HDD (or CDD) for the same period. Once normalized, the performance period usage was subtracted from the baseline period usage to determine weather-normalized savings.

The BOM included billing data for all fuels for two years prior to the implementation of the program and for three years after the training commenced. Table 7 notes the average weather normalized usage over the base period and performance period. The last semi-annual reporting period was dropped because it overlapped the first COVID-19 pandemic lockdown when energy usage changed dramatically. Billing data was weather normalized using the semi-annual periods since that was the resolution of the consumption data.

Table 7. BOM Consumption Analysis Results

Energy	**Base Period** Mar-2017 to Feb-2018	**Post Period** Mar-2019 to Feb-2020	**Savings**	**Units**	**Savings Fraction**
Electricity	68,237,137	66,996,528	1,240,609	kWh	1.8%
Natural gas	122,109	106,091	16,018	therms	13.1%
District steam	262,760	286,256	(23,496)	Mlbs	-8.9%
Chilled water	9,651,239	12,051,446	(2,400,207)	ton-hrs	-24.9%

This facility purchases chilled water and district steam from a sister adjacent facility. The chilled water consumption is equivalent to about 8 GWh of electricity, while the steam accounts for about 97% of the thermal consumption compared to 3% provided by natural gas.

Engineering analysis

This project record demonstrates that the university was taking concrete actions during the performance period. Table 6 summarizes the ECMs noted as implemented in the project record or by the site contact during the interview. Estimates were derived from savings estimates produced by the client or their consultant included in the project record.

Table 8. Audit Recommended RCx and Low-Cost Measures

Energy Conservation Measure (ECM)	Building	Electric Savings (kWh)	District steam (Mlbs)	Chiller (ton-hrs)
Nighttime setback re-programming project	Building 1			
Building 1 Total		280,570	9,373	
Replace leaking valves	Building 2			
Fan-powered box, recommission dampers and sensors and revise sequence	Building 2			
Central AHU staging	Building 2			
Building 2 Total		234,481	5,435	
TOTAL Building 1 and 2		515,051	14,808	

Site ID: SID-62

Subject: Impact findings for the site SID-62

Details: Training and other organizational activities, tracked and evaluated savings.

Facility type	Downstate residential multifamily properties
Area served by training (sq ft)	2,311,911
Agreement effective	June 1, 2018
Scorecard status	Encumbered

Summary

This organization developed 43 multifamily low- and middle-income and supportive housing residential buildings in Brooklyn and the Bronx. The properties are managed by three different property management firms with 40 staff in total. This includes building superintendents (30) and managers, including three maintenance directors. One apparent motivation for the training is to develop consistent procedures across all buildings.

Table 1 summarizes the evaluated savings. The savings estimates consider all the available evidence including project file documents, consumption data, site interviews, and the results of subsequent analysis. There is evidence of substantial first-year savings in a weather-normalized consumption analysis, although there is no corroborating engineering analysis.

Table 27. Site Savings Summary

First Year Savings	Electric (MWh)	Natural Gas (MMBtus)
Scorecard reported savings	121	4,135
Evaluated savings	207	7,330
Realization rate	171%	177%
Annual base energy use	3,855	138,420
Tracked savings fraction	3.1%	3.0%
Evaluated savings fraction	5.4%	5.3%

The electric and natural gas savings were estimated using utility billing data consumption. There was no evidence in the files corroborating actions taken by the facility staff to produce the savings.

Events Calendar

Table 28 identifies key events in the history of the project. The table also identifies the months with billing data from either the BOM Report (available in six-month intervals) or utility-provided billing (available in monthly intervals), with a “B” or “P” indicating the month was included in the evaluated baseline or performance period, respectively. The red line indicates records that are hidden to keep the table to a reasonable length.

Table 28. Event and Billing Data Calendar [template]

Month-Year	Events	BOM Billing	Utility Billing	BOM Period
Jan-2017	First month of BOM baseline	Elec, Gas		Baseline
Feb-2017		Elec, Gas		Baseline
Nov-2017		Elec, Gas		Baseline
Dec-2017		Elec, Gas	B Elec, Gas	Baseline
Jan-2018		B Elec, Gas	B Elec, Gas	Baseline
May-2018		B Elec, Gas	B Elec, Gas	Baseline
Jun-2018	Agreement effective date	B Elec, Gas	B Elec, Gas	Baseline
Jul-2018		B Elec, Gas	B Elec, Gas	Baseline
Feb-2019		P Elec, Gas	P Elec, Gas	Performance
Mar-2019	Heating Training (34 trained)	P Elec, Gas	P Elec, Gas	Performance
Apr-2019		P Elec, Gas	P Elec, Gas	Performance
May-2019	Training the trainer (approximate)	P Elec, Gas	P Elec, Gas	Performance
Jun-2019		P Elec, Gas	P Elec, Gas	Performance
Jul-2019		P Elec, Gas	P Elec, Gas	Performance
Aug-2019	Non-Heating Training (29 trained)	P Elec, Gas	P Elec, Gas	Performance
Sep-2019		P Elec, Gas	P Elec, Gas	Performance
Dec-2019		P Elec, Gas	P Elec, Gas	Performance
Aug-2020			Elec, Gas	
Sep-2020	Last Quarterly Report		Elec, Gas	
Oct-2020			Elec, Gas	

Description of Training and Related Activities

This description of the training was derived from a review of project file material. An inventory of the project file is included under Data Collection.

The training curriculum described in the scope of work was intended to include the following elements. Note that no classroom material, like slide decks, or detailed classroom descriptions or syllabus were included in the project files.

Systems and Operations curriculum:

- Basic boiler operations and maintenance
- Hydronic system distribution operations and maintenance

- Preventative maintenance on hydronic systems
- Mechanical ventilation, including exhaust, air handlers, and filter cleaning/replacement
- Elevator troubleshooting and basic maintenance
- Pilot monitoring and analysis of key performance indicators
- Building science concepts
- Stack effect concepts and air infiltration reduction strategies
- Management and mitigation of moisture infiltration
- On-site generation
- Cogen operations and maintenance
- Local laws and codes
- New York City Local Law 84 and Local Law 87 awareness and concepts
- NYC Housing and Maintenance Code, including signage and inspections**.**
- Special attention for the following was included in the scope**:**
    - The Contractor shall provide training on sequences of operation to participants in groups, based on space heating distribution type.
    - Building Management System (BMS) curriculum:
        - How it works, and why it is useful.
        - Accessing and using the web-based enhanced analytics, trending, and alarming.

In addition to the curriculum, the activities scoped included **production of manuals**.

- O&M Manual: Create centralized operations and maintenance procedures and O&M manuals for building operators and maintenance staff to be used portfolio-wide. Procedures shall be identical portfolio-wide when possible and shall be tailored to HVAC systems as appropriate. Procedures shall cover daily, weekly, monthly, and quarterly inspections and actions to take.
- There were no manuals included in the project file, nor any note of them in the quarterly report.

Training delivery was described in the scope as follows:

- Training consisted of classroom training, one day focused on heating systems and a second on non-heating systems.
- Hands-on field training with one day conducted in the customer properties, one day associated with heating, and a second day associated with non-heating equipment.
- The scope estimated 38 staff would be trained.
- Attendance records support that about 38 people were trained with both classroom and field components.

Organizational structures. The scope of work described the following activities. The content could not be confirmed, although the Quarterly Report noted that six trainers were trained.

- The SOW specified that about six carefully selected staff members would be trained to improve the BMS operation and then mentor other staff in those techniques.
- Quarterly Report notes that six trainers were trained.

Tracked Savings

The savings for this project were in NYSERDA's Quarter 4 2021 CEF Report (known as the "Scorecard") as "complete" and are summarized in Table 2.

Table 29. Scorecard Reported Savings – Project Status is Encumbered [template]

Building	Electric Savings (MWh)	Gas Savings (MMBtu)
44 buildings	121	4,135
TOTAL	121	4,135

Table 3 summarizes the square footage of the buildings in the project.

Table 30. Building Area (square footage) [template]

Building	Building Type	Building Area
44 buildings	Residential multifamily	2,311,911
TOTAL		2,311,911

Data Collection

Project documentation

The Evaluation Team reviewed Building O&M project documentation provided by NYSERDA program staff. The project files included the following information:

- Agreement with a scope of work, dated June 2018
- Application
- Quarterly Reports (11 in total)
- BOM Report with 42 months of usage in semi-annual periods
- 2015 ACEEE paper entitled "Enhancing Elevator Efficiency"
- Attendance tracking spreadsheet
- Sign-in sheets and trainee surveys
- Spreadsheet summary of non-heating training surveys

Site interview

A site contact with knowledge of the building operation could not be recruited for an interview.

Consumption data

The Building O&M or BOM report for this site included billing data for an extended base period and for the performance period. The BOM Report billing data is provided in six-month intervals, not monthly. Monthly utility billing data was also acquired for electricity and natural gas.

Table 31. Summary of Billing Data

Bill Type	Fuel	Period	Months	Total for Period	Monthly Average	Units
BOM	Electricity	Jan 2017 to Sep 2020	42	13,378,777	318,542	kWh
BOM	NG	Jan 2017 to Sep 2020	42	4,153,424	98,891	therms
Utility	Electricity	Dec 2017 to Feb 2022	63			kWh
Utility	NG	Dec 2017 to Feb 2022	63			therms

Savings Analysis

The WFD development training is intended to empower individuals and organizations with the skills and the motivation to improve building operations through a combination of low-cost measures and best practices behaviors. Behavior-related impacts are ideally captured using whole billing analytics, since the savings result from an accumulation of smaller measures and the baseline and performance conditions are not easily characterized using an engineering approach. However, it also useful and follows best evaluation practices to verify that the organization implemented the behavioral changes and to corroborate the magnitude of the savings with a high-level engineering analysis.

The electric and natural gas savings for this site is based on a billing analysis using the monthly utility data. The project files did not include any information describing the implementation of any energy conservation measures (ECMs), so this site relies on the billing analysis alone.

Billing Analysis

Defining baseline and performance periods. The billing analysis uses the same baseline and performance period in principle as that specified in the BOM Report. The BOM Report is a NYSERDA-defined form used by the training providers to define the baseline period and to record consumption data every six months as the project progresses. The form calculates savings for each semi-annual interval as the difference between the baseline usage for the same six-month period and the most recent consumption data.

The evaluators do not recommend incorporating a "black-out" period from project start through the end of substantial training for these reasons:

- A black-out period is often applied in billing analysis of "widgets" so that the widget performance can be sharply delineated between the pre and post period. Training's impact is more diffuse and will start with the first day of training and accumulate in an unpredictable way overtime. A black-out period for this project would be eight months to a year in length.
- Since the baseline and performance period are closer in time without a black-out period, there are fewer other building changes impinging on the findings.
- The practice of defining the performance period beginning immediately from project start is observed in other whole-building behavioral programs and evaluations, like California's industrial behavioral program. Host sites can observe the savings and use that for team motivation.
- A very practical reason to not use a black-out period is COVID-19. COVID lockdown happened only a few months after the last training, and a black-out period would eliminate most of the performance period.

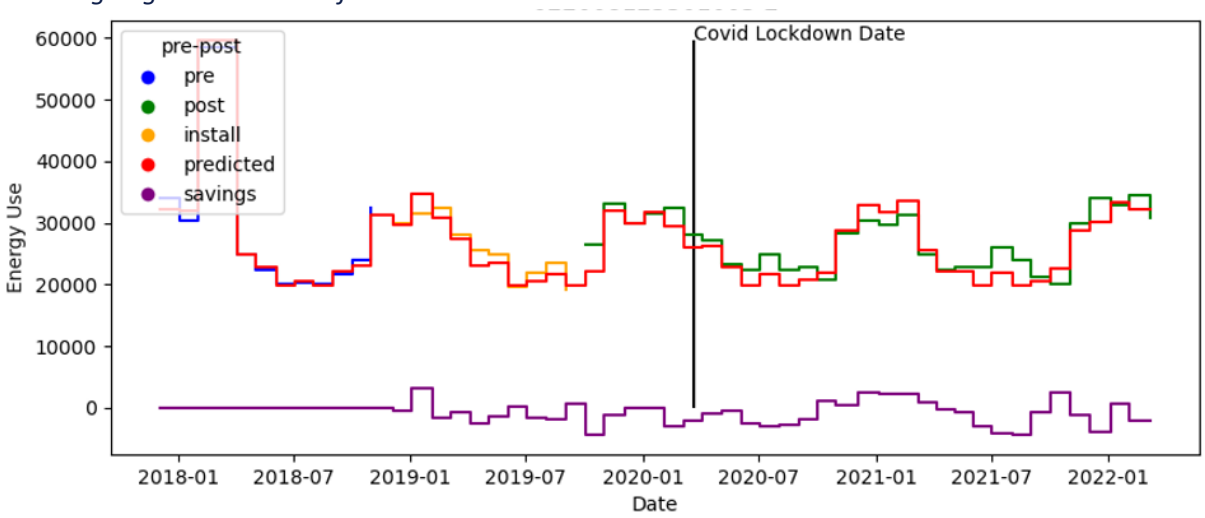
Utility Billing Results. In this analysis, the monthly utility provided billing data was regressed against historical weather data following CalTrack protocols for cleaning and screening data. Data from seven meters were dropped from the analysis, due to anomalies. Table 9 presents the savings fractions for all included 45 electric and 51 gas meters for the first and second 12-month period of the BOM Performance Period and for subsequent calendar years. The savings fraction for 2019 was selected as the most applicable savings fraction aligning with the BOM performance period without overlapping COVID.

Table 32. Utility Billing Analysis Results by Electric and Natural Gas

	Modeled Base	BOM 12 Month Savings	BOM 24 Month Savings	2019 Savings	2020 Savings	2021 Savings
Electric	12,287,582	5.4%	6.2%	5.4%	6.8%	9.2%
Gas	3,010,602	4.1%	3.9%	5.3%	7.2%	-7.0%

Figure 1 illustrates the results of the analysis for one of the electric accounts.

Figure 1. Billing Regression Results for a Selected Account



BOM Billing Results. The normal approach for a site-specific billing analysis is to regress the monthly consumption figures against the heating and cooling degree days (HDD and CDD, respectively). However, the BOM data is provided in six-month intervals, not monthly, reducing the number of data points available and masking their correspondence with weather. In this analysis, the baseline and performance period usages were weather normalized by applying a ratio of the historical to TMY3 HDD (or CDD) for the same period. Once normalized, the performance period usage was subtracted from the baseline period usage to determine weather-normalized savings.

The BOM included billing data for all fuels for one year prior to the implementation of the program and for 12 months after the training commenced (matching the utility billing periods). Table 5 notes the average usage over two years in the base period and one year post period. Billing data was weather normalized using the semi-annual periods since that was the resolution of the consumption data. This is presented for comparison purposes but was not used in the evaluated savings.

Table 33. Consumption Analysis Results

Energy	Base Period Jan 2018 to Dec 2018	Post Period Jan 2019 to Dec 2019	Savings	Units	Savings Fraction
Electricity	3,787,156	3,433,097	354,059	kWh	9.3%
Natural gas	1,418,553	972,673	445,879	therms	31.4%

Engineering analysis

The project files contained no information about implemented measures, nor would the site respond to requests for interviews; therefore, there is no engineering analysis.

Site ID: SID-67

Subject: Impact findings for the site SID-67

Details: Training and other organizational activities, tracked and evaluated savings.

Facility type	Suburban university college
Area served by training (sqft)	839,834
Agreement effective	October 1, 2018 (specific date was not in project file)
Scorecard status	Complete

Summary

This is a public college of 2200 students dedicated to the environmental studies located upstate in a suburban setting. The school is associated with an adjacent University, within which it was founded and from which it imports district steam. The college's curricula focus on the understanding, management, and sustainability of the environment and natural resources.

The training provider training included staff technical training and other activities fostering organizational changes to instill practices of continuous improvements. The activities at this site had elements of "Strategic Energy Management" which is designed to create organizational changes fostering ongoing energy reductions. In addition to the multiple training sessions offered to diverse trades and at all staff levels, the program initiated organizational structures (an Energy Champion and Green Team), and coaching.

Table 1 summarizes the evaluated savings. The savings estimates consider all the available evidence including project file documents, consumption data, site interviews and the results of subsequent analysis. There is evidence of substantial first year savings in a weather-normalized consumption analysis which is corroborated by the engineering analysis. The thermal energy savings fraction was 3.2% combining natural gas, and purchased steam on a BTU basis.

Table 1. Site Savings Summary

First Year Savings	Electric (MWh)	Natural Gas* (MMBtus)	# 2 Fuel Oil (MMBtus)
CEF reported savings	261	3,011	Non reported
Evaluated savings	743	2,529	2,678
Realization rate	285%	109%	NA
Annual base energy use	11,293	95,427	7,097
Tracked savings fraction			
Evaluated savings fraction	6.6%	3.2%	17.8%

*Includes the contribution of district steam savings.

The consumption analysis was based on the semi-annual usage data provided for the primary fuels in the semi-annual BOM report. The BOM included district steam and fuel oil, which were not reported in the Scorecard. An engineering analysis was conducted to further corroborate the billing findings and did identify actions the university took that supported the billing findings. Engineering analysis corroborated the magnitude of the savings and was based on typical savings for the measures recorded as implemented or in the process of being implemented in the Green Team Opportunity Logs.

While first year savings are substantial with reductions in all observed fuels and credibly attributed to the program, the continuous improvement practices were suspended in February 2020 with the COVID lockdown. The university responded to COVID by increasing ventilation substantially and suspending in-person classes, which appears to have dramatically decreased electric usage and increased thermal usage. In this same period, the Energy Champion left for another position and the Green Team suspended meeting in early 2020 and have not reconvened. Staff report that they are focused on operating the buildings safely while running short-handed. While billing usage may have increases, most of the measures which were implemented are likely still achieving savings.

Events Calendar

Table 2 identifies key events in the history of the project. The table also identifies the months with billing data from either the BOM Report (available in six-month intervals) or utility provided billing. The red line indicates records that are hidden to keep the table to a reasonable length. The table identifies those months identified as baseline or performance periods in the BOM Report.

Table 2. Event and Billing Data Calendar

Month-Year	Events	BOM Billing	Utility Billing	Period	Notes
Nov-16	BOM Report first data entry	Elec, NG, Steam, oil	Elec, NG	Baseline	
Dec-16		Elec, NG, Steam, oil	Elec, NG	Baseline	
Sep-18		Elec, NG, Steam, oil	Elec, NG	Baseline	
Oct-18	Effective date, per email	Elec, NG, Steam, oil	Elec, NG	Baseline	
Nov-18		Elec, NG, Steam, oil	Elec, NG	Performance	
Dec-18		Elec, NG, Steam, oil	Elec, NG	Performance	
Jan-19	GPRO training	Elec, NG, Steam, oil	Elec, NG	Performance	
Feb-19		Elec, NG, Steam, oil	Elec, NG	Performance	
Mar-19		Elec, NG, Steam, oil	Elec, NG	Performance	

Month-Year	Events	BOM Billing	Utility Billing	Period	Notes
Apr-19		Elec, NG, Steam, oil	Elec, NG	Performance	
May-19	Two day training; First Opportunity Log entry	Elec, NG, Steam, oil	Elec, NG	Performance	
Jun-19	Opportunity Log entry	Elec, NG, Steam, oil	Elec, NG	Performance	
Jul-19		Elec, NG, Steam, oil	Elec, NG	Performance	
Aug-19	Opportunity Log entry	Elec, NG, Steam, oil	Elec, NG	Performance	
Sep-19		Elec, NG, Steam, oil	Elec, NG	Performance	
Oct-19	Opportunity Log entry	Elec, NG, Steam, oil	Elec, NG	Performance	
Nov-19	Train the trainer training	Elec, NG, Steam, oil	Elec, NG	Performance	
Dec-19		Elec, NG, Steam, oil	Elec, NG	Performance	
Jan-20	Last Opportunity Log entry	Elec, NG, Steam, oil	Elec, NG	Performance	
Feb-20		Elec, NG, Steam, oil	Elec, NG	Performance	
Mar-20	COVID lockdown	Elec, NG, Steam, oil	Elec, NG	Performance	
Sep-20		Elec, NG, Steam, oil	Elec, NG	Performance	
Oct-20	Final report issued by trainer	Elec, NG, Steam, oil	Elec, NG	Performance	
Mar-21		Elec, NG, Steam, oil	Elec, NG	Performance	
Apr-21		Elec, NG, Steam, oil	Elec, NG	Performance	
May-21			Elec, NG		
Aug-21			Elec, NG		
Sep-21			Elec, NG		

Training Description

Notice of a signed contract was issued October 2018. Initial training occurred in January 2019. Additional training components occurred in May 2019 and continued until June 2020. More exact dates were not found in the records. While there are records of training, such as attendee surveys, they aren't dated. Only a few Quarterly Vendor reports were included in the project file, which is another source of training dates.

The plan for the university included staff training, but also training of trainers, coaching, data tracking, and formation of a cross-functional Green Team. The Green Team's mission was to meet on a regular basis to brainstorm opportunities and create an action plan to implement them. An Opportunity log recording candidate projects and tracked their progress overtime was included in the project file.

The Opportunity Log included entries beginning June 2019 with the last update of the version included in the file was January 2020. This log showed a robust process with a total of 40 opportunities developed between May 2019 and January 2020 with updates approximately bi-monthly. This list forms the basis of the engineering analysis.

The training included these components:

1. GPRO Fundamentals and Operations & Maintenance Essentials
    a. 13 of 57 trained per records
    b. Record of 12 post surveys
    c. Final reports do not offer details about the training that was provided, the start/end dates, or the final attendance.
2. HVAC/R System Optimization; Electrical Distribution Optimization; Lighting Efficiency; Water System Efficiencies. Instrumentation and Process Measurement and Control, HVAC Electrical Controls and Air Distribution, Maintenance Planning and Scheduling. Various Courses: Conquer the Energy Code Training, EMIT training, Blower Door Testing Training, Thermal IR Imaging Training, Energy Master Plan Training, TPC - Instrumentation and Process Measurement and Control.
3. Training included hands-on training in the use of blower-door testing for small commercial buildings and infrared cameras. Augmented with: HVAC Electrical Controls and Air Distribution, Maintenance Planning and Scheduling, Existing Building Commissioning Training, Certified Facilities Manager Training and Credential.
4. Also coaching was provided.
    a. No record of number trained. Intended to train 57
    b. No clear documentation of when specifically, these training were done so quarterly reports and implementer's email dates were used to bracket the start and end of the training sessions.

The final vendor report noted these accomplishments (October 2020)

- 35 staff were trained and 2 staff were trained to be trainers.
- Formulation of the Sustainability Action Plan Review with the Green Team working with a program coach.
- Pre-post surveys of attendees to training
- Formation of a Preventative Maintenance team
- 13 certificates earned

Tracked Savings

The savings for this project were in NYSERDA's Quarter 4 2021 CEF Report (known as the 'Scorecard') as "encumbered" and are summarized in Table 3.

Table 3. Scorecard Reported Savings – Project Status is Encumbered

Building	Electric Savings (MWh)	Gas Savings (MMBtu)
Building 1	22	194
Building 2	22	194
Building 3	22	194
Building 4	22	194
Building 5	22	194
Building 6	22	194
Building 7	22	194
Building 8	22	194
Building 9	22	194
Building 10	22	194
Building 11	22	194
Building 12	22	194
TOTAL	261	2,326

This savings fraction shown in Table 1 were calculated using the CEF Reported savings and the weather normalized average baseline energy use.

Data Collection

Project documentation

The Evaluation Team reviewed Building O&M project documentation provided by NYSERDA program staff. The project files included the following information:

- Building O&M site report which contained semi-annual reporting of all energy use, dated [June 2020 Final]
- SOW contract(s) between NYSERDA and the training provider
- Application
- Quarterly progress reports (2/29/2020, 10/28/2020 (final))
- Training provider monthly updates (for select months)
- Sustainability action and training Plan (tracked implemented measures) “Opportunity Log”
- Trainee surveys (pre/post)
- Contract extension through 2021 due to COVID-19 pandemic
- A comprehensive training plan (about 50 different training modules), specifying target trade, costs, and whether training was required for new hires or not.

Site interview

The Evaluation Team also conducted an interview with two of the contacts at the organization, facility staff professionals January 24, 2022. The contacts confirmed the buildings that were managed by the trainees, the impact of COVID-19 pandemic on facility/building operations, and the broader outcomes of the training. The interviews confirmed the following:

- The buildings listed in the CEF Report are buildings of the main campus and all that square footage was served by the staff that were engaged with the training.
- COVID-19 pandemic substantially impacted the buildings operations beginning in March 2020, since students could no longer live on campus and classes transitioned to on-line format. Additionally, building ventilation rates were increased to 100% fresh air. Normal classroom occupancy did not occur until the fall of 2021.
- The staff who were considered the Energy Champion, the key driving force behind the continuous improvement effort left the organization and the Green Team thus suspended its meetings.
- The O&M facility/building staff was focused on operating safely while operating short-handed. They have not found hires for the open slots, including the Energy Champion position.

Billing data

The Building O&M or BOM report for this site included billing data for an extended base period and for the performance period. The BOM Report billing data is provided in six-month intervals, not monthly. Monthly utility billing data was also acquired for electricity and about 5% of the natural gas, but was not available for steam or fuel oil.

Table 5 summarizes the billing data that was provided by period and source. Note, this data has not been weather normalized. This site purchases steam from an adjacent facility. Based on the magnitude of the natural gas savings, it appears the steam consumption and related savings were converted to natural gas in the Scorecard. The thermal energy is provided by district steam (52% on a BTU basis), natural gas (40%) and fuel oil (8%).

Table 5. Summary of Billing Data

Bill Type	Fuel	Period	Months	Total for Period	Monthly Average	Units
BOM	Electric	Nov 2016– Apr 2020	42	35,858,354	853,770	kWh
BOM	NG	Nov 2016– Apr 2020	42	1,562,146	37,194	therms
BOM	#2 Oil	Nov 2016– Apr 2020	42	187,752	4,470	gallons
BOM	Steam	Nov 2016– Apr 2020	42	101,390	2,414	Mlbs
Utility	Electric					

Savings Analysis

The WFD development training is intended to empower individuals and organizations with the skills and the motivation to improve building operations through a combination of low cost measures and best practices behaviors. Behavior related impacts are ideally captured using whole billing analytics, since the savings result from an accumulation of smaller measures and the baseline and performance conditions are not easily characterized using an engineering approach. However, it also useful and follows best evaluation practices to verify that the organization implemented the behavioral changes and to corroborate the magnitude of the savings with a high-level engineering analysis.

The saving for this site is based on an energy consumption analysis using the BOM Reported consumption data corroborated using an engineering based high-level estimates of impacts for measures recorded as implemented by the team in the Opportunity Log.

Billing Analysis

The normal approach for a site-specific billing analysis is to regress the monthly consumption figures against the heating and cooling degree days (HDD and CDD, respectively). However, the BOM data is provided in six-month intervals not monthly, reducing the number of data points available and masking their correspondence with weather. In this analysis, the baseline and performance period energy consumptions were weather normalized by applying a ratio of the historical to TMY3 HDD (or CDD) for the same period. Once normalized, the performance period usage was subtracted from the baseline period usage to determine weather-normalized savings.

Defining baseline and performance periods. The billing analysis uses the same baseline and performance period as that specified in the BOM Report. The BOM Report is a NYSERDA defined form used by the training providers to define the baseline period and to record consumption data every six months as the project progresses. The form calculates savings for each semi-annual interval as the difference between the baseline usage for the same six-month period and the most recent consumption data.

In the evaluator billing analysis, the training period was not 'blacked out' from the performance period for these reasons:

- The billing analysis lines up with how the customer and training providers were reporting the baseline and performance period.
- The practice of defining the performance period beginning immediately from project start is observed in other whole building behavioral programs and evaluations, like California's industrial behavioral program.

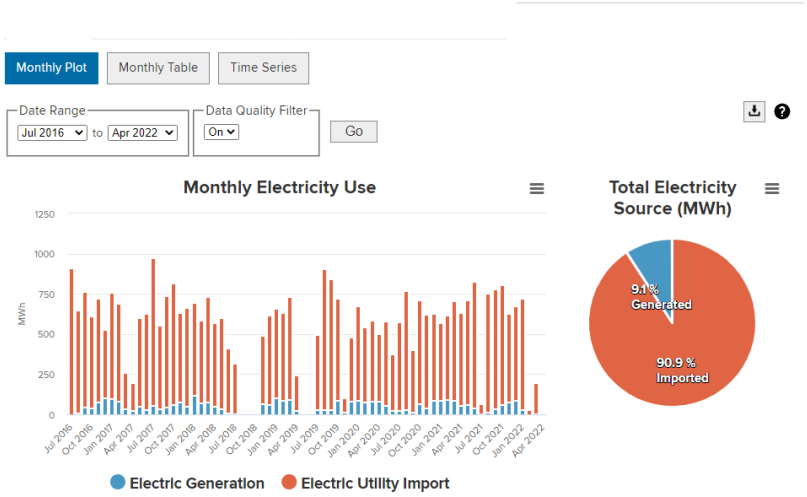
- A black-out period is often applied in billing analysis of 'widgets' because the installation can be defined within a few months and it allows for the widget performance to be sharply delineated between the pre and post period. Training's impact is more diffuse and will start with the first day of training and accumulate in an unpredictable way overtime.
- A blackout period for this project would be eight months to a year in length. This prolonged period allows more building changes to accumulate impinging making comparisons with the baseline period less certain.
- A very practical reason to not use a blackout period is COVID. COVID lockdown happened only a few months after the last training and a black-out period would eliminate most of the performance period.

Equivalent fuel and CHP production. The facility thermal loads (space heating, service water, cooking, and some process) are served by #2 fuel oil (7% of thermal load), natural gas (40%) and district steam purchase (53%). Additional natural gas is also purchased to operate the CHP. The site purchases steam from a district system operated by an adjacent university.

Each of the fuels was independently analyzed in the billing analysis, but the consumption and saving were combined using equivalent BTUs into a campus 'thermal load' and "thermal savings". The steam purchased usage was converted to natural gas consumption assuming a seasonal efficiency of 70%.

The site also includes a 195 kW microturbine installed in 2017 operating on natural gas. The generated electricity was added to the baseline and performance period electrical load, while the net gas consumed (accounting for heat recovery) was subtracted from the purchased gas. Figure 1 summarizes the CHP performance as captured in NYSERDA's DER database.

Figure 1. CHP metrics



Weather Normalized Results. The BOM included billing data for all fuels for two years prior to the implementation of the program and for 18 months after the training commenced. Table 6 notes the average usage over two years in the base period and one year post period. The last semi-annual reporting period was dropped because it overlapped the first COVID-19 pandemic lockdown when gas usage increased dramatically. Billing data was weather normalized using the semi-annual periods since that was the resolution of the consumption data.

Table 6. Billing Analysis Results

Energy	Base Period 11/01/2016 to 10/31/2018	Post Period 11/1/2018 to 10/31/2019	Savings	Units	Savings Fraction
Electricity	11,293,100	10,550,050	743,050	kWh	6.6%
Natural gas	83,851	81,322	1,157	MMBtu	3.0%
#2 fuel oil	51,058	41,973	9,085	gallons	17.8%

Engineering analysis

The engineering analysis was based on the 45 projects listed in the Opportunity Log and whether they were completed or in-progress at the time of the Log's last update. Of the 45 individual opportunities, 12 were noted as completed or being implemented. Thirteen of the opportunities did not results in energy savings (for example: add CO2 detectors for gas appliances) and the balance were either dropped or without imminent implementation plans.

The engineering estimate of savings are based on the measures in the Opportunity Log that were recorded as completed or in the process of being implemented at the time of the Log update (January 2020). The engineering estimate is a "back-of-the envelope" calculation using represented normalized energy usage (on a per square-foot basis) and reasonable, but aggressive deemed savings fractions appropriate for the measures implemented. The purpose of the calculations is to provide further support for the billing analysis. Table 7 compares the billing results and the engineering analysis.

Table 7. Comparison of billing analysis and engineering analysis results

Energy	Billing Analysis Savings	Engineering Analysis	Units	Fraction
Electricity	743,050	404,846	kWh	54%
Thermal load	3,792	3,164	MMBtu	83%

The engineering analysis demonstrates that the university was taking concrete actions that should yield energy savings of the magnitude seen in the billing analysis. The project descriptions in the log were quite brief and the evaluators were not able to gather any additional data to refine them which partially explains

the discrepancies. Table 8 summarizes the energy use assumptions for each of the buildings in the analysis. The starting point for the analysis is the average end-use (i.e. heating, cooling, lighting) energy use per square-foot (energy use index or EUI) for a similar buildings. The typical building EUIs were derived from the US Energy Information Administration Commercial Buildings Energy Consumption Survey (CBECS) which is an authoritative source for typical building performance information.

Table 8. Building specific energy use assumptions

Building	Building Type	Reference Building Type	Area (Sqft)	Heating EUI - kBtu/sf	Cooling EUI kBtu/sf	Vent EUI - kBtu/sf	Lighting EUI
Baker	Office / Lab / Class	Inpatient	133,500	99.5	25.5	23.4	33
Bray	Office	Office	95,530	27.6	6.6	16.2	9.2
Campus	Mixed	Average	839,834	31.6	7.3	9.8	8
Gateway	Student Union	Public Assembly	52,400	52.3	15.8	5.3	6.4
Illick	Office / Lab / Class	Inpatient	140,870	99.5	25.5	23.4	33
Illick, Baker	Office / Lab / Class	Inpatient	274,370	99.5	25.5	23.4	33
Walters	Office / Lab / Class	Inpatient	85,560	99.5	25.5	23.4	33

In the next step, the measures identified in the opportunity log were translated to typical savings. Table 9 on the next page summarizes the engineering estimates for each of the opportunities. The Action Items note the project description detail offered in the documents. From these, descriptions, typical savings were estimated using engineering judgment.

Table 9. High level saving estimates for Opportunity Log measures

Action Items	Building	Building Type	Building Area (Sqft)	Usave and Savings Assumptions	Savings Fraction	Heating MMBtu	Cooling kWh	Vent kWh	Lighting kWh
Put timers on lecture hall lights in B1 first story	B1	Office/ Lab Class	133,500	Reduced hrs in 15% of space	10%				7,009
Bathroom Lighting - Vacancy Sensors	B2	Mixed	839,834	Reduced hrs in 5% of space	10%				14,697
Minimize Stack Effect in B2	B2	Office	95,530	Reduced infiltration	5%	132	9,266		

Action Items	Building	Building Type	Building Area (Sqft)	Usave and Savings Assumptions	Savings Fraction	Heating MMBtu	Cooling kWh	Vent kWh	Lighting kWh
Repair of Defunct Enthalpy Wheel – G1AHU-3	G1	Campus Center	52,400	Accounts for 1/3 of building airflow	5%	137	12,120		
400 LED Plug and play	Campus	Mixed	839,834	3500 hrs & 32 w to 15 w					23,800
Air flow reduction in I1	I1	Office/ Lab Class	140,870	Resheave and adjust OA	2%	280	21,021		
Dynamic ventilation Reset – I1, B1, J1 select units	I1, B1r, J1	Office/ Lab	274,370	VFD for about 10% of the building area	2%			37,543	
Lower Steam Header Pressure- CHP	Campus	Mixed	839,834	Reduced pressure produces 1% improvement	1%	172			
Recommissioning of B1 Lab AHU's, ERU's and Controls.	B1	Office	133,500	Aggressive RCx	15%	1,992	149,411	137,004	
Outdoor Air Reset for Heating Loop in W1	W1	Lab	85,560	Typical reset savings	2%	170			
B1 Pole Lights	B1	Office	133,500	20@ 100w/3000 hrs					6,000
Steam Trap Survey in the Fall I1	I1	Office/ Lab Class	140,870	Repair about 10% of the traps	2%	280			
TOTAL				Total Savings		3,164	191,818	174,547	51,506

Site ID: SID-06

Subject: Impact findings for the site SID-06

Details: Training and other organizational activities, tracked and evaluated savings.

Facility type	Downstate residential multifamily property portfolio
Area served by training (sq ft)	22,339,187
Agreement effective	March 28, 2018
Scorecard status	Encumbered

Summary

The customer owns and manages 83 market-rate multifamily residential properties downstate throughout NYC. The customer has developed an energy master plan, "Operation Emerald," with lists of ECMs. Part of the goal of the training is to incorporate energy savings O&M measures into the master plan.

The core training consisted of two-days of inclass training, followed by one day of field training. The training was offered to the entire facility staff of 101 members. There was a particular focus on O&M and maintaining boiler systems. Two additional activities: training select staff to assist in subsequent courses and the development of building specific manuals were scoped, but it is not clear in the record whether these were completed.

Table 34 summarizes the evaluated savings. The savings estimates consider all the available evidence including project file documents, consumption data, site interviews, and the results of subsequent analysis. There is evidence of substantial first-year savings in a weather-normalized consumption analysis, which is corroborated by the engineering analysis.

Table 34. Site Savings Summary [template]

First Year Savings	Electric (MWh)	Natural Gas (MMBtus)
Scorecard reported savings	2,159	24,008
Evaluated savings	1,549	42,192
Realization rate	72%	176%
Annual base energy use	76,233	797,592
Tracked savings fraction	2.8%	3.0%
Evaluated savings fraction	2.0%	5.3%

A site contact could not be recruited for an interview or to release utility bills. The project files did not include any record of the implementation of specific measures because of the training.

Events Calendar

Table 35 identifies key events in the history of the project. The table also identifies the months with billing data from either the BOM Report (available in six-month intervals) or utility-provided billing (available in monthly intervals). The table identifies those months identified as baseline or performance periods in the BOM Report. The red line indicates records that are hidden to keep the table to a reasonable length.

Table 35. Event and Billing Data Calendar

Month-Year	Events	BOM Billing	Utility Billing	BOM Period
Oct-2016	First BOM baseline month	Elec, Gas		Baseline
Nov-2016		Elec, Gas		Baseline
Sep-2017		Elec, Gas		Baseline
Oct-2017		B Elec, Gas		Baseline
Nov-2017		B Elec, Gas		Baseline
Dec-2017		B Elec, Gas	B Elec	Baseline
Jan-2018		B Elec, Gas	B Elec	Baseline
Feb-2018		B Elec, Gas	B Elec	Baseline
Mar-2018	Agreement effective	B Elec, Gas	B Elec	Baseline
Apr-2018		B Elec, Gas	B Elec	Baseline
Aug-2018		B Elec, Gas	B Elec	Baseline
Sep-2018		B Elec, Gas	Elec	Baseline
Oct-2018		P Elec, Gas	Elec	Performance
Nov-2018		P Elec, Gas	Elec	Performance
Dec-2018	First Quarterly Report	P Elec, Gas	Elec	Performance
Jan-2019		P Elec, Gas	P Elec	Performance
Feb-2019	Training	P Elec, Gas	P Elec	Performance
Mar-2019	Training – 8 sessions, 61 staff	P Elec, Gas	P Elec	Performance
Apr-2019		P Elec, Gas	P Elec	Performance
May-2019		P Elec, Gas	P Elec	Performance
Jun-2019		P Elec, Gas	P Elec	Performance
Jul-2019		P Elec, Gas	P Elec	Performance
Aug-2019	Training	P Elec, Gas	P Elec	Performance
Sep-2019	Training – 53 staff	P Elec, Gas	P Elec	Performance
Oct-2019			P Elec	
Nov-2019			P Elec	
Dec-2019			P Elec	
Jan-2020			Elec	
Oct-2020	Last Quarterly Report		Elec	
Nov-2020			Elec	

Description of Training and Related Activities

This description of the training was derived from the agreement scope of work. There was no additional material provided to material. An inventory of the project file is included under Data Collection.

Training was scoped to include these elements, although there was no other evidence in the project files (like classroom slide decks):

- Classroom and hands-on instruction based on "Operation Emerald."
- Intended to address the systems in the buildings including
  - Facility-specific sequences of operation
  - Steam distribution
  - Hydronic systems
  - Steam and hydronic boilers
  - Mechanical exhausts
  - Stack effects and air infiltration
  - Advanced control operations and data analysis
  - Advanced energy systems: CHP and PV
- Intended to be delivered as follows:
  - Two days of classroom training. Training cohorts set-up by equipment type served.
  - Mentors were to attend the first training round and subsequently teach/co-teach on subsequent rounds. This does not appear to have happened.
  - On-site field training follows in small groups in half-day sessions.
  - The field instruction should use the manuals described below.

Manual development. The scope of work included production of two sets of manuals, each tailored to the specific buildings in the portfolio. **There was no other evidence in the project files** of the manuals. The Quarterly Reports mentioned delivery of 'check-lists' but not manuals.

- O&M Logs and Checklists including
  - O&M logs and checklists
    - Recommended frequency
    - Consistent procedures across all buildings
  - Air distribution and infiltration
  - Indoor air quality

Organizational structures. The scope of work included activities designed to create organizational structures to sustain ongoing improvements. The activities included:

- **Mentoring program**. The scope included mentoring, although there was **no evidence in the project files or Quarterly Reports** that this happened.
  - Mentors chosen based on positive experience, about 13 to be selected
  - Mentors will co-teach a round of in-classroom training
  - Mentors seen as key to ensure that the training materials are used and understood beyond the scope of the project
  - Training is part of onboarding new hires

Tracked Savings

The savings for this project were in NYSERDA's Quarter 4 2021 CEF Report (known as the "Scorecard") as "complete" and are summarized in Table 36.

Table 36. Scorecard Reported Savings – Project Status is Encumbered [template]

Building	Electric Savings (MWh)	Gas Savings (MMBtu)
83 buildings downstate	2,159	24,008
TOTAL		

Table 37 summarizes the square footage of the buildings in the project.

Table 37. Building Area (square footage) [template]

Building	Building Type	Building Area
83 buildings downstate	Multifamily	22,339,187
TOTAL		

Data Collection

Project documentation

The Evaluation Team reviewed Building O&M project documentation provided by NYSERDA program staff. The project files included the following information:

- Application
- Agreement with a March 28, 2018, effective date. Includes a scope of work.
- Quarterly Reports – 11 included in the file. These were quite brief.

Site interview

A site contact with knowledge of the building operation could not be recruited for an interview.

Consumption data

Table 38 summarizes the available billing data for this project. The Building O&M or BOM report for this site included billing data for an extended base period and for the performance period. The BOM Report billing data is provided in six-month intervals, not monthly. Monthly utility billing data was also acquired for electricity and gas.

Table 38. Summary of Billing Data

Bill Type	Fuel	Period	Months	Total for Period	Monthly Average	Units
BOM	Electricity	Oct 2016 to Sep 2019	36	247,159,931	6,865,554	kWh
BOM	Natural gas	Oct 2016 to Sep 2019	36	22,685,811	630,161	therms
Utility	Electricity	Dec 2017 to Feb 2022	51			kWh
Utility	Natural gas	None	0			therms

Savings Analysis

The WFD development training is intended to empower individuals and organizations with the skills and the motivation to improve building operations through a combination of low-cost measures and best practices behaviors. Behavior-related impacts are ideally captured using whole billing analytics, since the savings result from an accumulation of smaller measures and the baseline and performance conditions are not easily characterized using an engineering approach. However, it also useful and follows best evaluation practices to verify that the organization implemented the behavioral changes and to corroborate the magnitude of the savings with a high-level engineering analysis.

The saving for this site is based on a billing analysis using the BOM Reported consumption data for natural gas and on the utility-provided monthly data for electricity. There was no information included in the project files describing the implementation of any energy conservation measures (ECMs), so this site relies on the billing analysis alone.

Billing Analysis

Defining baseline and performance periods. The billing analysis uses the same baseline and performance period as that specified in the BOM Report. The BOM Report is a NYSERDA-defined form used by the training providers to define the baseline period and to record consumption data every six months as the project progresses. The form calculates savings for each semi-annual interval as the difference between the baseline usage for the same six-month period and the most recent consumption data.

The evaluators do not recommend incorporating a "black-out" period from project start through the end of substantial training for these reasons:

- A black-out period is often applied in billing analysis of "widgets" so that the widget performance can be sharply delineated between the pre and post period. Training's impact is more diffuse and will start with the first day of training and accumulate in an unpredictable way overtime. A black-out period for this project would be eight months to a year in length.
- Since the baseline and performance period are closer in time without a black-out period, there are fewer other building changes impinging on the findings.
- The practice of defining the performance period beginning immediately from project start is observed in other whole building behavioral programs and evaluations, like California's industrial behavioral program. Host sites can observe the savings and use that for team motivation.
- A very practical reason to not use a black-out period is COVID-19. COVID lockdown happened only a few months after the last training, and a black-out period would eliminate most of the performance period.

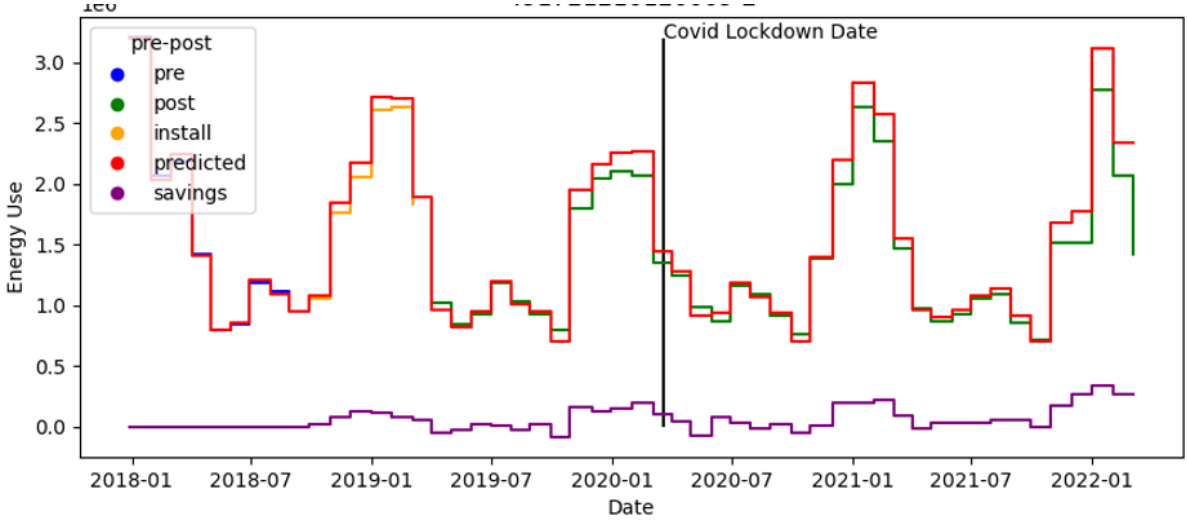
Utility Billing Results. In this analysis, the monthly utility provided billing data was regressed against historical weather data following CalTrack protocols for cleaning and screening data. Data from three meters out of 101 were dropped from the analysis, due to anomalies. Table 39 presents the savings fraction for electric meters for the first and second 12-month period of the BOM Performance Period and for subsequent calendar years. The savings fraction for 2019 was selected as the most applicable savings fraction aligning with the BOM performance period without overlapping COVID.

Table 39. Utility Billing Analysis Results by Electric and Natural Gas

	Modeled Base	BOM 12 Month Savings	BOM 24 Month Savings	2019 Savings	2020 Savings	2021 Savings
Electric	145,506,278	1.3%	3.0%	2.0%	5.6%	6.6%
Gas	No data acquired					

Figure 2 illustrates the results of the analysis for one of the electric accounts.

Figure 2. Billing Regression Results for a Selected Account



BOM Consumption Results. The normal approach for a site-specific billing analysis is to regress the monthly consumption figures against the heating and cooling degree days (HDD and CDD, respectively). However, the BOM data is provided in six-month intervals, not monthly, reducing the number of data points available and masking their correspondence with weather. In this analysis, the baseline and performance period usages were weather normalized by applying a ratio of the historical to TMY3 HDD (or CDD) for the same period. Once normalized, the performance period usage was subtracted from the baseline period usage to determine weather-normalized savings.

The BOM included billing data for all fuels for two years prior to the implementation of the program and for 12 months after the training commenced. Table 40 notes the usage over one year in the base period and one year post period. Billing data was weather normalized using the semi-annual periods, since that was the resolution of the consumption data.

Table 40. Consumption Analysis Results [template]

Energy	Base Period	Post Period	Savings	Units	Savings Fraction
Electricity	76,232,991	90,750,394	(14,517,403)	kWh	-19.0%
Natural gas	7,975,918	7,554,001	421,916	therms	5.3%

Engineering analysis

The project files contained no information about implemented measures, nor would the site respond to requests for interviews; therefore, there is no engineering analysis.

Appendix B: Data Collection Instruments

NYSERDA Talent Pipeline – Interns and OJT: Non-Participant Business Owners Semi-Structured Interview Instrument

Date: 8/11/2021

Interviewer Information

Interviewer instructions are in *italics*.

Programmer Information

Programming instructions are CAPITALIZED.

The Evaluation Team will input the following data in order to reference the information during the interview. Throughout this instrument, pipe in fields are denoted by brackets and capital letters: [EXAMPLE].

Table 2: Database Information Piped into the Survey Instrument

Variable Name	Variable Description and Values
CONTACT_NAME	Name of contact at company
ADDRESS	Address at company
BUSINESS_NAME	Name of the business

Program Description

NYSERDA is investing in a talent pipeline to ensure that New York State clean energy, electrification, and energy efficiency businesses have a robust supply of new and existing workers with the required occupational skills, credentials, and experience. This will ensure workers are trained to provide the professional services and technical skills necessary to design, manufacture, specify, sell, distribute, install, operate, maintain, repair, and inspect clean energy technology and systems. Focus areas include energy efficiency; electrification (air- and ground-source heat pumps in support of NY Clean Heat); cleantech companies, including startups; and energy storage.

Activities will focus on expanding training infrastructure and capacity and offsetting the cost of hiring and training new workers, which can lead to soft cost reductions by decreasing the time and costs associated with getting a worker to full productivity. All training for new workers will be directed by specific business training and hiring needs and include direct involvement of businesses in activities such as providing internships, job cooperatives, site visits and interviewing graduates to ensure job placement.

The initiative's primary objectives are to:

- Expand training infrastructure within a company/portfolio
- Offset or reduce the cost and timeline of hiring and training new workers
- Provide relevant and effective training (The objectives associated with this are addressed by training provider and trainee surveys, not this survey.)

The initiative seeks to achieve the above objectives by engaging with training providers to develop and implement clean energy training and with employers to hire interns, provide on-the-job training (OJT), and apprenticeships.

Instrument

Note: We are offering a $50 Amazon gift card to those who complete the interview. The incentive will be sent either electronically or via mail.

Email Survey Invitation Letter

SUBJECT LINE: Share your thoughts on your workforce training and get $50

Dear [Name of Non-participant],

We need your participation in an important study and will express our thanks by sending you a $50 Amazon gift card.

The New York State Energy Research and Development Authority, or NYSERDA, needs your help to improve the services for the workforce of energy efficiency and clean tech companies like yours throughout the state. This information will help NYSERDA improve its workforce development program aimed at training workers to provide the professional and technical skills necessary to design, manufacture, specify, sell, distribute, install, operate, maintain, repair, or inspect clean energy technology and systems.

NYSERDA has contracted with an independent research firm, RMS, to contact organizations like your for this study. **Please click here to share your thoughts: [INPUT LINK]**

Our questions take about 25 minutes to answer. If you have any questions or concerns about this study, please feel free to contact me directly at [INPUT PHONE #] or Dr. Patricia Gonzales, Senior Project Manager at NYSERDA (*patricia.gonzales@nyserda.ny.gov*).

Everything discussed in any conversation we have will be kept confidential to the extent permitted by law including but not limited to the Freedom of Information Law (FOIL).

If you are not the best person for us to talk to about your hiring or workforce training practices at your organization, please let me know who I should contact and how to contact them.

Thank you for your time and consideration.

[Input name]

[Input title]

RMS

Phone Scheduling Script

IF PHONE ANSWERED BY GATEKEEPER:

Hi, this is [CALLER NAME] from RMS, calling on behalf of the New York State Energy Research and Development Authority, or NYSERDA. I'm trying to reach [CONTACT NAME] regarding NYSERDA's Workforce Training: Talent Pipeline Program. I emailed [CONTACT NAME] a few days ago that I would be calling. Is [HE/SHE] available?

[IF NOT AVAILABLE, try to get a time when contact will be available.]

IF PHONE ANSWERED BY NAMED CONTACT:

Hi, this is [CALLER NAME] from RMS, an independent research firm under contract with the New York State Energy Research and Development Authority, or NYSERDA. NYSERDA is conducting a study and wants to better understand the hiring practices and future needs of your industry. I'm trying to reach the person that manages your hiring practices. Is that person available?

[IF NOT AVAILABLE, try to get a point of contact and a time when contact will be available.]

[IF CONTACT IS APPROPRIATE PERSON:]

Great. I would like to schedule a time in the next few days to talk about your organization's hiring and training practices. The interview will take about 20 minutes and we are offering a $50 gift card for your time. What time is best for you? Or if this is a good time to talk, we can start now.

[IF NEEDED:] Thank you very much. I look forward to talking to you on [SCHEDULED DATE].

IF GATEKEEPER ASKS WHAT THIS IS ABOUT:

NYSERDA wants to better understand how clean energy and energy efficiency staff are hired and trained throughout the state. This information will help NYSERDA improve its programs and services aimed at reducing energy use in the state.

IF GATEKEEPER ASKS WHO NYSERDA IS:

NYSERDA is the New York State Energy Research and Development Authority. NYSERDA works with individuals and organizations in both the residential and nonresidential sector to promote energy efficiency and the use of renewable energy sources through research and development, training, and other energy-saving programs. You can get further information by going to the NYSERDA website, *www.nyserda.ny.gov*.

IF THEY HAVE CONCERNS OR QUESTIONS ABOUT THE LEGITIMACY OF THIS STUDY:

You can contact Dr. Patricia Gonzales, Senior Project Manager at NYSERDA, to obtain additional information about this study or our role. Do you want her email address? [IF YES:] *patricia.gonzales@nyserda.ny.gov*

PHONE ANSWERED BY NAMED CONTACT OR CALL TRANSFERRED TO KNOWLEDGEABLE PERSON

Hi, this is [CALLER NAME] from RMS, an independent research firm under contract with the New York State Energy Research and Development Authority, or NYSERDA. NYSERDA is conducting a study and wants to better understand the hiring practices and future needs of your industry. I'm trying to reach the person that manages your hiring practices. Is that person available?

[AFTER SCHEDULING CALL:]

My questions will focus on your hiring and training practices. I'll ask about the number of staff in your organization, what you expect to need in the future in terms of staffing, the skills you expect new staff to have, and how long it takes to hire new staff.

Before I go, do you have any questions for me?

Thank you very much. I look forward to talking to you on [SCHEDULED DATE].

Survey Questions

Data Collection Mode: email/web or phone

Screening

[DISPLAY WITH S1] We need to ask you a couple of questions first to determine if you eligible to take our survey.

Our records show that your organization provides services and/or products in the clean energy space. For your organization, or business unit if you are part of a large company, which of the following selections best describes your clean energy business? *[If delivering this over the phone, read response options.]*

[MULTIPLE RESPONSE]

Heat pumps
High efficiency heating, ventilation, and air conditioning (HVAC)
Other renewable heating and cooling
High efficiency water heating
Insulation and/or air sealing
High efficiency lighting and controls
Building automation and controls
Smart grid
Energy storage
Solar electric and/or related areas
Alternate transportation
Renewable fuels including wind
Energy efficiency and clean technology areas not noted above (write in): **[OPEN-ENDED]**
None of the above – we do not offer services/products in the energy efficiency or clean energy space [EXCLUSIVE OPTION] [TERMINATE]

[IF S1= NONE OF THE ABOVE, TERMINATE] You are not eligible to take the survey. We are looking to speak with organizations that employ staff who provide services in the energy efficiency and clean energy space.

[IF S1≠NONE OF THE ABOVE]

Please more specifically describe the products or services your organization or business unit offers in the clean energy space.

[OPEN ENDED]

[IF S1≠NONE OF THE ABOVE]

How familiar are you with the hiring practices and future hiring needs at your organization? *[If delivering this over the phone, read response options.]*

[SINGLE ANSWER]

Very familiar
Moderately familiar
Not at all familiar

[DISPLAY IF S3=NOT AT ALL FAMILIAR]

Could you provide the name and contact information of the person most knowledgeable about hiring staff for which your organization received wage reimbursments? [TERMINATE]

Name: [OPEN ENDED]

Title: [OPEN ENDED]

Email: [OPEN ENDED]

Phone: [OPEN ENDED]

[IF S3= NOT AT ALL FAMILIAR, TERMINATE] Thank you for taking the time to respond to these questions. We are looking to speak with those who are at least moderately familiar about hiring at your organization. Since you indicated you are not familiar with these new hire positions, we have no more questions for you at this time.

Role

[ASK ALL THAT PASS SCREENING]

Q1. What is your current role? Are you personally the owner of your company, a top officer or a part of the executive team, a manager who is not a part of the executive team, or something else?

[MULTIPLE RESPONSE]

Owner of the company or organization
Top Officer (part of the executive team)
A hiring manager (not part of the executive team)
Other, please specify: [OPEN-ENDED RESPONSE]

[DISPLAY WITH Q2] Thank you for clarifying your role. This next question is meant to better understand the products and services in your organization or business unit geared toward the New York market.

[ASK ALL THAT PASS SCREENING]

About what percentage of your organization or business unit's sales are in New York state?

[INSERT SLIDER BAR WITH RANGE FROM 0 TO 100%]

[Percent]
Don't know

[DISPLAY TOGETHER WITH Q3] The next questions are about your labor force, the relationship between the labor pool and your business plans, and the activities associated with staff retention, recruiting, on-boarding and training.

[ASK ALL THAT PASS SCREENING]

Can you please provide an estimate of the number of full time equivalent (FTE) staff in New York state that were on the payroll of your clean energy organization or business unit in July 2019, 2020, and 2021? Your best estimate is fine.

2019: [OPEN ENDED]
2020: [OPEN ENDED]
2021: [OPEN ENDED]

1

[ASK ALL THAT PASS SCREENING]

Can you please project the number of FTEs in New York state your clean energy organization or business unit will require to meet your business objectives in 2022 and 2023? If it is the same number of FTEs as in 2021, then input that number. If you project your FTE will grow or decline, then input total number of FTEs that takes into the account growth or decline.

2022: [OPEN ENDED]
2023: [OPEN ENDED]

[ASK ALL THAT PASS SCREENING]

Thinking about your future staffing needs in 2022 and 2023, on a scale of 0 to 10, where 0 means "not at all confident" and 10 means "fully confident", how confident are you in the following.

[INSERT SCALE AS DEFINED FOR EACH ITEM WITH A DON'T KNOW RESPONSE AND NOT APPLICABLE RESPONSE]

<u>In 2022:</u>

My organization or business unit will be able to acquire the additional hires we need.
New hires will have the necessary training required for their position.

<u>In 2023:</u>

My organization or business unit will be able to acquire the additional hires we need.
New hires will have the necessary training required for their position.

[IF RATING IS LESS THAN 6 ON ANY ITEM IN Q5]

You noted a lower confidence in finding the trained staff you need in the future. Please explain why you gave that/those response/s.

[OPEN ENDED]

Don’t know

[ASK ALL THAT PASS SCREENING]

What would be the impact on your organization or business unit if your organization had 10% fewer FTEs in 2022?

[OPEN ENDED]

Internships

[ASK ALL THAT PASS SCREENING]

Does your organization or business unit hire interns? [Interns are staff that are unpaid or paid and hired for a fixed, defined period and are clearly distinct from full-time permanent positions.]

Yes, we do.
No, we do not hire interns. [SEND TO SECTION “On-The-Job Training”]
Don’t know

[DISPLAY IF = Don’t know]

Could you provide the name and contact information of the person who would know about intern hiring? [SEND TO SECTION “On-The-Job Training”]

Name: [OPEN ENDED]

Title: [OPEN ENDED]

Email: [OPEN ENDED]

Phone: [OPEN ENDED]

[DISPLAY IF Q8 = 1]

Since 2018, how many interns did your organization or business unit hire? Your best estimate is fine.

[OPEN-ENDED NUMERIC RESPONSE] interns
Don’t know - Who at your organization would know? Please provide their contact information: [OPEN-ENDED]

[DISPLAY IF Q8 = 1]

Of the interns you’ve hired, what percent were:

In a 4-yr college/university degree program, currently or recently: [OPEN-ENDED]%
In a 2-yr college/university degree program, currently or recently: [OPEN-ENDED]%
In a certificate or vocational program, currently or recently: [OPEN-ENDED]%
In a training that did not offer certification or degree (e.g., job preparedness program like AmeriCorps or NYSERDA-funded Career Pathways program): [OPEN-ENDED]%
Those who recently had no training/education noted above: [OPEN-ENDED]%

[DISPLAY IF Q8 = 1]

What did your organization hope to achieve by hiring interns? [MULTISELECT]

Hire temporary help because your organization needed extra set of hands
Offer individuals a trial period that can lead to something more
Wanted to mentor people early in their career
Other (please specify): [OPEN-ENDED]

[DISPLAY IF Q8 = 1]

Of the interns that completed the internship at your organization since 2018, how many of them fall into these categories? Your best estimate is fine.

Were hired into a permanent position: ___
The position was offered to them but they did not accept: ____
The position was not offered to them: _____
Don't know

[DISPLAY IF Q8 = 1]

On a scale from 0 to 10, where 0 is "strongly disagree", 5 is "neither agree or disagree" and 10 is "strongly agree," please indicate how much you agree with the following [INCLUDE A DON'T KNOW OPTION FOR EACH]:

Finding workforce with skills in the clean energy space is difficult

[IF RESPONSE TO Q13 IS 7 OR GREATER]
In the prior question, please explain why you gave a rating of [INPUT RATING FROM Q13].

[OPEN ENDED]
Don't know

[DISPLAY IF Q8 = 1]

In 2018 versus 2021, if you lost a junior employee, how long did it take, on average, to find and recruit that person's replacement (in terms of months)? Your best estimate is fine.

2018: [OPEN-ENDED] month(s)
2018: Don't know – Who at your organization would know? Please provide their contact information: [OPEN-ENDED]

2021: [OPEN-ENDED] month(s)
2021: Don't Know – Who at your organization would know? Please provide their contact information: [OPEN-ENDED]

[DISPLAY IF Q8 = 1]

In 2018 versus 2021, if you hired a new junior employee, how long would it take, on average, to train that person to the required level of skills, in months? Your best estimate is fine.

2018: [OPEN-ENDED] month(s)
2018: Don't know – Who at your organization would know? Please provide their contact information: [OPEN-ENDED]

2021: [OPEN-ENDED] month(s)
2021: Don't Know – Who at your organization would know? Please provide their contact information: [OPEN-ENDED]

[DISPLAY IF Q8 = 1]
As you answered the questions about how long it would take to train a new junior hire to the required level of skill, how did you interpret the phrase, "required level of skill?" [*Read options 1-4*]

[SINGLE RESPONSE]

Minimum level of competence to perform the required tasks, with supervision
Minimum level of competence to perform the required tasks, with no supervision
Same level of skill of a departing junior employee
Something else – please specify: [OPEN-ENDED RESPONSE]
Don't know

[DISPLAY IF Q8 = 1]
Now thinking about costs, in 2018 versus 2021, what did it cost your organization to find and recruit a junior-level hire, on average? By "find and recruit", we mean expenditures related to job board fees, candidate assessment cost, external or internal recruiter expenses, and/or employer branding efforts (if applicable). **Your best estimate is fine.**

2018: [OPEN-ENDED] U.S. Dollars
2018: Don't know – Who at your organization would know? Please provide their contact information: [OPEN-ENDED]

2021: [OPEN-ENDED] U.S. Dollars
2021: Don't Know – Who at your organization would know? Please provide their contact information: [OPEN-ENDED]

[DISPLAY IF Q8 = 1]
In 2018 versus 2021, what was your typical training cost on average for a new junior-level hire? Your best estimate is fine.

2018: [OPEN-ENDED] U.S. Dollars
2018: Don't know – Who at your organization would know? Please provide their contact information: [OPEN-ENDED]

2021: [OPEN-ENDED] U.S. Dollars
2021: Don't Know – Who at your organization would know? Please provide their contact information: [OPEN-ENDED]

[DISPLAY IF Q8 = 1]
2
On average, how long did it take interns to make half as many errors on their assigned tasks compared to when they started? Please answer in months.

[OPEN-ENDED] months
Don't Know

[DISPLAY IF Q8 = 1]
On average, how long did it take interns to accomplish tasks with little supervision? Please answer in months.

[OPEN-ENDED] months
Don't Know

[DISPLAY IF Q8 = 1]
Of those interns that you hired full time, what percentage have you let go?

[OPEN-ENDED] %
Don't Know

[DISPLAY IF Q8 = 1]
Of those interns that you hired full time, what percentage advanced from the position for which they were brought on?

[OPEN-ENDED] %
Don't Know

[DISPLAY IF Q8 = 1, AND Q13 OR Q14 <100%]
Based on your prior answers, your organization did not offer every intern a full-time positions after their internship was over. What were the reasons for not hiring them on as full-time staff? [MULTIPLE RESPONSE, RANDOMIZED; KEEP OTHER AND DON'T KNOW AT THE END]

Intern has not finished school yet
Didn't have the salary to hire them
They lacked the technical skills for the position
They lacked the soft skills needed for the position
They relocated
They were tardy/did not show up on time
The position was offered to them but they did not accept
Other: [OPEN-ENDED]
Don't know

On-The-Job Training

[ASK ALL WHO PASS SCREENING]

To confirm, does your company or business unit offer on-the-job training to new hires in the first three months of their employment, such as onboarding, hands on experience with equipment, safety training, or other relevant on-the-job training?

Yes
No, my company or business unit does not offer on-the-job training to new hires in the first three months of their employment
Don't know

[ASK IF Q29 = Don't know]

Could you provide the name and contact information of the person most knowledgeable about hiring and staff training? [SEND TO SECTION "General"]

Name: [OPEN ENDED]

Title: [OPEN ENDED]

Email: [OPEN ENDED]

Phone: [OPEN ENDED]

[ASK ALL WHO PASS SCREENING]

On a scale from 0 to 10, where 0 is "strongly disagree", 5 is "neither agree or disagree" and 10 is "strongly agree," please indicate how much you agree with the following:

Training new employees in the clean energy space is difficult
Don't know.

[IF RESPONSE TO Q28 IS 7 OR GREATER]
In the prior question, please explain why you gave a a rating of [INPUT RATING FROM Q28].

[OPEN ENDED]
Don't know

[ASK ALL WHO PASS SCREENING AND DID NOT ANSWER Q15]

In 2018 and 2021, when an employee left the company, how long did it take, on average, to find and recruit someone to fill-in the position (in terms of months)? Your best estimate is fine and think of both junior and senior positions that you had to fill-in.

2018: [OPEN-ENDED] month(s), on average, to find/recruit **junior** staff
2018: Don't Know – Who at your organization would know? Please provide their contact information: [OPEN-ENDED]

2021: [OPEN-ENDED] month(s), on average, to find/recruit **junior** staff
2021: Don't Know – Who at your organization would know? Please provide their contact information: [OPEN-ENDED]

2018: [OPEN-ENDED] month(s), on average, to find/recruit **senior** staff
2021: Don't Know – Who at your organization would know? Please provide their contact information: [OPEN-ENDED]

2021: [OPEN-ENDED] month(s), on average, to find/recruit **senior** staff
2021: Don't Know – Who at your organization would know? Please provide their contact information: [OPEN-ENDED]

[ASK ALL WHO PASS SCREENING AND ANSWERED Q15]

In 2018 and 2021, when a senior employee left the company, how long did it take, on average, to find and recruit someone to fill-in that position (in terms of months)? Your best estimate is fine.

2018: [OPEN-ENDED] month(s), on average, to find/recruit **senior** staff
2021: [OPEN-ENDED] month(s), on average, to find/recruit **senior** staff
Don't Know – Who at your organization would know? Please provide their contact information: [OPEN-ENDED]

[ASK ALL WHO PASS SCREENING AND DID NOT ANSWER Q16]

Again in 2018 and 2021, when you hired a new employee, how long did it take, on average, to train that person to the required level of skills, in months? Your best estimate is fine and think of both junior and senior staff you hired.

2018: [OPEN-ENDED] month(s), on average, to train **junior** staff

2018: Don't Know – Who at your organization would know? Please provide their contact information: [OPEN-ENDED]

2021: [OPEN-ENDED] month(s), on average, to train **junior** staff

2021: Don't Know – Who at your organization would know? Please provide their contact information: [OPEN-ENDED]

2018: [OPEN-ENDED] month(s), on average, to train **senior** staff

2018: Don't Know – Who at your organization would know? Please provide their contact information: [OPEN-ENDED]

2021: [OPEN-ENDED] month(s), on average, to train **senior** staff

2021: Don't Know – Who at your organization would know? Please provide their contact information: [OPEN-ENDED]

[ASK ALL WHO PASS SCREENING AND ANSWERED Q16]

Again in 2018 and 2021, when you hired a new senior employee, how long did it take, on average, to train that person to the required level of skills, in months? Your best estimate is fine.

2018: [OPEN-ENDED] month(s), on average, to train **senior** staff
2018: Don't Know – Who at your organization would know? Please provide their contact information: [OPEN-ENDED]

2021: [OPEN-ENDED] month(s), on average, to train **senior** staff
2021: Don't Know – Who at your organization would know? Please provide their contact information: [OPEN-ENDED]

[ASK ALL WHO PASS SCREENING AND WHO DID NOT ANSWER Q17]

As you answered the questions about how long it would take to train a new employee to the required level of skill, how did you interpret the phrase, "required level of skill?"

[SINGLE RESPONSE]

Minimum level of competence to perform the required tasks, with supervision
Minimum level of competence to perform the required tasks, with no supervision
Same level of skill of a departing employee
Something else – please specify: [OPEN-ENDED RESPONSE]
Don't know

[ASK ALL WHO PASS SCREENING AND DID NOT ANSWER Q18]

Now thinking about costs, in 2018 and 2021, what did it cost your organization to find and recruit a new hire, on average? By "find and recruit", we mean expenditures related to job board fees, candidate assessment cost, external or internal recruiter expenses, and/or employer branding efforts (if applicable). **Your best estimate is fine. Please provide an average cost for both junior and senior hires.**

2018: [OPEN-ENDED] U.S. Dollars, on average to find/recruit **junior** hire

2018: Don't Know – Who at your organization would know? Please provide their contact information: [OPEN-ENDED]

2021: [OPEN-ENDED] U.S. Dollars, on average to find/recruit **junior** hire

2021: Don't Know – Who at your organization would know? Please provide their contact information: [OPEN-ENDED]

2018: [OPEN-ENDED] U.S. Dollars, on average to find/recruit **senior** hire

2018: Don't Know – Who at your organization would know? Please provide their contact information: [OPEN-ENDED]

2021: [OPEN-ENDED] U.S. Dollars, on average to find/recruit **senior** hire
Don't Know – Who at your organization would know? Please provide their contact information: [OPEN-ENDED]

[ASK ALL WHO PASS SCREENING AND ANSWERED Q18]

Now thinking about costs, in 2018 and 2021, what did it cost your organization to find and recruit a new hire, on average? By "find and recruit", we mean expenditures related to job board fees, candidate assessment cost, external or internal recruiter expenses, and/or employer branding efforts (if applicable). **Your best estimate is fine.**

2018: [OPEN-ENDED] U.S. Dollars, on average to find/recruit **senior** hire

2018: Don't Know – Who at your organization would know? Please provide their contact information: [OPEN-ENDED]

2021: [OPEN-ENDED] U.S. Dollars, on average to find/recruit **senior** hire
Don't Know – Who at your organization would know? Please provide their contact information: [OPEN-ENDED]

[ASK ALL WHO PASS SCREENING]

In 2018 and 2021, what was your typical training cost on average for a new staff hire? Your best estimate is fine.

2018: [OPEN-ENDED] U.S. Dollars
Don't Know – Who at your organization would know? Please provide their contact information: [OPEN-ENDED]

2021: [OPEN-ENDED] U.S. Dollars
Don't Know – Who at your organization would know? Please provide their contact information: [OPEN-ENDED]

[ASK ALL WHO PASS SCREENING AND DID NOT ANSWER Q20]

On average, how long does it take new staff to make half as fewer errors on their assigned tasks compared to when they started? **Your best estimate is fine. Please answer for both junior and senior hires.**

[OPEN-ENDED] month(s), on average, to train **junior** staff
Don't know

[OPEN-ENDED] month(s), on average, to train **senior** staff
Don't know

[ASK ALL WHO PASS SCREENING AND ANSWERED Q20]

On average, how long does it take new senior staff to make half as fewer errors on their assigned tasks compared to when they started? **Your best estimate is fine.**

[OPEN-ENDED] month(s), on average, to train **senior** staff
Don't know

[ASK ALL WHO PASS SCREENING]

When a new **junior hire** does not work out and your organization decides not to keep them on staff, what are the reasons for not keeping them on staff? [MULTIPLE RESPONSE, RANDOMIZED]

My organization doesn't have the monetary resources to keep them
They lack the technical skills for the position
They lack the soft skills needed for the position
They relocated
They are tardy/do not show up on time
They resign or quit
Other: [OPEN-ENDED]
Don't know

When a new **senior hire** does not work out and your organization decides not to keep them on staff, what are the reasons for not keeping them on staff? [MULTIPLE RESPONSE, RANDOMIZED]

My organization doesn't have the monetary resources to keep them
They lack the technical skills for the position
They lack the soft skills needed for the position
They move away
They are tardy/do not show up on time
They resign or quit
Other: [OPEN-ENDED]
Don't know

General

[ASK ALL]

Do you have any other information or feedback that you would like to share?

[OPEN ENDED]

That's all of our questions. Thank you so much for taking the time to answer these questions.

Talent Pipeline Participant and Non-participant Training Provider Survey

PURPOSE

The Evaluation Team will survey participating and non-participating training providers to gain insight into perceptions of the state of the clean, green, and energy efficient workforce, the cost and time required to train new workers, and any gaps or room to invest or develop workforce development resources.

VARIABLE LIST

Variable	Definition
[STATUS]	1=Participating training provider 2=Non-participating training provider

[YEAR]	Year(s) organization participated in NYSERDA program
[COMPANY_NAME]	Name of training organization
[ASSISTANCE_DESCRIPTION]	Description of NYSERDA's assistance (e.g. funding for curriculum development, new hire training)
[PON]	Number of PON under which provider received funds
[TRAINER_TARGET]	Total number of trainers trained goal (direct)
[WORKER_TARGET]	Total number of individuals trained goal
[TRAINERS_TRAINED]	Number of trainers trained according to NYSERDA records
[WORKERS_TRAINED]	Number of workers trained according to NYSERDA records
[PROJECT_START_DATE]	Start date of NYSERDA funded Talent Pipeline project

SURVEY INVITATION LETTER

Participant email invitation:

SUBJECT LINE: Share your experience with NYSERDA's Workforce Development Program

Dear [Name of Participant],

As a participating training provider in the Talent Pipeline Initiative of New York State Energy Research and Development Authority's (NYSERDA) Workforce Training Program, your organization received or will receive funds under Program Opportunity Notice (PON) [PON] to provide clean energy technology training in New York. Thank you for your participation!

NYSERDA has asked us to contact participating training providers like you to get your perspective on current training and trainer needs and the training outcomes, which will be essential to assessing the program's effects.

We need to get responses from as many participating training providers as possible to ensure that the feedback we provide to NYSERDA is accurate and representative. Can you be one of the providers who help us reach our goal of getting feedback from all current providers? We have designed our questions to take about 15 to 20 minutes to answer, although we encourage you to provide as much detail as you would like.

Please click **this link** to provide your feedback.

If you need to stop at any time, just exit the browser window. You can complete the survey by clicking the link again, which will take you back to where you left off. When you are finished, be sure to click the "Submit" button at the end.

We really need your input to help us answer key questions about the Talent Pipeline program. If you have any questions or concerns about this study, please feel free to contact XX at NYSERDA [NEED CONTACT INFO] or the DNV study lead, Mersiha McClaren, Director at DNV (mersiha.mcclaren@dnv.com).

All responses you provide us will be kept confidential to the extent permitted by law including but not limited to the Freedom of Information Law (FOIL); nothing you or anyone your organization reports to us will be identified with you or your organization in our reports.

If you are not the best person for us to talk to about your organization's workforce training, please let me know who I should contact and how to contact them.

Thank you for your time and consideration,

DNV Energy Insights USA Inc.
mersiha.mcclaren@dnv.com
503-446-2656 ext. 220

Non-participant email invitation:

Subject line: Share your thoughts on clean energy workforce development with NYSERDA and get $50

Dear [Name of Participant]

If your organization provides workforce training on clean energy technologies, such as electrification, offshore wind, energy efficiency, or energy storage, we need your participation in this important study and will express our thanks by sending you a $50 Amazon gift card. Or if you wish, we will donate the $50 to a charity of your choice.

Does your organization provide workforce training or develop curriculum for training on clean energy technologies, such as electrification, offshore wind, energy efficiency, or energy storage?

Yes (LINK TO SURVEY)
No (LINK TO SCREEN OUT MESSAGE)
Don't Know (LINK TO SCREEN OUT MESSAGE)

NYSERDA is always looking for ways to improve its workforce development training and assistance for clean, green, and energy efficient businesses and training organizations. This is where you come in! We need feedback from folks on the ground working to train workers in this industry throughout New York. Your feedback is vital for NYSERDA to understand training practices and develop future program offerings for the marketplace. Can you be one of the training providers who will help us reach our goal of 70 responses?

We have designed our questions to take about 15 to 20 minutes to answer, although we encourage you to provide as much detail as you feel like.

To begin, click on the link below:

[INSERT LINK]

All of your responses will be confidential to the extent permitted by law including but not limited to the Freedom of Information Law (FOIL), and any analyses will not identify individuals. If you have any questions about this study, please contact the NYSERDA project manager at XXXX or the DNV Study lead, Mersiha McClaren, at XXXX

Thank you for your participation.

Sincerely,

The NYSERDA Team

[INCLUDE OPT-OUT OF SURVEY LINK]

SCREENING AND BACKGROUND

[DISPLAY Q1 IF STATUS=1]

- NYSERDA records indicate that your organization developed and delivered training funded through the in NYSERDA Workforce Development Talent Pipeline Initiative in [YEAR]. This training is specific to clean energy technologies, such as building electrification, offshore wind, energy efficiency, or energy storage.

  - Were you involved in the development and delivery of the training?

Only the training development
Only the training delivery
Both training development and delivery
Not involved in either

[DISPLAY Q2 AND TERMINATE IF Q1=4]

- Could you provide the name and contact information of the person most knowledgeable about the development and delivery of the training funded through the NYSERDA Workforce Development Talent Pipeline Initiative?

Name: **[OPEN ENDED]**
Title: **[OPEN ENDED]**
Email: **[OPEN ENDED]**
Phone: **[OPEN ENDED]**

[DISPLAY Q3 IF Q1<>4 OR IF STATUS=2]

- What is your job title or role? Please select all that apply. **[MULTISELECT]**

Proprietor/Owner
President/CEO
Other type of manager
Curriculum developer
Instructor
Manager of instruction
Other (please specify) **[OPEN-ENDED]**
Don't know **[EXCLUSIVE]**

PARTICIPATING TRAINING PROVIDER

- NYSERDA is interested in learning about all of your organization's training programs that ready people to enter the clean, green, and energy efficient workforce. Please select the kinds of assistance your organization provides from the list below, even those that are not funded by NYSERDA. **[MULTISELECT]**

1. In-class training
2. Train-the-trainer – prepares companies to train their own in-house staff
3. Online courses (self-guided)
4. Online courses (instructor guided)
5. Assistance with getting internships or on-the-job training
6. Placement assistance

96. Other (write in) **[OPEN-ENDED]**

[DISPLAY SECTION IF STATUS=1]

- Please select the types of training that your organization provides. **[MULTISELECT]**

1. Electrification
2. Off-shore Wind
3. Energy efficiency
4. Solar power
5. Energy management
6. HVAC technician
7. Engineering (mechanical, electrical, other)
8. Construction
9. Electrician
10. Smart grid
11. Biomass
12. Energy storage
13. Hydropower
14. Safety
15. Basic skills to prepare students for the above
96. Other (write in): **[OPEN-ENDED]**

- What type of degree or certification do the clean energy trainees receive after completing your organization's [Q28 RESPONSE] training? **[MULTISELECT]**

1. Associate degree
2. Bachelor's degree
3. Master's degree
4. Continuing education unit/credit
5. License
6. Certification through external org (Who?) **[OPEN-ENDED]**
7. [COMPANY_NAME] certification
8. None **[EXCLUSIVE]**
96. Other (write in): **[OPEN-ENDED]**

[DISPLAY Q7 IF TRAINERS_TRAINED<=TRAINER_TARGET]

- According to NYSERDA records, your organization provides clean energy companies with "train-the-trainer" training. This training prepares clean energy companies to train their own in-house staff. NYSERDA records indicate your organization is seeking to instruct a total of [TRAINER_TARGET] clean energy staff trainers and has trained [TRAINERS_TRAINED] so far, using program funds. Are you on track to meet that goal?

1. Yes
2. No

[DISPLAY Q8 AND Q9 IF Q7=2]

- You indicated that you are not on target to meet your train-the-trainer training goal. Please select all the reasons you are not on track. **[MULTISELECT]**

1. Unable to find interested candidates
2. Scheduling issues (interested students but have scheduling conflicts)
3. Trainer COVID-19 health concerns
4. Student COVID-19 health concerns
5. Not enough capacity (your organization's instructor staff or other staff)
6. None of the above **[EXCLUSIVE]**

98. Don't Know **[EXCLUSIVE]**

- Are there any other reasons you are not on track to meet the trainer training goal? **[OPEN-ENDED]**

[DISPLAY Q10 IF WORKERS_TRAINED<=WORKERS_TARGET]

- According to NYSERDA records, your organization directly instructs the clean energy company staff in specific skills. This effort is seeking to train a total of [WORKERS_TARGET] clean energy employees (or workers) and has trained [WORKERS_TRAINED] so far, using NYSERDA program funds. Are you on track to meet that goal?

1. Yes
2. No

[DISPLAY Q11 AND Q12 IF Q7=2]

- You indicated that you are not on target to meet your direct worker training goal. Please select all the reasons you are not on track. **[MULTISELECT]**

1. Unable to find interested candidates
2. Scheduling issues (interested students but have scheduling conflicts)
3. Trainer COVID-19 health concerns
4. Student COVID-19 health concerns
5. Not enough capacity (trainers, other staff)
6. None of the above **[EXCLUSIVE]**
98. Don't Know **[EXCLUSIVE]**

- Are there any other reasons you are not on track to meet the worker training goal? **[OPEN-ENDED]**

- How many individuals did your organization train in clean energy technology through NYSERDA-sponsored training in New York State in 2019 and 2020?

A. 2019: **[OPEN-ENDED]**
B. 2020: **[OPEN-ENDED]**

- How many individuals did your organization train in clean energy technology in New York State in 2019 and 2020 that were not sponsored by NYSERDA?

A. 2019: **[OPEN-ENDED]**
B. 2020: **[OPEN-ENDED]**

[DISPLAY Q15 IF Q13 OR Q14 IS BLANK]

- Are you or someone else at your organization able to provide this information via email? If yes, we will follow up with you after survey completion to gather this information.

1. Yes
2. No

- **[DISPLAY Q16 IF Q14>0]**

- Thinking of the training your organization provided to workers that was not sponsored by NYSERDA, did your experience with NYSERDA influence that training? This influence might reflect modifications to in-house curriculum or the staffing up or training of your organization to produce your offering or other clients. Please use a 0-10 scale to answer where 0 means experience with NYSERDA was not at all influential to

10 means it was highly influential. **[INSERT 0-10 SCALE AS DEFINED, WITH 98=DK]**

- Of those workers your organization has trained since [PROJECT_START_DATE] through the NYSERDA Workforce Development Talent Pipeline Initiative, what percent have participated in each type of training. Please use the sliders below. A best estimate is fine. **[INSERT SLIDER BAR MATRIX WITH RANGE FROM 0 TO 100% AND FOUR ROWS WITH A-D. INCLUDE DON'T KNOW OPTION.]**

A. In-person classroom training?
B. Virtual / remote training?
C. Incorporates hands on instruction of equipment?
D. One to ten-day stand-alone training at a job site?
E. Course within a larger curriculum?
F. Apprenticeships?
G. Job Search / Job Preparedness Skills Training

- The next questions are about student placements in internships or entry level jobs. First, we would like an estimate of the percentage of students trained through your organization's NYSERDA funded training that were already employed at clean, green, or energy efficiency businesses before enrolling in your organization's training. We will ask this separately for those that have completed your organization's training and of those that have enrolled but not yet completed the training.

- Of those students that have completed your organization's NYSERDA-funded training, what percent were already employed at clean, green, or energy efficiency businesses before enrolling in your organization's training? Please use the sliders below. A best estimate is fine. **[INSERT SLIDER BAR THAT RANGES FROM 0 TO 100%. INCLUDE DON'T KNOW OPTION.]**

- Of those students that have not yet completed training your organization's NYSERDA-funded training, what percent were already employed at clean, green, or energy efficiency businesses before enrolling in your organization's training? Please use the sliders below. A best estimate is fine. **[INSERT SLIDER BAR THAT RANGES FROM 0 TO 100%. INCLUDE DON'T KNOW OPTION.]**

- So it looks like [1- Q18]% of the trainees that have completed training and [1- Q19]% of those that have not yet completed training did not work in the clean tech field before they started training. We will call these trainees "new cleantech workers." The next two questions are about what percentage of those new cleantech workers have been placed at entry level jobs at clean, green, or energy efficiency businesses.

- Of those new cleantech workers that have completed training, what percent have been placed in internships or at entry level jobs at clean, green, or energy efficiency businesses? Please use the sliders below. A best estimate is fine. **[INSERT TWO SLIDER BARS WTH "ENTRY LEVEL JOB" AND "INTERNSHIP" LABELS TO THE LEFT AND RANGES FROM 0 TO 100%. INCLUDE DON'T KNOW OPTION.]**

- Of those new cleantech workers that have not yet completed training, what percent have been placed in internships or at entry level jobs at clean, green, or energy efficiency businesses? Please use the sliders below. A best estimate is fine. **[INSERT TWO SLIDER BARS WTH "ENTRY LEVEL JOB" AND "INTERNSHIP" LABELS**

TO THE LEFT AND RANGES FROM 0 TO 100%. INCLUDE DON'T KNOW OPTION.]

- The next questions are about the curricula that your organization has used in its NYSERDA funded training.

- Did your organization use existing curricula that have been used elsewhere without modification, modify existing curricula, or develop entirely new curricula, or some combination of these approaches? **[MULTISELECT]**

1. Used existing curricula without modification
2. Made modifications to existing curricula
3. Developed entirely new curricula

Other (Specify) **[OPEN-ENDED]**

Don't know **[EXCLUSIVE]**

[DISPLAY Q23 AND Q24 IF Q22= 2]

- What modifications are being made or will be made to existing curricula?

- *[PROBE ABOUT: which curricula, what changes (amount of class time, materials used, topics covered, amount of hands-on experience)]*

  [OPEN-ENDED]

- Why did you think these changes/additions were needed? *[PROBE: What specific gaps in the existing curricula were you trying to address?]*

  [OPEN-ENDED]

[DISPLAY Q25 AND Q26 IF Q22=3]

- What new curricula are being developed? *[PROBE: For what specific type of topics are new curricula being developed?]*

  [OPEN-ENDED]

- Why was it necessary to develop entirely new curricula? *[PROBE: What specific gaps in the existing curricula were you trying to address?]*

  [OPEN-ENDED]

NON-PARTICIPANT TRAINING PROVIDER

[DISPLAY SECTION IF STATUS=2]

- NYSERDA is interested in learning about your organization's training programs that ready people to enter the clean, green, and energy efficient workforce. Please select the kinds of assistance your organization provides from the list below. **[MULTISELECT]**

1. In-class training
2. Train-the-trainer –prepares companies to train their own in-house staff
3. Online courses (self-guided)
4. Online courses (instructor guided)
5. Assistance with getting internships or on-the-job training
6. Placement assistance

96. Other (write in) **[OPEN-ENDED]**

- Please select the types of training that your organization provides. **[MULTISELECT]**

1. Electrification
2. Off-shore Wind
3. Energy efficiency
4. Solar power
5. Energy management
6. HVAC technician
7. Engineering (mechanical, electrical, other)
8. Construction
9. Electrician
10. Smart grid
11. Biomass
12. Energy storage
13. Hydropower
14. Safety
15. Basic skills to prepare students for the above
96. Other (write in): **[OPEN-ENDED]**

- What type of degree or certification do trainees receive after completing your organization's [Q28 RESPONSE] training? **[MULTISELECT]**

1. Associate degree
2. Bachelor's degree
3. Master's degree
4. Continuing education unit/credit
5. License
6. Certification through external org (Who?) **[OPEN-ENDED]**
7. **[COMPANY_NAME]** certification
8. None **[EXCLUSIVE]**
96. Other (write in): **[OPEN-ENDED]**

- Are you aware that NYSERDA offers funding to help support energy efficiency and clean energy businesses and training providers to recruit and train new and existing workers?

1. Yes
2. No

[DISPLAY Q31 AND Q32 IF Q30=1]

- Has your organization ever applied for NYSERDA funding to help support workforce development?

1. Yes
2. No

- Has your organization received funding from NYSERDA to help support workforce development training?

1. Yes
2. No

[DISPLAY Q33 IF Q31=2]

- Why has your organization opted not to apply for NYSERDA funding to help support workforce development?

[OPEN-ENDED]

[DISPLAY Q34 IF Q27 =2]

- You indicated that your organization provides train-the-trainer services. How many trainers did your organization train in "train-the-trainer" clean energy technology in New York State in 2019 and 2020?

A. 2019: **[OPEN-ENDED]**
B. 2020: **[OPEN-ENDED]**

[DISPLAY Q35 IF Q27 =1, 3, 4, 5, 6, OR 96]

- How many workers did your organization train directly in clean energy technology in New York State in 2019 and 2020?

- 2019: **[OPEN-ENDED]**

A. 2020: **[OPEN-ENDED]**

[DISPLAY Q36 IF Q34 OR Q35 IS BLANK]

- Are you or someone else at your organization able to provide this information via email? If yes, we will follow up with you after survey completion to gather this information.

1. Yes
2. No

- **[DISPLAY Q37 IF Q35>0 AND Q32=1]**

- Has your experience with NYSERDA influenced the training your organization provides to workers? This influence might reflect modifications to in-house curriculum or the staffing up or training of your organization to produce your offering or other elements. Please use a 0-10 scale to answer where 0 means experience with NYSERDA was not at all influential to 10 means it was highly influential. **[INSERT 0-10 SCALE AS DEFINED, WITH 98=DK**

- What limits the number of workers your organization can train? **[MULTISELECT]**

1. Level of demand for trained workers
2. Level of demand among workers for training
3. Availability of trainers
4. Access to training facilities

96. Other (write in): **[OPEN-ENDED]**

- Of those workers your organization has trained since 2019, what percent have participated in each type of training. Please use the sliders below. A best estimate is fine. **[INSERT SLIDER BAR MATRIX WITH RANGE FROM 0 TO 100% AND FOUR ROWS WITH A-D. INCLUDE DON'T KNOW OPTION.]**

A. Incorporates hands on instruction of equipment?
B. One to ten-day stand-alone training at a job site?
C. Course within a larger curriculum?
D. Apprenticeships?
E. In-person classroom training?

PERCEPTIONS OF MARKET NEEDS

- NYSERDA is interested in learning how to best support the workforce development pipeline for energy efficiency and clean energy businesses in New York State. What would be the most effective manner for NYSERDA to help support training providers

that are fostering the growth of the clean energy and energy efficiency workforce? Please use a scale from 0 (not at all effective) to 10 (extremely effective) to rate how effective it would be for NYSERDA to…. [**INSERT SCALE AS DEFINED WITH DON'T KNOW=98]**

1. Independently develop training content and publish it for training providers and businesses to use
2. Provide funding to training providers curriculum development
3. Provide funding to training providers for purchase of training equipment
4. Provide funding for employers to invest in employee training
5. Provide funding for training organizations to fund training positions
6. Provide funding to businesses to fund internships or apprenticeships
7. Provide funding to businesses to fund on-the-job training
8. Market or perform outreach to recruit trainees to businesses
9. Market or perform outreach to recruit trainees to training through third-party organizations such as nonprofits, consultants, or private companies
10. Provide funding to businesses to fund on-the-job training
96. Other (write in): **[OPEN-ENDED]**

- **[DISPLAY Q41 IF Q40.2>5]**
- Can you expand on the needed funding for curriculum development? (To develop new curricula or update/modify existing curricula? For new or existing workers?) **[OPEN-ENDED]**
- What types of clean energy technology curriculum are currently lacking that are needed to meet business needs in New York State? **[MULTISELECT]**

1. Electrification
2. Off-shore Wind
3. Energy efficiency
4. Solar power
5. Energy management
6. HVAC technician
7. Engineering (mechanical, electrical, other)
8. Construction
9. Electrician
10. Smart grid
11. Biomass
12. Energy storage
13. Hydropower
14. Safety
15. Basic skills to prepare students for the above
16. None **[EXCLUSIVE]**
96. Other (write in) **[OPEN-ENDED]**

- What kinds of clean energy technology curriculum is your company considering developing to help to meet business needs in New York State? **[MULTISELECT]**

1. Electrification
2. Off-shore Wind
3. Energy efficiency
4. Solar power
5. Energy management
6. HVAC technician

7. Engineering (mechanical, electrical, other)
8. Construction
9. Electrician
10. Smart grid
11. Biomass
12. Energy storage
13. Hydropower
14. Safety
15. Basic skills to prepare students for the above
16. None **[EXCLUSIVE]**
96. Other (write in) **[OPEN-ENDED]**

- What else might NYSERDA do to help support training providers that are fostering the growth of the clean energy and energy efficiency workforce?
  [OPEN-ENDED]

- Thinking again about supporting the workforce development pipeline for energy efficiency and clean energy businesses in New York State, what actions or steps do you think are needed to address current business needs? [**MULTISELECT]**

A. There needs to be more state, local, or federal funding to sponsor on-the-job training or internships
B. There need to be more qualified training providers
C. Improve and update existing training curricula
D. Increase outreach and marketing efforts to recruit workers

Don't know

- What other actions or steps would help support the workforce development pipeline to address current business needs?

  [OPEN-ENDED]

- Thinking again about supporting the workforce development pipeline for energy efficiency, do you have any comments for NYSERDA generally? Or any specific recommendations to help NYSERDA support green, clean, or energy efficient workforce development?

  [OPEN-ENDED]

Thank you for your time and responses. If you have any questions or concerns, please contact NYSERDA at 1-800-NYSERDA for additional information. If you have any specific questions about this study, please contact Mersiha McClaren at *mersiha.mcclaren@dnv.com* or Patricia Gonzales at *Patricia.Gonzales@nyserda.ny.gov*.

Talent Pipeline Interns and OJT: Participant Business Owners Semi-Structured Interview Survey

Date: 8/2/2021

Interviewer Information

Interviewer instructions are in *italics*.

Programmer Information

Programming instructions are CAPITALIZED.

The Evaluation Team will input the following data from the Talent Pipeline program tracking data in order to reference the information during the interview. Throughout this instrument, pipe in fields are denoted by brackets and capital letters: [EXAMPLE].

Table 2: Database Information Piped into the Survey Instrument

Variable Name	Variable Description and Values
CONTACT_NAME	Name of contact at company
ADDRESS	Address at company
BUSINESS_NAME	Name of the business
PARTICIPANT_TYPE	OJT= Received OJT funding, Internship= Received Internship funding
INTERNSHIP	1 = Participant in internship program
OJT	1 = Participant in on-the-job training program
NUMBER_INTERNS	Number of interns NYSERDA funded at organization
NUMBER_OJT	Number of on-the-job staff NYSERDA funded at organization

Program Description

NYSERDA is investing in a talent pipeline to ensure that New York State clean energy, electrification, and energy efficiency businesses have a robust supply of new and existing workers with the required occupational skills, credentials, and experience. This will ensure workers are trained to provide the professional services and technical skills necessary to design, manufacture, specify, sell, distribute, install, operate, maintain, repair, and inspect clean energy technology and systems. Focus areas include energy efficiency; electrification (air- and ground-source heat pumps in support of NY Clean Heat); cleantech companies, including startups; and energy storage.

Activities will focus on expanding training infrastructure and capacity and offsetting the cost of hiring and training new workers, which can lead to soft cost reductions by decreasing the time and costs associated with getting a worker to full productivity. All training for new workers will be directed by specific business training and hiring needs and include direct involvement of businesses in activities such as providing internships, job cooperatives, site visits and interviewing graduates to ensure job placement.

The initiative's primary objectives are to:

- Expand training infrastructure within a company/portfolio
- Offset or reduce the cost and timeline of hiring and training new workers
- Provide relevant and effective training (The objectives associated with this are addressed by training provider and trainee surveys, not this survey.)

The initiative seeks to achieve the above objectives by engaging with training providers to develop and implement clean tech training and with employers to hire interns, provide on-the-job training (OJT), and apprenticeships.

Instrument

Email Survey Invitation Letter

SUBJECT LINE: Share your experience with NYSERDA

Dear [Name of Participant],

Our records show that staff at your organization received wage subsidies for onboarding interns or on-the-job training of workers or for hiring interns to perform work in the clean energy sector from the New York State Energy Research and Development Authority **(NYSERDA) Workforce Training: Talent Pipeline Program**, Program Opportunity Notices (PONs) 3982 or 4000. Thank you for playing an important role in growing clean energy in New York State!

NYSERDA has contracted with an independent research firm, DNV, to contact business owners or hiring managers like you to **learn about their workforce**, specifically the workforce for which NYSERDA provided wage subsidies or reimbursments, which will be essential to assessing this program's effects. **If you are not the best person for us to talk to about your hiring process and NYSERDA wage subsides, please let me know who I should contact and how to reach them.**

Please click **this link** you provide your feedback.

If you need to stop at any time, just exit the browser window. You can complete the survey by clicking the link again, which will take you back to where you left off. When you are finished, be sure to click the "Submit" button at the end. We understand that you may not be able to answer some of our questions. We still would like to hear from you about your experience. The survey should take about 20 minutes to complete.

We really need your input to help us answer key questions about the Talent Pipeline Program. If you have any questions or concerns about the legitimacy of this study, please feel free to contact me directly at [INPUT PHONE #] or Dr. Patricia Gonzales, Senior Project Manager at NYSERDA (*patricia.gonzales@nyserda.ny.gov*).

All of your responses will be confidential to the extent permitted by law including but not limited to the Freedom of Information Law (FOIL), and any analyses will not identify individuals.

Thank you for your time and consideration,

[INPUT NAME]

[INPUT TITLE]
DNV Energy Services USA Inc.

Phone Scheduling Script

IF PHONE ANSWERED BY GATEKEEPER:

> Hi, this is [CALLER NAME] from DNV, calling on behalf of the New York State Energy Research and Development Authority, or NYSERDA. I'm trying to reach [CONTACT NAME] regarding NYSERDA's Workforce Training: Talent Pipeline Program. I emailed [CONTACT NAME] a few days ago that I would be calling. Is [HE/SHE] available?

[IF NOT AVAILABLE, try to get a time when contact will be available.]

IF PHONE ANSWERED BY NAMED CONTACT:

Hi, this is [CALLER NAME] from DNV, calling on behalf of the New York State Energy Research and Development Authority, or NYSERDA, regarding Workforce: Talent Pipeline Program. I emailed you a few days ago that I would be calling to try to schedule a time to talk. Do you recall that email?

[IF DOES NOT RECALL, repeat information from email.]

Are you the best person to talk to about your organization's NYSERDA-funded internships or on-the-job training positions that your organization has brought on?

[IF NOT, attempt to get the correct name and contact information and attempt to contact that person.]

[IF CONTACT IS APPROPRIATE PERSON:]

I would like to schedule a time in the next few days or so to talk about your organization's hiring and training practices and the interns or on-the-job training positions funded in part by NYSERDA that your organization has had. What time is best for you? Or if now is a good time to talk, please let me know.

[IF NEEDED:] Thank you very much. I look forward to talking to you on [SCHEDULED DATE].

Survey Questions

Screening

NYSERDA records indicate that your organization has participated in their Workforce Development: Talent Pipeline program. This means your organization brought on interns or new hires for which NYSERDA has reimbursed a portion of wages.

How familiar are you with new hire positions that your organization staffed through wage reimbursement received from NYSERDA? Please answer on a scale of 1-5, in which 1 means "not at all familiar" and 5 means "very familiar". [INSERT 1-5 SCALE.]

[SINGLE ANSWER]

[DISPLAY IF S1<=3 OR DON'T KNOW]

Could you provide the name and contact information of the person most knowledgeable about hiring staff for which your organization received wage reimbursements? [TERMINATE]

Name: [OPEN ENDED]

Title: [OPEN ENDED]

Email: [OPEN ENDED]

Phone: [OPEN ENDED]

[IF S1 <= 3 OR DON'T KNOW, (NOT FAMILIAR WITH NYSERDA-FUNDED POSITIONS) TERMINATE AFTER THEY ANSWER S2] Thank you for taking the time to respond to these questions. We are looking to speak with those who are at least moderately familiar about new hire or intern positions that were partially funded by NYSERDA. Since you indicated you are not familiar with these new hire positions, we have no more questions for you at this time.

[DISPLAY IF S1=4,5]

What is your current role? Are you personally the owner of your company, a top officer or a part of the executive team, a manager who is not a part of the executive team, or something else?

[MULTIPLE RESPONSE]

Owner of the company or organization
Top Officer (part of the executive team)
A hiring manager (not part of the executive team)
Other, please specify: [OPEN-ENDED RESPONSE]

Role

[ASK ALL THAT PASS SCREENING]

Thank you for clarifying your role. These next questions are meant to better understand the products and services provided by your organization or business unit.

Q1. Our records show that your organization provides services and/or products in the clean energy space. For your organization, or business unit if you are part of a large company, which of the following selections best describes your clean energy business?

[MULTIPLE RESPONSE]

Heat pumps
High efficiency heating, ventilation, and airconditioning (HVAC)
Other renewable heating and cooling
High efficiency water heating
Insulation and/or air sealing
High efficiency lighting and controls
Building automation and controls
Smart grid
Energy storage
Solar electric and/or related areas
Alternate transportation
Renewable fuels including wind
Energy efficiency and clean technology areas not noted above (write in): **[OPEN-ENDED]**

[ASK ALL THAT PASS SCREENING]

Please more specifically describe the products or services your organization or business unit offers in the clean energy space.

[OPEN ENDED]

[ASK ALL THAT PASS SCREENING]

About what percentage of your organization or business unit's sales across products or services are in New York state?

[SINGLE RESPONSE]

Percentage of products/services in New York State: [OPEN ENDED]
Don't know

[DISPLAY TOGETHER WITH Q4] The next questions are about your labor force, the relationship between the labor pool and your business plans, and the activities associated with staff retention, recruiting, on-boarding and training.

[ASK ALL THAT PASS SCREENING. MULTIPLE RESPONSE.]

Can you please provide an estimate of the number of full time equivalent (FTE) staff in New York state that were on the payroll of your clean energy organization or business unit in July 2019, 2020, and 2021? Your best estimate is fine. [*If respondent doesn't know, write "don't know" in the text field."]*

2019: [OPEN ENDED]
2020: [OPEN ENDED]
2021: [OPEN ENDED]

[ASK ALL THAT PASS SCREENING. MULTIPLE RESPONSE.]

Can you please project the number of FTEs in New York state your clean energy organization or business unit will require to meet your business objectives in 2022 and 2023? If it is the same number of FTEs as in 2021, then input that number. If you project your FTE will grow or decline, then input a total number of FTEs that takes into the account growth or decline.

2022: [OPEN ENDED]
2023: [OPEN ENDED]

[ASK ALL THAT PASS SCREENING]

Thinking about your future staffing needs in 2022 and 2023, on a scale of 0 to 10, where 0 means "not at all confident" and 10 means "fully confident", how confident are you in the following.

[INSERT SCALE AS DEFINED FOR EACH ITEM WITH A DON'T KNOW RESPONSE AND NOT APPLICABLE RESPONSE]

<u>In 2022</u>:

My organization or business unit will be able to acquire the additional hires we need.
New hires will have the necessary training required for their position.

<u>In 2023</u>:

My organization or business unit will be able to acquire the additional hires we need.
New hires will have the necessary training required for their position.

[IF RATING IS LESS THAN 6 ON ANY ITEM IN Q6]

You noted a lower confidence in finding the trained staff you need in the future. Please explain why you gave that/those response/s.

[OPEN ENDED]
Don't know

[ASK ALL THAT PASS SCREENING]

What would be the impact on your organization or business unit if your organization had 10% fewer FTEs in 2022?

[OPEN ENDED]

Internships

[ASK IF INTERNSHIP = 1]

According to our records, your organization has brought on [NUMBER_INTERNS] interns whose wages were partially reimbursed through funding from NYSERDA. Is that correct?

Yes, that's correct.
No – please input the number of interns whose wages were partially reimbursed by NYSERDA: [OPEN-ENDED]
No – Did *not* bring on any interns whose wages were partially reimbursed by NYSERDA [SEND TO SECTION "On-The-Job Training"]
Don't know

[DISPLAY IF Q9 = Don't know]

Could you provide the name and contact information of the person who would know about intern hiring? [SEND TO SECTION "On-The-Job Training"]

Name: [OPEN ENDED]

Title: [OPEN ENDED]

Email: [OPEN ENDED]

Phone: [OPEN ENDED]

[ASK IF INTERNSHIP = 1, Q9 = 1, 2]

Of the interns you brought on board whose wages were partially reimbursed by NYSERDA, what percent were:

In a 4-yr college/university degree program, currently and/or recently: [OPEN-ENDED]%
In a 2-yr college/university degree program, currently and/or recently: [OPEN-ENDED]%
In a certificate or vocational program, currently and/or recently: [OPEN-ENDED]%
In a training that did not offer certification or degree (e.g., job preparedness program like AmeriCorps or NYSERDA-funded Career Pathways program): [OPEN-ENDED]%
Those who recently had no training/education noted above: [OPEN-ENDED]%

[ASK IF INTERNSHIP = 1, Q9 = 1,2]

What did your organization hope to achieve by hiring interns? [MULTISELECT]

Hire temporary help because your organization needed an extra set of hands

Offer individuals a trial period that could lead to something more permanent
Wanted to mentor people early in their career
Other (please specify): [OPEN-ENDED]

[ASK IF INTERNSHIP = 1, Q9 = 1,2]

On a scale from 0 to 10, where 0 is "strongly disagree", 5 is "neither agree or disagree" and 10 is "strongly agree," please indicate how much you agree with the following [INCLUDE A DON'T KNOW OPTION FOR EACH]:

Finding workforce with skills in the clean energy space is difficult [DISPLAY FIRST]
Without NYSERDA's intern placement assistance we would not have found our interns
Without NYSERDA's reimbursement, we would not have hired our interns for their internship

[IF RESPONSE TO Q13 IS 7 OR GREATER FOR ANY ANSWER]
In the prior question, you noted some disagreement with [IINPUT ITEMS FROM Q13 WITH RATINGS 7 OR GREATER] Please explain why you gave that/those response(s).

[OPEN ENDED]
[OPEN ENDED]
[OPEN ENDED]
Don't know

[ASK IF INTERNSHIP = 1, Q9 = 1,2]

Of the interns that completed the internship at your organization for which you received NYSERDA wage reimbursment, how many of them fall into these categories? Your best estimate is fine.

Were hired full time: ___[NUMBER ANSWER]
The position was offered to them but they did not accept: ____ [NUMBER ANSWER]
The position was not not offered to them: _____ [NUMBER ANSWER]
Don't know

[ASK IF INTERNSHIP = 1, Q9 = 1,2]

In 2018 and 2021, if you lost a junior employee, how long did it take, on average, to find and recruit that person (in terms of months)? Your best estimate is fine.

Note: We ask about 2018 because that is the time period when the NYSERDA internship funding program was not around.

2018: [OPEN-ENDED] month(s)
2021: [OPEN-ENDED] month(s)
Don't Know – Who at your organization would know? Please provide their contact information: [OPEN-ENDED]

[ASK IF INTERNSHIP = 1, Q9 = 1, 2]

How did participation in NYSERDA's internship funding program affect your recruiting time, on average, to find and recruit junior staff?

Please answer on a slider bar below. "0" means *no effect. Negative numbers mean reduction in time while positive numbers mean increase in time. For example, -1* means th*e internship program*

helped reduce recruiting time to find junior staff by one month, whereas +1 means the internship program increased the time to recruit and find junior by 1 month.

[INSERT SLIDE BAR WITH MONTHS FROM -12 to 0 to +12] [INCLUDE DON'T KNOW OPTION]

[ASK IF INTERNSHIP = 1, Q9 = 1, 2]

In 2018 and 2021, if you hired a new junior employee, how long would it take, on average, to train that person to the required level of skills in months? Your best estimate is fine.

Note: Again we ask about 2018 because that is the time period when the NYSERDA internship funding program was not around.

2018: [OPEN-ENDED] month(s)
2021: [OPEN-ENDED] month(s)
Don't Know – Who at your organization would know? Please provide their contact information: [OPEN-ENDED]

[ASK IF INTERNSHIP = 1, Q9 = 1, 2]

How did the participation in NYSERDA's internship funding program affect the length of time to train your junior staff to the required level of skill, on average?

Please answer on a slider bar below. "0" mean no effect. Negative numbers mean reduction in time while positive numbers mean increase in time. For example, -1 means the internship program helped reduce training time by one month, whereas +1 means the internship program increased the training time by 1 month.

[INSERT SLIDE BAR WITH MONTHS FROM -12 to 0 to +12] [INCLUDE DON'T KNOW OPTION]

[ASK IF INTERNSHIP = 1, Q9 = 1, 2]

As you answered the questions about how long it would take to train a new junior hire to the required level of skill, how did you interpret the phrase, "required level of skill?" [*Read options 1-4*]

[SINGLE RESPONSE]

Minimum level of competence to perform the required tasks, with supervision
Minimum level of competence to perform the required tasks, with no supervision
Same level of skill of a departing junior employee
Something else – please specify: [OPEN-ENDED RESPONSE]
Don't know

[ASK IF INTERNSHIP = 1, Q9 = 1, 2]

In 2018 and 2021, on average, what did it cost your organization to find and recruit a junior-level hire? By "find and recruit", we mean expenditures related to job board fees, candidate assessment cost, external or internal recruiter expenses, and/or employer branding efforts (if applicable). **Your best estimate is fine.**

2018: [OPEN-ENDED] U.S. Dollars
2021: [OPEN-ENDED] U.S. Dollars
Don't know – Who at your organization would know? Please provide their contact information: [OPEN-ENDED]

[ASK IF INTERNSHIP = 1, Q9 = 1, 2, and Q1 OR Q1>0]
You mentioned you hired some of the interns full time. How did the participation in NYSERDA's internship funding program affect your recruiting and hiring costs to fill in a junior staff position?

[SINGLE RESPONSE]

No effect on recruiting and hiring cost
Increased the cost, on average
Reduced the cost, on average
Don't know

[ASK IF Q21=2 OR 3]

How much were recruiting and hiring costs [IF Q21=2 INPUT "increased"; IF Q21=3 INPUT "reduced"], on average, because of your participation in NYSERDA internship funding program? Please answer as a percentage.

[OPEN-ENDED] %
Don't know

[ASK IF INTERNSHIP = 1, Q9 = 1,2]
Was the cost to train interns the same, higher, or lower compared to training your typical new junior-level hire?

[SINGLE RESPONSE]

The same
Higher
Lower
Don't know

[ASK IF Q21=2 OR 3]

How much [IF Q21=2 INPUT "more"; IF Q21=3 INPUT "less"] were your training costs on average, per hire, if you compare your intern to typical new junior-level hire? Please answer in percentage terms (for example, 50% [IF Q21=2 INPUT "more"; IF Q21=3 INPUT "less"].

[OPEN-ENDED] %
Don't know

[ASK IF INTERNSHIP = 1, Q9 = 1,2]
Now thinking of 2018 and 2021, what was your typical training cost on average for a new junior-level hire? Your best estimate is fine.

2018: [OPEN-ENDED] U.S. Dollars
2021: [OPEN-ENDED] U.S. Dollars
Don't Know – Who at your organization would know? Please provide their contact information: [OPEN-ENDED]

[ASK IF INTERNSHIP = 1, Q9 = 1,2]
On average, how long did it take interns to make half as less errors on their assigned tasks compared to when they started? Please answer in months.

[OPEN-ENDED] months
Don't Know

[ASK IF INTERNSHIP = 1, Q9 = 1,2]
On average, how long did it take interns to accomplish tasks with little supervision ? Please answer in months.

[OPEN-ENDED] months
Don't Know

[ASK IF Q15 ANSWER FOR 1. > 0]
Of those interns that you hired full time, what proportion have you terminated or laid off?

[OPEN-ENDED] %
Don't Know

[ASK IF Q15 ANSWER FOR 1. > 0]
Of those interns that you hired full time, what proportion advanced from the position they were hired for?

[OPEN-ENDED] %
Don't Know

[ASK IF ANSWER FOR Q15 1. > 0 AND LESS THAN Q9 1. OR 2.]
Based on your prior answers, your organization did not offer every intern a full-time positions after their internship was over. What were the reasons for not hiring them as full-time staff? [MULTIPLE RESPONSE, RANDOMIZED; KEEP OTHER AND DON'T KNOW AT THE END]

Intern has not finished school yet
Didn't have the salary to hire them
They lacked the technical skills for the position
They lacked the soft skills needed for the position
They relocated
They were tardy/did not show up on time
The position was offered to them but they did not accept
Other: [OPEN-ENDED]
Don't know

On-The-Job Training

[ASK IF OJT = 1]

According to our records, your organization or business unit has had [NUMBER_OJT] new hires for which your organization received NYSERDA's on-the-job training (**OJT**) wage reimbursement. Is that correct?

Yes, that's correct.
No – please input the number of new hires for which your organization received NYSERDA OJT wage reimbursement: [OPEN-ENDED]
No, my organization or business unit has not brought on any new hires that received NYSERDA OJT wage reimbursement. [SEND TO SECTION "General"]
Don't know

[ASK IF Q32 = Don't know]

Could you provide the name and contact information of the person most knowledgeable about hiring and staff training? [SEND TO SECTION "General"]

Name: [OPEN ENDED]

Title: [OPEN ENDED]

Email: [OPEN ENDED]

Phone: [OPEN ENDED]

[ASK IF Q32 = 1, 2]

What did your organization hope to achieve by bringing on hires for which you received NYSERDA OJT wage reimbursement? [MULTISELECT]

Wanted to minimize hiring and training costs to be able to hire more staff
Offer individuals a trial period that could lead to something more permanent
Wanted to grow new business or services by hiring more staff
Wanted to grow existing business or services by hiring more staff
Other (please specify): [OPEN-ENDED]

[ASK IF Q32 = 1 ,2]

On a scale from 0 to 10, where 0 is "strongly disagree", 5 is "neither agree or disagree" and 10 is "strongly agree," please indicate how much you agree with the following [INCLUDE A DON'T KNOW OPTION FOR EACH]:

[DO NOT DISPLAY IF Q9 = 3 OR -98] Finding workforce with skills in clean energy space is difficult [DISPLAY FIRST]
Without NYSERDA's help to identify those new hires eligible for NYSERDA's OJT wage reimbursement, we would not have found them
Without NYSERDA's reimbursement, we would not have brought on the staff for which we received NYSERDA's OJT wage reimbursement

[IF RESPONSE TO Q35 IS 7 OR GREATER FOR ANY ANSWER]
In the prior question, you noted some disagreement with [IINPUT ITEMS FROM Q13 WITH RATINGS 7 OR GREATER] Please explain why you gave that/those response(s).

[OPEN ENDED]
[OPEN ENDED]
[OPEN ENDED]
Don't know

[ASK IF Q32 = 1 ,2]

In 2018 and 2021, when you lost an employee at the same level of expertise as the staff for which you received NYSERDA OJT wage reimbursement, how long did it take, on average, to find and recruit for that position (in terms of months)?

Note: We ask about 2018 because that is the time period when the NYSERDA On-The-Job Training or OJT funding program was not around.

2018: [OPEN-ENDED] month(s)
2021: [OPEN-ENDED] month(s)
Don't Know – Who at your organization would know? Please provide their contact information: [OPEN-ENDED]

[ASK IF Q32 = 1, 2]

How did participation in NYSERDA's on-the-job training or OJT program affect your recruiting time, on average, to find and recruit staff?

Please answer on a slider bar below. "0" means *no effect. Negative numbers mean reduction in time while positive numbers mean increase in time. For example, -1* means th*e on-the-job training or OJT program helped reduce recruiting time to find junior staff by one month, whereas +1 means the OJT program increased the time to recruit and find staff by 1 month.*

[INSERT SLIDE BAR WITH MONTHS FROM -12 to 0 to +12] [INCLUDE DON'T KNOW OPTION]

[ASK IF Q32 = 1, 2]

In 2018 and 2021, when you hired a new employee at the same level of expertise as your staff for which you received NYSERDA OJT wage reimbursement, how long did it take, on average, to train that person to the required level of skills in months?

Note: Again, we ask about 2018 because that is the time period when the NYSERDA On-The-Job Training or OJT funding program was not around.

2018: [OPEN-ENDED] month(s)
2021: [OPEN-ENDED] month(s)
Don't Know – Who at your organization would know? Please provide their contact information: [OPEN-ENDED]

[ASK IF Q32 = 1, 2]

How did the participation in NYSERDA's OJT program affect the length of time to train your new staff to the required level of skill, on average? Again, we are talking about staff that would be at the same level of skill as your NYSERDA-subsidized OJT staff.

Please answer on a slider bar below. "0" means *no effect. Negative numbers mean reduction in time while positive numbers mean increase in time. For example, -1* means th*e on-the-job training or OJT program helped reduce recruiting time to find staff by one month, whereas +1 means the OJT program increased the time to recruit and find staff by 1 month.*

[INSERT SLIDE BAR WITH MONTHS FROM -12 to 0 to +12] [INCLUDE DON'T KNOW OPTION]

[ASK IF Q32 = 1, 2]

As you answered the questions about how long it would take to train a new employee to the required level of skill, how did you interpret the phrase, "required level of skill?"

[SINGLE RESPONSE]

Minimum level of competence to perform the required tasks, with supervision
Minimum level of competence to perform the required tasks, with no supervision
Same level of skill of a departing employee
Something else – please specify: [OPEN-ENDED RESPONSE]
Don't know

[ASK IF Q32 = 1, 2]

Of those NYSERDA-subsidized OJT new hires that your company or business unit brought on, what percent are still with you after NYSERDA finished distributing OJT wage reimbursement? NYSERDA finishes distributing wage reimbursement after 4-6 months from the start of the hire date. **Your best estimate is fine.**

[OPEN-ENDED RESPONSE] %
Don't know

[ASK IF Q32 = 1, 2]

In 2018 and 2021, on average, what did it cost your organization to find and recruit a new hire? Only think of hires for positions delivering services and goods, exclude administrative hires. By "find and recruit", we mean expenditures related to job board fees, candidate assessment cost, external or internal recruiter expenses, and/or employer branding efforts (if applicable). **Your best estimate is fine.**

2018: [OPEN-ENDED] U.S. Dollars
2021: [OPEN-ENDED] U.S. Dollars
Don't Know – Who at your organization would know? Please provide their contact information: [OPEN-ENDED]

[ASK IF Q42 > 0%]

You mentioned some or all of NYSERDA-subsidized OJT staff is still with you. How did the participation in NYSERDA's OJT program affect your recruiting and hiring costs to fill in a staff position?

[SINGLE RESPONSE]

No effect on recruiting and hiring cost
Increased the cost, on average
Reduced the cost, on average
Don't know

[ASK IF Q42 > 0%]

How much were recruiting and hiring costs [IF Q44=2 INPUT "increased"; IF Q44=3 INPUT "reduced"], on average, because of your participation in NYSERDA OJT program? Please answer as a percentage.

[OPEN-ENDED] %

[ASK IF Q32 = 1, 2]

Was the cost to train NYSERDA-subsidized OJT staff the same, higher, or lower compared to training your typical new hire?

[SINGLE RESPONSE]

The same
Higher
Lower
Don't know

[ASK IF Q32 = 1, 2]

How much [IF Q46=2 INPUT “more”; IF Q46=3 INPUT “less”] were your training costs on average, per hire, if you compare your NYSERDA-subsidized OJT staff to a new hire with a comparable skillset? Please answer in percentage terms (for example, 50% [IF Q46=2 INPUT “more”; IF Q46=3 INPUT “less”].

[OPEN-ENDED] %
Don’t know

[ASK IF Q32 = 1, 2]

Now thinking of 2018 and 2021, what was your typical training cost on average for a new staff hire that is at the same level of expertise as the NYSERDA-subsidized OJT staff? Your best estimate is fine.

2018: [OPEN-ENDED] U.S. Dollars
2021: [OPEN-ENDED] U.S. Dollars
Don’t Know – Who at your organization would know? Please provide their contact information: [OPEN-ENDED]

[ASK IF Q32 = 1, 2]

On average, how long did it take NYSERDA-subsidized OJT staff to make half as less errors on their assigned tasks compared to when they started? Please answer in months.

[OPEN-ENDED] months
Don’t know

[ASK IF Q32 = 1, 2]

On average, how long did it take NYSERDA-subsidized OJT staff to accomplish tasks with little supervision? Please answer in months.

[OPEN-ENDED] months
Don’t know

[ASK IF Q42 > 0%]

Of those NYSERDA-subsidized OJT staff that were still with you after NYSERDA finished distributing the wage reimbursement, what percent have you since terminated or laid off?

[OPEN-ENDED] %
Don’t know

[ASK IF Q42 > 0%]

Of those NYSERDA-subsidized OJT staff that are still with you after NYSERDA finished distributing the wage reimbursement, what percentage of them advanced from the position for which they were initially hired ?

[OPEN-ENDED] %
Don’t know

[ASK IF Q42 > 0%]

Based on your prior answers, your organization did not retain every NYSERDA-subsidized OJT staff after NYSERDA finished distributing the wage reimbursement. What were the reasons for not keeping them? [MULTIPLE RESPONSE, RANDOMIZED]

Didn't have the monetary resources to keep them
They lacked the technical skills for the position
They lacked the soft skills needed for the position
They relocated
They were tardy/did not show up on time
They resigned or quit
Other: [OPEN-ENDED]
Don't know

General

[ASK ALL]

Do you have any recommendations to improve NYSERDA's [IF INTERNSHIP = 1 INPUT "internship program"; IF OJT = 1, INPUT "on-the-job training or OJT program"; IF INTERNSHIP = 1 AND IF OJT = 1, INPUT "internship and OJT programs"]?

[OPEN-ENDED]

That's all of our questions. Thank you so much for taking the time to answer these questions.

Talent Pipeline Participant Trainee Survey

PURPOSE

The Evaluation Team will survey participating trainees to assess the relevance and effectiveness of the training efforts and associated trainee learning.

VARIABLE LIST

Variable	Definition
[NAME OF PARTICIPANT]	Name of trainee
[YEAR]	Year organization participated in NYSERDA program
[TRAINING_PROVIDER]	Name of training organization

SURVEY INVITATION LETTER

Participant email invitation:

SUBJECT LINE: Share your experience with [TRAINING_PROVIDER]'s Workforce Development Program

Dear [NAME OF PARTICIPANT],

According to [TRAINING_PROVIDER]'s records you participated in a workforce development training in [YEAR]. Thank you for your participation!

[TRAINING PROVIDER] received funding from the New York State Energy Research and Development Authority (NYSERDA), which works with residents, business owners, and others to promote energy efficiency and the use of renewable energy sources. NYSERDA is interested in learning about your experience to help assess the program's effects.

We need to get responses from as many trainees as possible to ensure that the feedback we provide to NYSERDA is accurate and representative. Can you be one of the people who help us reach our goal of getting feedback from [XX] trainees? We have designed our questions to take about 10 minutes to answer, although we encourage you to provide as much detail as you like.

Please click **this link** to provide your feedback.

If you need to stop at any time, just exit the browser window. You can complete the survey by clicking the link again, which will take you back to where you left off. When you are finished, be sure to click the "Submit" button at the end.

We really need your input to help us answer key questions about the training program. If you have any questions or concerns about the legitimacy of this survey, please feel free to contact XX at NYSERDA [NEED CONTACT INFO] or the DNV study lead, Mersiha McClaren, Director at DNV (mersiha.mcclaren@dnv.com).

All responses you provide us will be confidential to the extent permitted by law including but not limited to the Freedom of Information Law (FOIL); nothing you report to us will be identified with you in our reports.

Thank you for your time and consideration,

DNV Energy Insights USA Inc.
mersiha.mcclaren@dnv.com
503-446-2656 ext. 220

SCREENING

[DISPLAY Q1 IF STATUS=1]

- [TRAINING_PROVIDER]records indicate that you participated in training in [YEAR]. This training is specific to clean energy technologies, such as building electrification, offshore wind, energy efficiency, or energy storage.
- Is this correct?

Yes
No

[TERMINATE IF Q1=2]

BACKGROUND

- Were you employed before participating in the training?

Yes
No

[DISPLAY Q4 IF Q3=1]

- Which of the following would best characterize that employer's industry? **[MULTISELECT]**

Was not employed **[EXCLUSIVE]**
Off-shore Wind
Weatherization
Solar power
Energy management
HVAC technician
Engineering (mechanical, electrical, other)
Construction
Electrician
Smart grid
Biomass
Energy storage
Hydropower
Other (please specify) **[OPEN ENDED]**

[DISPLAY Q5 IF Q3=2]

- Which of the following best characterizes your employer's industry? **[MULTISELECT]**

I am not currently employed **[EXCLUSIVE]**
Off-shore Wind
Weatherization
Solar power
Energy management
HVAC technician
Engineering (mechanical, electrical, other)
Construction
Electrician
Smart grid
Biomass
Energy storage
Hydropower
Other (please specify) **[OPEN ENDED]**

[DISPLAY Q6 IF Q5<>1]

- What is the name of your current employer?

[OPEN-ENDED]

- Please select the type(s) of training that your participated in. **[MULTISELECT]**

1. Electrification
2. Off-shore Wind
3. Energy efficiency
4. Solar power
5. Energy management
6. HVAC technician
7. Engineering (mechanical, electrical, other)
8. Construction
9. Electrician
10. Smart grid
11. Biomass
12. Energy storage
13. Hydropower
14. Safety
15. Basic preparatory skills

96. Other (write in): **[OPEN-ENDED]**

- Please select all the kinds of activities you participated in through [TRAINING_PROVIDER]'s training. If you took more than one training, please select all activities that apply to any of the trainings. **[MULTISELECT]**

1. In-class training
2. Train-the-trainer –prepares companies to train their own in-house staff
3. Online courses (self-guided)
4. Online courses (instructor guided)
5. Assistance with getting internships or on-the-job training
6. Placement assistance
7. Hands on training with equipment
8. One to ten-day stand-alone training at an employer's premises
9. Course within a larger curriculum

96. Other (write in) **[OPEN-ENDED]**

- What type of degrees or certifications did you receive for completing the [Q7 RESPONSE] training? Again, please select all that apply to any training you took. **[MULTISELECT]**

1. Associate degree
2. Bachelor's degree
3. Master's degree

4. Continuing education unit/credit
5. License
6. Certification through external org (Who?) **[OPEN-ENDED]**
7. [TRAINING_PROVIDER] certification
8. None [EXCLUSIVE]
96. Other (write in): **[OPEN-ENDED]**

POST-TRAINING INFO

- Within 12 months after completing the training, were you working at a <u>new</u> job that related to the training?

1. Yes
2. No
98. Cannot recall

[DISPLAY Q11 IF Q10=1]

- How long did it take you to find your new job, from the time you started looking until you were hired? Please indicate the number of weeks <u>or</u> months.

Number of weeks: **[OPEN-ENDED]**
Number of months: **[OPEN-ENDED]**

- Have you used any of the skills or knowledge you learned through [TRAINING_PROVIDER]'s training?

1. Yes
2. No
98. Cannot recall

[DISPLAY Q13 AND Q14 IF Q12=1]

- How often do you use the skills or knowledge you learned at [TRAINING_PROVIDER]'s training? Please use a scale from 0 (never) to 10 (everyday). **[INSERT SCALE AS DEFINED WITH 98=DON'T KNOW]**
- What specific skills or knowledge you learned during [TRAINING_PROVIDER]'s training have you used since completing the training?

[OPEN-ENDED]

[DISPLAY Q15 IF Q10=1]

- Thinking back to your first few weeks on your new job, how prepared to perform the job did you feel? Please use a scale from 0 (not at all prepared) to 10 (fully prepared). **[INSERT SCALE AS DEFINED WITH 98=DON'T KNOW]**

[DISPLAY Q16 IF Q15<6]

- What additional training or resources would you have needed to feel prepared? **[MULTISELECT]**

1. Hands-on training with job-related equipment
2. Hands-on training with job-related computer software
3. Explanations or background on general industry-related issues
4. Explanations or background on specific job-related issues

96. Other (please specify) **[OPEN-ENDED]**

- Have you shared any of the skills or knowledge you learned through [TRAINING_PROVIDER]'s training with your coworkers or colleagues?

1. Yes
2. No

98. Don't Know

[DISPLAY Q18, Q19, Q20 IF Q17=1]

- How many people have you shared with?

[OPEN-ENDED; NUMERIC]

- How much time did you spend sharing the skill or knowledge you learned through the training?

0-15 minutes
16-29 minutes
30-45 minutes
46-59 minutes
More than an hour

- In what manner did you share the skills or knowledge you gained from the training? **[MULTISELECT]**

Through informal conversation or demonstration
Through an in-person class or presentation
Through an online class or presentation
Other (please specify) **[OPEN-ENDED]**

MOTIVATION AND GOALS

- What did you hope to achieve by participating in this [TRAINING_PROVIDER] training? **[MULTISELECT]**

Improve my industry skills or knowledge

Take on greater responsibility at my current employer
Get higher wages at my current employer
Take on different types of work at my current employer
Get a job with greater responsibility elsewhere
Get a higher paying job elsewhere

1. Take on different types of work elsewhere
96. Other (please specify): **[OPEN-ENDED]**

[DISPLAY Q22 IF Q21 IS ANSWERED]

- Thinking about those various reasons for taking the training, has the training helped you to achieve those goals? [**INSERT 1=YES AND 2=NO WITH 98=DON'T KNOW]**

1. Improve my industry skills or knowledge **[DISPLAY IF Q21=1]**
2. Take on greater responsibility at my current employer **[DISPLAY IF Q21=2]**
3. Get higher wages at my current employer **[DISPLAY IF Q21=3]**
4. Take on different types of work at my current employer **[DISPLAY IF Q21=4]**
5. Get a job with greater responsibility elsewhere **[DISPLAY IF Q21=5]**
6. Get a higher paying job elsewhere **[DISPLAY IF Q21=6]**
7. Take on different types of work elsewhere **[DISPLAY IF Q21=7]**
96. Other (please specify): **[OPEN-ENDED] [DISPLAY IF Q21=96]**

[DISPLAY Q23 IF ANY Q22=2 OR 98]

- Thinking about your reasons for taking the training, how much do you think the training will help you to achieve these goals? Please use a scale from 0 (not at all) to 10 (a great deal). **[INSERT SCALE AS DEFINED WITH 98=DON'T KNOW]**

1. Improve my industry skills or knowledge **[DISPLAY IF Q22.1=2 OR 98]**
2. Take on greater responsibility at my current employer **[DISPLAY IF Q22.2=2 OR 98]**
3. Get higher wages at my current employer **[DISPLAY IF Q22.3=2 OR 98]**
4. Take on different types of work at my current employer **[DISPLAY IF Q22.4=2 OR 98]**
5. Get a job with greater responsibility elsewhere **[DISPLAY IF Q22.5=2 OR 98]**
6. Get a higher paying job elsewhere **[DISPLAY IF Q22.6=2 OR 98]**
7. Take on different types of work elsewhere **[DISPLAY IF Q22.7=2 OR 98]**
96. Other (please specify): **[OPEN-ENDED] [DISPLAY IF Q22.96=2 OR 98]**

SATISFACTION AND OTHER TRAINING

- Using a scale of 1 to 5, where 1 is "very dissatisfied" and 5 is "very satisfied", how satisfied were you with the overall training? **[INSERT SCALE AS DEFINED WITH 98=DON'T KNOW]**

[DISPLAY Q25 IF Q24<4]

- What about your experience was less than satisfactory?

[OPEN-ENDED]

- In addition to your training with [TRAINING_PROVIDER], have you participated in any of the following types of on-the-job training after completing the NYSERDA Workforce Development training?

Internship with current employer
Internship with a different employer
Apprenticeship with current employer
Apprenticeship with a different employer
Other on-the-job training (please describe) **[OPEN-ENDED]**

- Are there any additional types of training or instruction that would help you to advance in your career or better perform in your current role or potential future roles?

1. Yes
2. No
98. Don't Know

[DISPLAY Q28 IF Q27=1]

- What additional types of training or instruction would help you advance in your career or better perform in your current role or potential future roles?

Electrification
Off-shore Wind
Energy efficiency
Solar power
Energy management
HVAC technician
Engineering (mechanical, electrical, other)
Construction
Electrician
Smart grid
Biomass
Energy storage
Hydropower
Safety
Basic preparatory skills
Other (write in): **[OPEN-ENDED]**

- Thinking again about supporting the workforce development pipeline for energy Do you have any comments for NYSERDA generally? Or any specific recommendations to help NYSERDA support green, clean, or energy efficient workforce development?

[OPEN-ENDED]

DEMOGRAPHICS

The following questions are to help NYSERDA determine whether training its funding is serving all workers, including those in certain targeted groups.

- What is your date of birth?

[OPEN-ENDED: DATE]

- What is your current address? If you do not currently have a stable address, please indicate that in the "Address" field.

[ADDRESS] **[OPEN-ENDED]**
[CITY] **[OPEN-ENDED]**
[STATE] **[OPEN-ENDED]**
[ZIP] **[OPEN-ENDED]**

- Last year, was your household income less than $68,486?

Yes
No
Prefer not to say

- Which of the following types of assistance is your household eligible for or receiving? Please select all that apply or select "none of the above." **[MULTISELECT]**

1. Home Energy Assistance Program (HEAP)
2. Temporary Assistance for Needy Families (TANF)
3. Supplemental Nutrition Assistance Program (SNAP)
4. Other benefit program – please specify: **[OPEN-ENDED]**
5. None of the above **[EXCLUSIVE]**
1. Don't Know **[EXCLUSIVE]**
2. Prefer Not to Say **[EXCLUSIVE]**

- How do you identify your ethnicity? Please Select All that apply. **[MULTISELECT]**

Asian
Black/African American
Caucasian/White

Hispanic or Latino
Native American or Alaska Native
Pacific Islander or Native Hawaiian
Middle Eastern or North African
Other (Please Specify) **[OPEN ENDED]**
Prefer not to answer **[EXCLUSIVE]**