

# **Clean Energy Fund Workforce Development (WFD) Program**

## **Market Assessment and Impact Evaluation**

### **Final Report**

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# 1 Introduction

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This section presents a program description, the study goals, and a summary of the previous Workforce Development (WFD) and Training baseline market study.

## 1.1 Program Description

Presently, the WFD and Training Program consists of two initiatives: 1) the Building Operations and Maintenance (O&M) initiative and 2) the Talent Pipeline initiative.

**The Building O&M (BOM)** initiative is designed to achieve energy savings by training O&M staff to operate their buildings better, thereby reducing energy usage. The BOM effort targets employers, managers, and O&M service providers involved in building operations and maintenance across commercial, institutional, multifamily, and other sectors, especially larger organizations responsible for a portfolio of buildings for replication. The program is designed to increase O&M staff competencies through training in a manner that leads to improved building operations and measurable savings.

The initiative included training of select O&M staff to train co-workers, also called “training the trainer” instruction (or NYTTs<sup>1</sup> for NYSERDA-trained trainers) as well as the direct training of O&M staff via third-party training contractors. The program also supports the hiring of interns and apprentices through placement services, although this is a relatively minor activity as indicated by tracking.

**The Talent Pipeline** initiative is designed to create a workforce pipeline to ensure that New York State clean energy and electrification businesses have a robust supply of new and existing workers with the requisite skills and experiences. The WFD Clean Energy Fund Investment Plan (referred to as the “IP” throughout this document) notes two main activities for this initiative:

- **Expand training infrastructure.** This initiative partners with traditional education providers (e.g., higher education, unions, certification programs, technical high schools) to expand their training to meet the needs of the clean energy industry. The initiative has fostered offerings including university-level curricula, basic skills training for new workers, and specific technical training for both incumbent and new workers. Each participating education provider reports the number of staff trained, associated demographics, and outcomes such as certifications awarded and job placements.

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<sup>1</sup> Workers trained under the NYSERDA-sponsored training to train co-workers in O&M, hence, NYSERDA-trained trainers (NYTT).

- **Offset costs of hiring and training new workers.** The initiative also offers wage reimbursement for qualifying interns and new hires in qualifying businesses.

### 1.1.1 BOM Program Context

The BOM Program has not changed much since its initial roll-out. It funds suitable training projects that are proposed by the building owners and their training consultants. The first PON, PON 3442, expected the primary applicants to be the owners and operators of buildings with O&M staff applying for grants to train their O&M staff. The owners/operators of buildings were expected to be working with the training providers. The second PON, PON 3715, allowed for training organizations to also be the primary applicant, and it was still expected that training organizations would work with specific entities employing O&M staff that were served by New York utilities.

**Program backlog.** The BOM Program has a significant backlog based on Program reporting in the Q4-2021 Clean Energy Fund Quarterly Report (the “Scorecard”). The Report tracks completed, encumbered, and pre-encumbered projects and the expected energy savings for each project. The effect of the COVID-19 pandemic on recruiting participants is evident in a review of the encumbrance dates of the projects. About 30% of the encumbered reported energy savings across all BOM projects was recruited in 2019, dropping to two-thirds that rate in 2020 and rebounding in 2021. The enrollment or recruitment in 2021 still does not match 2019’s level of enrollments.

**Table 1-1. Scorecard Reported Number of Buildings and Energy Savings Encumbered by Year**

Pre-Encumbrance Year	Percentage of all BOM Buildings	Percentage of all BOM Annual Electric Savings (MWh)	Percentage of All BOM Encumbered Annual Natural Gas Savings (MMBtu)
2017 and earlier	24%	14%	14%
2018	16%	9%	9%
2019	18%	31%	31%
2020	14%	20%	20%
2021	27%	26%	26%

While there is no assurance that a pre-encumbered project will be completed, the backlog indicates a demand for the program.

### 1.1.2 Talent Pipeline Program Context

The Talent Pipeline initiative has been deployed within a larger economic and workforce context that is described in this section.

**Hiring insecurity.** The message from both participants and non-participants is clear: a shortage of a skilled workforce is a painful reality of running a clean energy business today. Employers are optimistic about the industry, forecasting that they will require 30-40% more staff to meet 2023 business plans, according to the employers surveyed in this study. When asked about how confident they were in finding staff to meet 2023 business plans, the respondents, on average, reported being 65% confident that they will find the staff. Both participating and non-participating employers report difficulty finding staff:

- *We can hardly get anyone to show up for the interview. We use Indeed and Zip recruiter and we get a couple of applications a week but 4/5 don't show up for the interview.*
- *I have actively been hiring for the last two years with no luck.*
- *Extraordinarily tight labor market coupled with a niche skillset that is needed.*
- *Tight labor markets in general and competition for engineers, construction, and electrician personnel due to the federal infrastructure bill and growth of solar in general.*

Finding people with the requisite skills and work attitude is also challenging:

- *We're finding it difficult to find qualified and reliable employees. I don't foresee this issue correcting itself within the near future.*
- *Technology is moving faster than most college-level engineering programs, new hires require a significant investment in training.*
- *Difficult to find new hires with requisite experience.*
- *Trades need to be taught by doing, and that is not happening. We have found ourselves have to spend resources (time/money/etc.) training people up in order for them to be somewhat helpful.*

The WFD program is addressing a very real barrier to growth in the clean energy sector.

The “New York Clean Energy Industry Report<sup>2</sup>” noted somewhat similar findings based on surveys completed about a year before this current study, during the first lockdown as a result of the COVID-19 pandemic. At that time, only about 23% of the businesses reported that they needed additional workers, although, paradoxically, businesses needing more workers could not find them, despite significant unemployment.

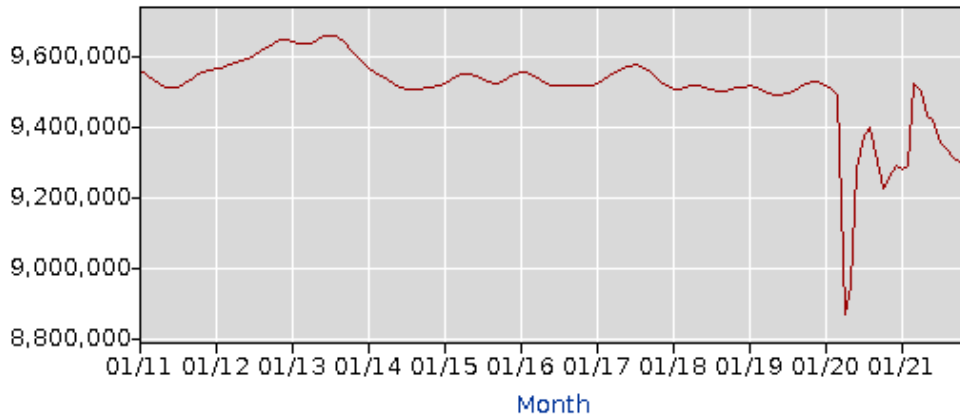
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<sup>2</sup> <https://www.nysesda.ny.gov/-/media/Files/Publications/Clean-energy-industry/2021-CEI-GEN-report.ashx>

### 1.1.3 COVID-19

The COVID-19 pandemic has profoundly impacted US and New York labor. Figure 1-1, provided by the US Bureau of Labor Statistics (BLS)<sup>3</sup>, shows a precipitous drop in the size of the New York labor force in early 2020 from which it has not fully recovered.

**Figure 1-1. New York Labor Force – Bureau of Labor Statistics**  
**labor force**



Counterintuitively, the workforce reductions have not resulted in a surplus of available workers. Other BLS statistics indicate that there is now less than one unemployed person in New York for every job opening.

The WFD Program is working against an enormous and unexpected headwind.

#### 1.1.3.1 BOM COVID Impacts

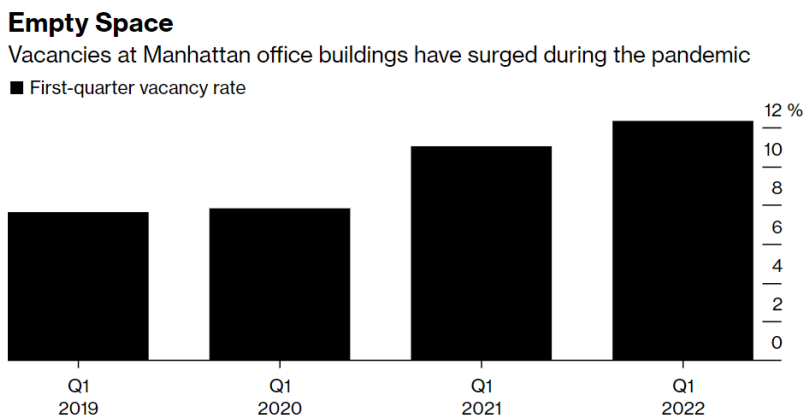
The building O&M workers targeted in this initiative serve office buildings (about 40% of square footage), larger multifamily complexes (36%), education (20%), and hospitals (4%). Most survey respondents reported immediate changes to building operations in the initial lockdown to increase ventilation rates or, where there was no occupancy, idle the buildings. Energy efficiency became a lower priority.

The hospitals and multifamily sectors remained at normal to increased occupancy levels with secondary reports of increased energy usage emerging in the literature. The educational sector was largely closed to in-class attendance until the fall of 2021, although student enrollment has not fully rebounded in higher education. The office sector has also been impacted by the pandemic. Although New York City offices

<sup>3</sup> [https://www.bls.gov/regions/new-york-new-jersey/news-release/areaemployment\\_newyork.htm](https://www.bls.gov/regions/new-york-new-jersey/news-release/areaemployment_newyork.htm)

were open to workers beginning in February, they have not returned in force. Office vacancies are at a forty-year high even as COVID-19 cases decline. Figure 1-2 illustrates the current vacancy rate in Manhattan.<sup>4</sup> The lockdown has appeared to accelerate the trend of working from home.

**Figure 1-2. Current Manhattan Office Building Vacancy Rates**

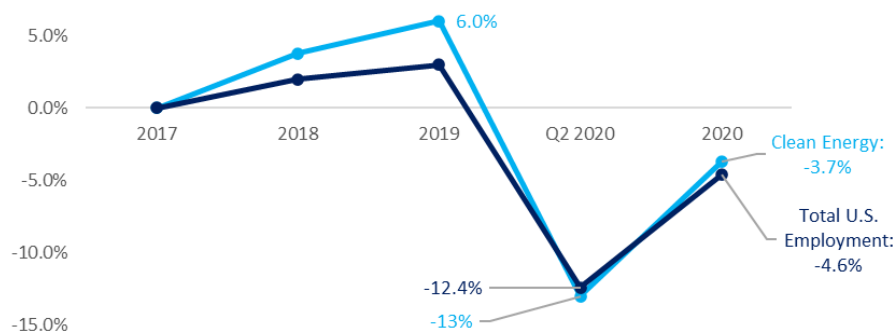


Source: CoStar Group Inc.  
 Note: 2022 data are through January.

### 1.1.3.2 COVID Impacts on the Clean Energy Market

Figure 1-3 illustrates the impact of the COVID-19 pandemic on US and clean energy employment growth,<sup>5</sup> showing a sharp decline in job growth that has not fully rebounded. Energy efficiency and solar installations were particularly hard hit since the work occurs on customer premises, a condition that was sharply curtailed during the pandemic lockdown.

**Figure 1-3. US and Clean Energy Employment Growth Rates, 2017-2020**



<sup>4</sup> <https://www.bloomberg.com/news/articles/2022-02-07/manhattan-offices-face-reckoning-with-divide-between-old-and-new#:~:text=Note%3A%202022%20data%20are%20through,of%20the%20space%20is%20available.>

<sup>5</sup> <https://e2.org/wp-content/uploads/2021/04/E2-2021-Clean-Jobs-America-Report-04-19-2021.pdf>

Training programs were also impacted by the COVID-19 pandemic. Participant training providers were required to adjust their training standards and practices to accommodate online learning. While pivoting to an online format allowed training providers to improve the accessibility of the material and perhaps reach a larger audience, it hindered their ability to provide trainees with the valuable in-person, hands-on experience that make training exercises so impactful. Not all topics translate well to the online format, which proved to be a limiting factor for training effectiveness in some cases, as well some O&M staff do not have the ability to access online training.

**Clean energy labor pool.** The “New York Clean Energy Industry Report<sup>6</sup>” reports that there were 157,700 clean energy workers in New York at the end of 2020, representing about 2% of the New York workforce. This aligns well with the Evaluation Team’s estimate of 155,400 workers based on the 6,000 businesses in New York identified as doing business in the clean energy sector and the average number of employees (25.9) determined by the employers surveyed in this study. Assuming a return to the US average 6% clean energy growth rate (noted in Figure 1-3) prior to the pandemic, New York clean energy businesses will need an additional 18,000 hires by 2022.

## **1.2 BOM Evaluation Objectives and Approach**

### **1.2.1 Current BOM Study**

Table 1-2 summarizes the objectives of this study for the BOM initiative and the data sources used to meet those objectives. In Table 1-2 and throughout this document, the Evaluation Team refers to organizations participating in the initiatives as “participants” or “participating organizations.”

Comparable organizations not participating in the initiatives are referred to as “non-participants” or “non-participating organizations.”

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<sup>6</sup> <https://www.nysersda.ny.gov/-/media/Files/Publications/Clean-energy-industry/2021-CEI-GEN-report.ashx>

**Table 1-2. BOM Study Objectives, Research Questions, and Data Sources**

<b>Objectives: Assess</b>	<b>Primary Evaluation Question(s)</b>	<b>Data Sources</b>
<b>Market Evaluation</b>		
Improvement and expansion of the readily available workforce qualified to train others in the area of building O&M	<p>What are the benefits of expanding the workforce qualified to train others?</p> <p>How many of your staff are currently qualified to deliver training to their peers either on the job or during designated times?</p> <p>What is the value of training to new and existing employees? (Measured in terms of job placements and/or internships, opportunities for low- and moderate-income workers, career paths and advancements, employee retention, and attainment of national, recognized certifications.)</p>	<p>Telephone interviews with 7 BOM trainers</p> <p>Telephone surveys with 14 participant and 72 non-participant building O&amp;M employers (owners/managers) across several verticals within the industry (institutional/ education, multifamily, and commercial)</p>
Promotion of an industry partnership approach to workforce training	<p>Does this partnership approach become incorporated into the culture and thus providing for future replication?</p> <p>Do partnerships help inform employer-driven workforce solutions, such as improved skills enhancement for existing workers, increased access to entry level jobs for disadvantaged (including workers from low- and moderate-income communities) New Yorkers, and increased energy savings and net operating income for building owners?</p>	<i>See Chapter 5 for Methodology Details</i>
Demonstration of the value of training to employers of building workers	<ol style="list-style-type: none"> <li>1. What are the gaps in current curricula, and what additions are needed to include new industry standards and technological changes?</li> <li>2. To what extent is facility equipment performance (i.e., improved performance and efficiency of systems) directly linked to the capabilities of the individuals responsible for building operations?</li> <li>3. Does instituting a culture of continuing professional development among operations and maintenance staff lead to improved worker retention, knowledge transfer as aging workers approach retirement, and decreased employer time to find and hire new talent with the appropriate skills?</li> </ol>	Same as above.
<b>Impact Evaluation</b>		
Verified Gross Savings	<p>What is the verified gross savings for the program?</p> <p>What is the appropriate average savings to be used for the program?</p>	<p>Gross savings method: IPMVP Option 3, Billing Data Analysis together with an engineering analysis of a sample of projects.</p> <p><i>See Chapter 5 for Methodology Details</i></p>

The IP has established metrics and targets for assessing the success of the initiative to impact the workforce over time. These metrics are summarized in Table 1-3. Please note that the BOM findings reported in Chapter 2 of this document reflect the 2021 assessment of these established metrics. The 2021 findings are compared to the baseline estimates noted in Table 1-3.



**Table 1-3. Summary of IP Metrics, BOM (Source: IP 5/20/2022 CEF IP, BOM Chapter)**

	<b>Indicators</b>	<b>Indicators Tracked By</b>	<b>2016 Baseline (Before/ Current)<sup>a</sup></b>	<b>2025 Target (cumulative)</b>
<b>Outputs</b>	Increase in number of workers trained (Note: electrification target shown in parenthesis)	Program	20	9,600 (1,000)
	Increase in the percent of trainees obtaining national certifications	Program	15%	30%
<b>Outcomes</b>	Increase number of staff qualified to train others	Evaluation	4,322	4,992
	Increase number of organizations developing new curricula	Evaluation	370 organizations	446
	Improve performance and efficiency of building systems	Program	0%	Not specified past 2024 (in 2024: 7%)
	Increase square feet of buildings whose owners invest in training infrastructure without NYSERDA funding	Evaluation	0	125 million sq. ft.

<sup>a</sup> A 0 (zero) denotes that the actual value is currently believed to be zero for baseline/market metrics. Also, 2016 is the date of market or program data assessed. The 2016 or baseline findings were published in 2018.

This evaluation study design measured only certain indicators referenced above. The output indicators, which are typically measurable metrics of program activities, are not assessed by the evaluation but rather tracked by the program. The outcome indicators (all but two), measuring near- to longer-term changes in the market that are expected to result from the program activities or outputs, are usually assessed by evaluation. Although the evaluation is not tasked to assess two outcome indicators (see Table 1-3), the evaluation team does offer results, when applicable, that can inform those two indicators.

The baseline estimates for the outcome indicators have already been developed (see the subsequent section discussing the Baseline BOM study). To study progress (or movement from the baseline values), the market research conducted in the Baseline BOM study will need to be repeated periodically. This study is the first market follow-up assessment of the progress as well as the initial impact evaluation for the BOM initiative. Comprehensive outcome indicator and impact updates are planned for 2023 and 2025. Table 1-4 outlines the data collection activities that will be conducted in each year.

**Table 1-4. BOM – Data Collection Activities by Year**

Data Collection Activity	Year 1	Year 2	Year 3	Year 4	Year 5
	Initial Baseline (Done)	No Activities	Market update/ Impact evaluation (Current Study)	Market update/ Impact evaluation	Market update/ Impact evaluation
Surveys of participating building owners/employers and property management companies	2018	-	2021	2023	2025
Surveys of non-participating building owners/employers and property management companies	2018	-	2021	2023	2025

Most outcome indicator metrics will apply to both participating and non-participating organizations, allowing comparisons between participants and non-participants at baseline and at each later assessment.

### 1.2.2 Previous BOM Study

In 2018, a baseline study of BOM program performance indicators was conducted. This study documented the program performance indicators at baseline (pre-CEF year of 2016)<sup>7</sup>. To assess the indicators, the baseline study team conducted interviews and surveys with 1) nine of twelve participating organizations and 2) 68 large commercial, institutional, and multifamily property managers (owners, managers) who were not engaged with the BOM initiative (i.e., non-participants). The surveyed non-participants were similar to the participants and the overall population in terms of the market sectors they represented.

This current BOM study repeats the baseline study approach to ascertain change in the indicators over time. The current study also includes an impact evaluation designed to assess and verify the initiative’s gross energy savings.

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<sup>7</sup> Again, the team collected data for the year 2016 when conducting the baseline study in 2017-2018.

### **1.3 Talent Pipeline Study Objectives and Approach**

Table 1-5 summarizes the objectives of this study for the Talent Pipeline initiative and the data sources used to meet those objectives.

**Table 1-5. Talent Pipeline Study Objectives, Research Questions, and Data Sources**

Objectives: Assess	Primary Evaluation Question(s)	Data Sources
Expansion of training infrastructure within a company/portfolio	<p>What are the gaps in current curricula, and what additions are needed to address the current and changing business needs?</p> <p>Will providers value support in developing training content (curricula) and infrastructure (equipment, trainers)? What type and level of support?</p> <p>How many students will be placed in internships or given access to entry-level jobs by the training providers? How many will then be hired directly by the business? How many new hires will there be through on-the-job training (OJT)? How many students participate in site visits, one-day on-site training at a business, apprenticeships, and/or classroom training?</p> <p>How many total workers and trainers can be trained through this initiative?</p>	<p>Mixed-mode survey with 18 participant and 25 non-participant training providers</p> <p><i>See Chapter 5 for Methodology Details</i></p>
Offset or reduction in the cost and timeline of hiring and training new workers	<p>Can time to train and hiring costs be reduced through this initiative? How?</p> <p>Can these trained workers reach full work potential sooner?</p> <p>How well is the program connecting and matching potential employers with potential employees through the internships and/or efforts to recruit workers from disadvantaged communities?</p>	<p>Mixed-mode survey with 54 participant and 66 non-participant cleantech businesses</p> <p><i>See Chapter 5 for Methodology Details</i></p>
The relevance and effectiveness of the training efforts and associated trainee learning	<p>Are the trainings relevant to the jobs being pursued by the trainees? Are trainees satisfied with the training?</p> <p>Are the trainees learning the intended knowledge and skills to meet the business needs? If not, what is needed to increase the knowledge/skills?</p> <p>To what extent are trainees applying the learnings from the training when they are on the job?</p> <p>Are targeted outcomes of the job occurring as a result of the training?</p> <p>Are trainees sharing information learned from the training with others?</p>	<p>Email survey with 26 participant trainees</p> <p><i>See Chapter 5 for Methodology Details</i></p>
<b>Impact Evaluation</b>		
Indirect Savings	<p>Since no direct energy savings are claimed for this initiative, the team has focused on answering: What are the indirect savings for the initiative?</p>	<p>Program/ secondary data, and information from surveys referenced above</p>

The IP has established metrics for assessing the success of this initiative to change the workforce market overtime. These metrics are summarized in Table 1-6. Please note that this study evaluated the outcome indicators only. Also note that the baseline outcome indicator metrics in Table 1-6 will likely be updated based on the findings from this evaluation. The baseline evaluation findings are reported in Chapter 2.

**Table 1-6. Summary of IP metrics, Talent Pipeline (Source: IP 5/20/2022, WFD Talent Pipeline Chapter)**

	<b>Indicators (Note: electrification targets are shown in parenthesis) <sup>a</sup></b>	<b>Indicators Tracked By</b>	<b>2018 Baseline (Before/ Current)<sup>b</sup></b>	<b>2022 Target (cumulative)</b>	<b>2025 Target (cumulative)</b>
<b>Outputs</b>	Number of students placed in internships by training providers as part of training through this initiative <sup>c</sup>	Program	0	300 (75)	600 (300)
	Number of Interns and Fellows <sup>b</sup>	Program	0	1,200 (100)	2,000 (500)
	Number of new hires through on-the-job program	Program	0	900 (250)	1,700 (600)
	Number of existing workers upskilled	Program	0	7,000 (2,200)	16,000 (8,000)
	Number of individuals trained for new job placement through this initiative	Program	0	2,200 (600)	9,000 (3,000)
	Number of new curriculum developed or modified through this initiative	Program	0	60	No target post 2024
	Number of trainers trained through this initiative	Program	0	90	120
<b>Outcomes</b>					
	Percent reduced cost to recruit and hire new workers	Evaluation	0 (To be updated, see evaluation findings in Ch. 2)	30%	30%
	Percent reduced time for workers to reach full productivity	Evaluation	0 (To be updated, see evaluation findings in Ch. 2)	20%	20%
	Number of new business and training provider partnerships created through this initiative	Evaluation	0 (To be updated, see evaluation findings in Ch. 2)	65	90

<sup>a</sup> The total number trained in electrification through the Talent Program is 13,000, per the IP. Another 1,000 building operators will be trained on electrification technologies through the Building O&M Program, per IP.

<sup>b</sup> A 0 (zero) denotes that the actual value is currently believed to be zero for baseline/market metrics.

<sup>c</sup> Interns hired directly by business through the Internship program will be separate and unique from students placed in internships by training providers.

In addition to the CEF metrics referenced above, the team also investigated topics that will offer insight on the Talent Pipeline program improvement, such as participants’ perspectives on the value of the program, satisfaction with the program, and type of additional support participating organizations may value.

This study design seeks to measure market progress over time in the indicators referenced above. Specifically, this study assessed the baseline period (2018) and the 2021 period. Another market and impact updates are planned for 2023 and/or 2025.

The Evaluation Team considered 2018 as the baseline year. In 2018, the Program had not yet developed contracts with the training providers (the first contracts started in 2019, under PON 3981). The Program also began the OJT and/or intern wage reimbursement (PON 3982 and 4000) in November/ December of 2018. Also, selecting 2021 (the year of this study) as the baseline would have been problematic due to the lingering COVID-19 pandemic impacts on the market. Instead, the team opted to collect information on the initiative for 2018 (pre-pandemic and pre-program period) and compare information from that time period to 2021, knowing the COVID-19 pandemic impacted 2021. The team leveraged program data collected in 2018 as well as survey data to obtain the 2018 information.

Note that survey data in particular (i.e., asking respondents to report on certain metrics for the year 2018) can be prone to recall bias. The team attempted to mitigate this risk by asking respondents to consult their workforce records when reporting the 2018 information

Table 1-7 outlines the data collection activities that will be conducted in each year.

**Table 1-7. Talent Pipeline – Data Collection Activities by Year**

Data Collection Activity	Year 1	Year 2	Year 3	Year 4	Year 5
	Initial Market Baseline & Update <sup>a</sup> (Current Study)	No Activity	Market Baseline Update	No Activity	Market Baseline Update
Surveys of participating and non-participating business employers	2018 & 2021	-	2023	-	2025
Surveys of participating and non-participating training providers	2018 & 2021	-	2023	-	2025
Survey of training participants (trainees)	2018 & 2021	-	2023	-	2025

<sup>a</sup> The team inquired about the year 2018 (which the team considered the baseline period) and the year 2021.

Surveyed non-participants were similar to the participants and the overall population in terms of the market sectors they represented (see Chapter 5 for additional detail).

## 2 Performance Indicator Assessment Results, Conclusions, and Recommendations

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The section documents evaluation findings for the Building O&M and Talent Pipeline initiatives.

### 2.1 BOM

The following sections provide details on BOM program data and data collected from surveys on the outcome indicators and additional topics identified in Chapter 1 referenced above. This section is organized considering the evaluation objectives noted above and the IP activities as follows:

Improvement and expansion of the readily available workforce in the area of building O&M

Promotion of an industry partnership approach to workforce training

Demonstration of the value of training to employers of building workers

Note that the findings from the previous BOM study reflect conditions in 2016.<sup>8</sup> These are referred to as the “baseline” metrics in the subsequent subsections. The primary data source for these findings are the participating and non-participating O&M building employer manager (“building manager”) surveys and tracking data. The IP identifies specific cumulative expected changes between the baseline and 2025. This report is based on data gathered in 2021, and thus reflect changes between the baseline<sup>9</sup> and 2021 or about 60% of the program period has lapsed.

#### 2.1.1 Improve and Expand Qualified Workforce

This section presents the findings, analysis, and metrics related to the objective to improve and expand the qualified workforce in BOM Program. Each subsequent subsection summarizes the evaluation 2021 findings for the IP output and outcome metrics for improvement and expansion of the qualified workforce in the BOM Program and compares the findings to the baseline findings. Additional details are also presented to support or explain the trends in metrics, where applicable.

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<sup>8</sup> The baseline findings were based on 2016 data and published in 2018.

<sup>9</sup> The baseline findings are based on 2018 data. The team asked respondents to report information for 2018 (the baseline period) and also for the 2021 period (post-baseline period).

**2.1.1.1 Summary of Evaluated Metrics**

Table 2-1 summarizes the change between the baseline and 2021 in outcome metrics and notes the 2025 targets to document the progress toward those targets. Ancillary statistics that are not IP specified metrics are included in the table using a smaller font.

**Table 2-1. Summary of Metrics Related to Improving and Expanding the Workforce**

	<b>Indicators</b>	<b>2016 Baseline (Prior Study)</b>	<b>2020 or 2021 Evaluated</b>	<b>2025 Target (cumulative)</b>	<b>Source</b>
Outputs	Increase in the number of workers trained by BOM (Electrification targets in parenthesis)	0	<i>Tracked by the program. Provided additional sig. finding below</i>	9,600 (1,000)	Program Data
	Pct of staff trained - P		76% (in 2021)		Building Manager Surveys
	Pct of staff trained - NP		34% (in 2021)		Building Manager Surveys
	Increase in the percent of trainees obtaining national certifications by BOM	15%	<i>Tracked by the program</i>	30%	Program Data
Outcomes					
	Increase number of staff qualified to train others (Pct of O&M staff qualified to train others)	4,322 (2.4%)	No significant change from baseline (Compared 2021 estimate)	4,992	Building Manager Surveys, Tracking
	Increase square feet of buildings whose owners invest in training infrastructure without NYSERDA funding		About 6 million sq. ft.	125 million sq. ft.	Owner Survey/ Indirect Savings Questions and BOM Impact Findings

The COVID-19 pandemic is a factor as discussed previously, somewhat to significantly redirecting O&M staff toward implementing safety protocols or in idling buildings that likely led to some level of layoffs or freezes in bringing on new staff. Program enrollments showed a steady increase, reaching 77 GWh and 689 BMBtu in encumbered savings in 2019. In 2020, or the first COVID-19 pandemic year, the encumbered savings declined by half. Enrollments have partially rebounded in 2021. It would appear the Program might be at risk of not meeting its 2025 goals, since outcome indicators have not changed significantly or markedly since the baseline in the desired direction. However, the BOM Program has a significant backlog, with about twenty times the savings in the encumbered stage compared to the completed stage. Presuming the program has sufficient implementation capacity, it has the customer



demand to meet its outcome goals, even with significant attrition of the projects in the pipeline.

Note that the non-participant sample (which represents the market) was designed to capture the market movement (a moderate effect). If the Program had a small effect on the market, the non-participant sample likely will not be able to detect it. A small effect, even if detected, provides limited evidence that market is transforming or moving in the desired direction.

The subsequent sections provide detailed findings on indicators summarized above.

### 2.1.1.2 Workers Trained by BOM

The output indicator pertaining to the increase in the number of workers trained is tracked by the program staff and thus not reported in this document. The Evaluation Team does provide additional information to inform this indicator.

In addition to BOM-funded training, building managers reported conducting training through other avenues, though at a lower rate (Table 2-2). On average, about half of O&M staff from the surveyed organizations participating in the BOM received non-NYSERDA-sponsored training. Very few staff (4% on average) received internal training with a formal curriculum. The BOM-sponsored O&M training was by far the most popular avenue for participating building managers to send their O&M staff for training.

The non-participating organizations also invested in training of their O&M staff (Table 2-2). Most commonly they contracted third-party training providers to either conduct training on-site or off-site.

Across all types of training noted in Table 2-2, the participating organizations trained a significantly higher proportion of their O&M staff than non-participants, on average. This indicates that BOM likely accelerated training of O&M staff among participants.

**Table 2-2. Proportion of New York Staff Who Received Formal O&M Training That Was Supported by the Organization (Source: BOM Participant Building Manager Survey)**

Training	Average % of staff that received formal O&M training	
	BOM participating organizations (n=14)	Non-participating organizations (n=72)
<b>NYSERDA-sponsored O&amp;M training</b>	67% <sup>*</sup>	n/a
<b>Non-NYSERDA-sponsored O&amp;M training</b>	47% <sup>†</sup>	30% <sup>‡</sup>
<b>In-house O&amp;M training using a formal curriculum</b>	4% <sup>*,†</sup>	15% <sup>‡</sup>
<b>Received NYSERDA-sponsored, non-NYSERDA-sponsored, or internal training<sup>a</sup></b>	76% <sup>a</sup>	34% <sup>a</sup>

<sup>a</sup> As a proxy for this metric, the Evaluation Team took the highest percent reported for the trainings referenced above for each organization and then estimated the average percent of staff trained in the participant and non-participant samples. Based on this approach, the difference between the participant and non-participants average percent of staff trained was statistically significant (Independent Samples T-test, p<0.05).

\*, †, ‡ = Within group, means are significantly different (Paired T-tests, p<0.05)

There is a sub-metric for “Increase in number of workers trained” noting an “electrification” goal of 1,000 workers. The electrification goal may not be appropriate for BOM because the training is focused on the existing conditions of the buildings served by the staff. There is little building management value (and no savings) to training staff in systems that are not present in the buildings. In addition, electrification requires a major investment in equipment and building infrastructure (for example increasing the capacity of the electrical system) while the BOM training is focused on low-cost no-cost improvements that match the scope of O&M staff responsibilities.

### ***2.1.1.3 Popularity of National Certifications***

The output indicator pertaining to the increase in percentage of trainees with nationally recognized certifications is tracked by the program staff and thus not reported in this document. The Evaluation Team does provide additional information to inform this indicator.

The surveyed O&M non-participant building managers reported how many of their staff received the following O&M certifications. Full descriptions of the certifications are included in Chapter 5.

- EPA 608 Refrigeration Certification
- NEEC Building Operator Certification or BOC
- Building Performance Institute or BPI certification(s)
- HVAC Excellence Certification
- Certified Energy Manager or Auditor
- NATE
- RETA Refrigeration Operator/Energy Specialist

There were preferences for certain types of certifications in certain building sectors. Table 2-3 shows the percent of non-participating O&M staff with NATE, EPA 608 Refrigeration, or Certified Energy Manager, the three most frequently reported certifications among non-participants (or in the market). Across these three certifications, O&M staff in commercial and medical settings prefer the EPA 608 Refrigeration certification, while those in the educational settings prefer NATE and Certified Energy Manager certification. Industrial O&M staff exhibit no clear preference.

**Table 2-3. Percent of O&M Staff With NATE, EPA 608 or CEM Certifications by Building Type (Source: Non-participant 2021 Surveys)**

<b>Building Type</b>	<b>North American Technician Excellence or NATE (n=72)</b>	<b>EPA 608 Refrigerants Certification (n=72)</b>	<b>Certified Energy Manager or CEM (n=72)</b>
Commercial Buildings	0%	5%	0%
Medical Buildings	<1%	4%	<1%
Educational Buildings	11%	3%	6%
Industrial Buildings	3%	3%	2%
Other: Retail, Hospitality, Government, etc.	<1%	<1%	0%

**2.1.1.4 Increase Square Feet of Buildings of Those Investing in Training Without NYSERDA Funds**

Indirect savings results address this metric and are provided in Chapter 4.

**2.1.1.5 Increase in Individuals Placed in Internships or Apprenticeships**

Based on survey responses, the Evaluation Team estimated the number of individuals placed into paid or unpaid O&M internships and apprenticeships, and the mean number of individuals placed per organization. However, the latest BOM IP, published May 20, 2022, no longer includes these indicators, which implies that findings related to internships and apprenticeships are no longer applicable.

Furthermore, program staff noted that BOM focuses on training the existing workforce, which means these indicators that measure new job placements are not applicable for BOM. **The T**

**2.1.1.6 Increase in the Low-to-Moderate Income (LMI) Workers Placed in O&M Positions**

The team estimated the increase in the number of LMI workers placed into O&M jobs. However, since this indicator was dropped from the latest BOM IP, published May 20, 2022, the survey findings on this indicator are no longer applicable. Moreover, the team learned that BOM focuses on existing workforce and this indicator is a measure of new job placements.

**2.1.1.7 Increase in Staff Qualified to Train Others**

One of the desired initiative outcomes is that participants will replicate the initiative-funded training throughout their organization without additional NYSERDA funds, per WFD IP. One way to help bring that about is to increase the number of O&M staff that are qualified to train others. For this metric, the Evaluation Team assessed both the primary metric (number of O&M staff qualified to train others) and a secondary metric (percentage of O&M staff qualified to train others). In 2021, several interviewed participants reported that their organization had O&M staff that were qualified to train others. The team estimated that about 5% of participant O&M staff were qualified to train others (see Table 2-4). Although this appears to be an increase from the baseline, this pattern was not statistically significant.

Program data revealed that approximately 37 staff were qualified to train others since program launch up to mid-2021 through the BOM-funded training. This data suggest there may be a small program effect on participant organizations pertaining to this indicator. Note that the participant survey sample is not large enough to detect a very small effect.

The surveyed non-participants reported a similar percent of staff that were qualified to train others as in the baseline. This indicates that market has not notably moved pertaining to this indicator in the desired direction. Please note that the non-participant sample (which represents the market) was designed to detect moderate rather than small effect. Thus, non-significant findings mean there is no moderate or notable effect on the market since the baseline.

**Table 2-4. Staff Qualified to Train Others**

Survey Group	Baseline (2016)	Current 2021 (Extrapolated to the pop. from survey data)		Sig. Difference
	Percent of Staff	Count of Organizations Investing in Train-the-Trainer	Percent of Staff Qualified to Train Others	Between Current & Baseline Estimate
Participants	<1%	12	5% <sup>a</sup>	Not sig.
Non-participants	2%	329	1%	Not sig.

<sup>a</sup> The program data also provides evidence that participating organizations are teaching their staff to train others. The program records note 37 individuals were trained to teach others through the BOM-funded training, which indicates program did have an effect on participants.

## 2.1.2 Promote Industry Partnerships to Workforce Training

This section presents the findings, analysis, and metrics related to the objective to promote an industry partnership approach to workforce training. Each subsequent subsection summarizes the evaluation 2021 findings for the IP output and outcome metrics related to promoting training partnerships in the BOM Program and compares the findings to the base year. Additional details are also presented to support or explain the trends in metrics, where applicable.

### 2.1.2.1 Summary of Evaluated Metrics

Table 2-5 summarizes the change between the baseline and 2021 in outcome metrics and notes the 2025 targets to document the progress toward those targets. Ancillary statistics that are not IP-specified metrics are included in a smaller font.

**Table 2-5. Summary of Metrics Related to Promotion of Industry Partnership Approach**

	<b>Indicators</b>	<b>Baseline – 2016 (Before/ Current)</b>	<b>2021 Evaluated</b>	<b>2025 Target (cumulative)</b>	<b>Source</b>
<b>Outcomes</b>	Increase in number of industry partnerships by BOM (total=partnership concluded + ongoing)	1	<i>Tracked by the program. Provided supplemental findings below</i>	NA – the latest BOM IP does not include this metric	Program Data
	Number of BOM contracts since 2017		More than 40		
	Number of contracts with multiple partnerships		4 contracts (~136 partnerships)		
	New partnerships reaching encumbered stage (with energy savings estimates)		13		
	Increase number of organizations developing new curricula in the market (Pct. developing new curricula in the market)	370 organizations (11%)	833 organizations (23%, sig. change from baseline) (70 or 8% of 833 organizations used new/ modified curricula funded by BOM)	446	Trainer Surveys & non-participant O&M employer survey

The supplementary findings on the number of industry partnerships outcome, which measures the engagement between training providers and the organizations receiving the training and allows the program to scale up or reach a wider audience, points to program success. One of the contracts leveraged an association to recruit 109 member locations, which resulted in 109 partnerships. Additionally, four BOM-funded training providers developed partnerships with multiple building O&M organizations, which resulted in training of 27 organizations or 27 partnerships. The remaining partnerships represented a single organization independently recruited for participation. The success of the association approach suggests reaching out to other trade organizations may be another fruitful source of participants.

The program records provide a window into the program pipeline of work-in-progress. The Program was able to recruit and engage an additional 13 new organizations during the pandemic and counted those organizations with an encumbrance date after 2019. These projects include estimates of savings and incentives and list all the buildings in the proposed scope. The pipeline also shows substantial additional activity with another 230 unique project IDs, although the information is insufficient to draw any additional conclusions about the magnitude of these pipeline projects.

The second metric measures the response of the market developing or tailoring curricula to meet evolving needs of the building O&M market. About 21% of non-participant organizations reported using their internal staff for developing or refining a formal O&M training curriculum. These non-participant organizations, when extrapolated to the non-participant population, account for 763 organizations. The 763 organizations plus the 70 participant organizations that worked with trainers to develop new or modified curricula equal to 833 organizations (or 23% in the building O&M market). The 23% of

organizations in the building O&M market that are developing new/modified curricula is significantly higher than the 11% estimate from the baseline. It appears that the BOM-funded training (70 or 8% of the 833 organizations) contributed to the growth in the percent of organizations introducing new or tailored O&M curricula to their O&M staff.

BOM-funded trainers reported revising curricula to, among other things, reflect the buildings and technologies served by the trainees and to add field perspectives by incorporating hands-on elements or by including lessons learned from previous training. Mid-course corrections were also observed in project files; for example, one project switched out blower-door training (which was not applicable to the sector) for instructions in commercial building controls, a much more salient topic.

### ***2.1.2.2 New Partnerships***

The outcome indicator pertaining to the increase in the number of partnerships is tracked by the program staff and thus not reported in this document. The Evaluation Team does provide additional feedback to inform this indicator.

This metric is classified as an “Outcome,” which is typically interpreted as a measure of an activity in the statewide market including non-participants. However, the forming of partnerships appears to be a program organized activity and therefore might be more appropriately considered as an Output.

### ***2.1.2.3 Increase in Number of New Curricula***

The Building O&M initiative aims to improve on or replace existing training curricula, and so one key indicator of this effort is the number of new curricula available. The Evaluation Team asked participants (trainers) whether they conducted the BOM-funded training with existing curricula that had been used elsewhere without modification, would modify existing curricula (and if so, how), or would develop and use entirely new curricula. Table 2-6 shows the responses. All eight surveyed trainer respondents from 2021 made modifications to the curricula to some extent.

Participant trainers modified existing curricula to:

- Add details specific to buildings being used for training and New York codes
- Update curricula details to match current technologies
- Incorporate questions, talking points, and field lessons from students for the benefit of the next class
- Incorporate additional site work to test different equipment and scenarios

Participant trainers added new curricula to:

Create building specifics from scratch if they were not already available

Include manufacturer’s training documentation

- Align course material with national certifications

Given these insights, the indicator should be redefined to expand beyond adding new curricula to include modifying existing curricula. The baseline study identified and then counted responses representing actions of “using entirely new curricula” and “a combination of new/modified curricula” to estimate the number of organizations with new curricula. It is likely that modifying a curriculum introduces new elements to the curriculum.

The team also asked trainers whether they engaged in non-NYSERDA funded O&M training. A majority of contacts could not provide an answer, thus, it is unclear whether trainer organizations leverage the curricula they developed outside of the BOM Program.

**Table 2-6. Participant Trainer Responses on Curricula Development (Multiple Response Allowed)**

Reported	First Program Year (2017-18)		Current 2021		Sig. Between Current & Baseline Estimate
	Number Reporting (N=9) <sup>a</sup>	Number of Organizations Trained, leveraging BOM funds	Number of Trainers (n=8)	Number of Organizations Trained, leveraging BOM funds	
Used existing curricula without modification	0	0	0	0	n/a
Modified existing curricula	3	3	2	2	n/a
Used entirely new curricula	1	1	0	0	n/a
Something else - a combination of new and modified curricula	5 (most)	5	8 (all)	68	n/a
Number (percent) of participant organizations with new curricula	6 (67%)	6	9 <sup>b</sup> (100%)	70 <sup>c</sup>	Sig.

<sup>a</sup> The baseline study evaluators interviewed all trainers associated with the first few contracts in 2017-2018. No need to extrapolate results to the population. For this metric, the first year of the program was considered the baseline period.

<sup>b</sup> Used responses to extrapolate to the 2021 participant trainer population. A total of nine trainers trained in 2021. Estimated that all nine trainers in 2021 used new curricula.

<sup>c</sup> A total of 70 organizations examined curricula developed or refined and sent staff for training where new or modified curricula was used. The sample of eight training providers trained 68 of those 70 organizations. Based on responses from the eight training providers, likely all organizations were exposed to the new elements in the curricula.

Note that during the baseline study, the evaluators learned that more than half (58%) of non-participating organizations reported they provided some sort of support or formal O&M training at baseline, much of the content of which was health and safety related. The evaluators also learned that the minority (11% of

organizations) of non-participant O&M training that was *not* health and safety related<sup>10</sup> was conducted either with new or new/modified curricula, which is consistent with the idea behind the BOM – that the NYSERDA funding is needed to drive the development of new or improved curricula.

In 2021, little over one-quarter (26%) of non-participating organizations reported training their building O&M staff on O&M topics that were *not* health and safety related. The open-ended responses suggest these organizations leveraged organizations such as NEEC BOC, RETA, engineering consultants, equipment vendors, and their own staff for training. Across these organizations that reported training their O&M staff on building system operations, efficiency, and similar relevant topics, a large proportion (78%) said they have conducted a formal in-house training – that is, used their staff to offer O&M training with a formal curriculum. This means that one-fifth (21%) of non-participant organizations have leveraged their internal staff for formal training, which means supporting them to develop or tailor an O&M curriculum. One-fifth of non-participant organizations equates to about 763 organizations, when extrapolated to the non-participant population.

The team combined the 763 non-participant and 70 participant organizations that worked with O&M trainers who developed or modified curricula to derive at 833 (or 23%) organizations that likely trained their staff with updated (either new or modified) curricula. The percent of organizations training their staff with updated curricula significantly increased since the baseline (Z-test of proportion,  $p < 0.05$ ).

The 70 participant organizations are about 8% of 833 organizations, which indicates that the Program helped accelerate the proportion of organizations using new or modified O&M curricula in the market.

Participant trainers believe that curricula should still be improved by adding training on topics such as:

- Heat pumps
- Tool purchasing and use
- Specifics on NYC buildings
- Air sealing, caulking, and insulation best practices
- Keeping training materials updated with accurate and current technological standards will likely continue to be a moving target.

Trainers identified several areas where NYSERDA can offer additional support in improving and expanding the BOM training:

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<sup>10</sup> Training related to building systems operations, refrigeration, HVAC, and other relevant O&M topics.



- Marketing and outreach are key areas of support needed by trainers to build out a trainee pipeline to increase enrollment into the program
- Improved and transparent documentation and communication processes from NYSERDA can help trainers understand expectations for required recordkeeping related to verifying successful trainings
- Develop specialized curricula by building type (schools, hospitals, campuses, etc.)
- Training can be a challenging investment for some organizations to make (paying for the training and paying for the employee’s time). Continued investment in virtual training options can make training modules accessible to more trainees.
- Gamification of training courses and exercises can be beneficial as O&M staff workforce becomes younger. Engaging trainees with technology will be a critical component for success.

### 2.1.3 Demonstrate the Value of Training to Employers with O&M staff

This section presents the findings, analysis, and metrics related to demonstrating the value of training to employees. Each subsequent subsection summarizes the evaluation 2021 findings for the IP output and outcome metrics for demonstrating value of BOM-funded training and compares the findings to the base year. Additional details are also presented to support or explain the trends in metrics, where applicable.

#### 2.1.3.1 Summary of Evaluated Metrics

Table 2-7 summarizes the change between the baseline and 2021 in outcome metrics and notes the 2025 targets to document the progress toward those targets.

**Table 2-7. Summary of Metrics Related to Value of Training**

	Indicators	Baseline – 2019 (Before/ Current)	2021 Evaluated	2025 Target (cumulative)	Source
Outcome	Improve performance and efficiency of building systems of BOM participants	0%	<i>Not part of market assessment evaluation, but impact findings in Chapter 4 provide insight into this metric</i>	In the latest BOM IP, no target listed past 2024 (In 2024: 7%)	Program Staff Tracks per Implementation Contractor (also BOM impact evaluation findings can be leveraged)
Possible New Metric	Typical savings fraction for typical buildings	Not studied previously	Electric 1.2% (see Chapter 4) Thermal: 2.3% (see Chapter 4)	NA	Impact evaluation

Improved building efficiency is a key IP outcome metric demonstrating program value to building managers and owners. The impact evaluation can inform this metric by examining the typical savings fraction. The typical savings fraction value represents the average savings achieved by the typical project calculated as the normalized evaluated saving divided by the normalized baseline energy usage. This value can be used by NYSERDA program staff for an estimate of expected annual savings. Chapter 3 describes these findings in more detail.

Also note that COVID-19 significantly impacted building operations, creating vacant buildings in the education and office sectors. The office sector has not rebounded and may not, due to a work-from-home change in the work culture. Under these conditions, it is possible that O&M BOM impacts are lagging for certain types of market sectors.

### ***2.1.3.2 Improve Performance and Efficiency of Building Systems***

BOM impact evaluation results inform this metric and are provided in Chapter 3.

### ***2.1.3.3 Time to Find and Train Employees***

Although the Evaluation Team assessed the reported time required to find, hire, and train new talent, this indicator was not listed as a key metric to measure and report on for the BOM Program in the latest IP. This indicator was estimated in the BOM baseline study. For this study, however, the Evaluation Team learned that BOM focuses on training the existing workforce, which means this indicator on new hires is not applicable for BOM.

### ***2.1.3.4 Improving Employee Retention***

Although the Evaluation Team assessed the employee retention metric, this indicator was not listed as a key metric to measure and report on for the BOM Program in the latest IP. The BOM logic model, however, did indicate the Program may improve program retention. Considering there is no metric listed in the IP measuring this particular logic model outcome, the logic model should then be updated to explain reasons for not measuring this outcome.

Additionally, it is unlikely that the employee retention outcome will be changed in the market, because during the baseline study the reported O&M staff turnover (or staff who voluntarily left excluding retirements, layoffs, and terminations) was at 2% (low). Voluntary staff turnover is a measure of employee retention. Low O&M voluntary staff turnover was also reported in the 2021 survey. When asked how much of a problem staff turnover was in 2021, 28 participants and nearly all (97%) non-

participants reported that it was not much of a problem.<sup>11</sup> On a scale from 0 to 10, where 0 meant “not at all a problem” and 10 mean “a very serious problem,” participant respondents provided an average rating of 4.7, conveying that there is a moderate amount of concern with staff turnover. Non-participants reported an average rating of 1.5, indicating that there is no concern with staff turnover. The rating differences between participants and non-participants were significant (T-test,  $p < 0.05$ ). Although participants appear more concerned with staff turnover, when asked about the number of staff that voluntarily left in 2020, the participant responses suggest that about 3% and 5% of staff left, on average in 2019 and 2020 respectively (which is a low voluntary turnover rate).

Based on baseline and this study’s survey responses, it is unlikely the Program can impact staff turnover from an estimated low rate (5% or less) to no turnover (a direction that would show improvement). Thus, it is recommended to exclude this outcome from the BOM logic model.

#### ***2.1.3.5 Wage Increase and Workers Advanced/Promoted Metrics – Removed from the Surveys***

The baseline study evaluators recommended removing questions on advancement and wage increases. During the baseline study, when answering questions about advancement and wage increases, a notable number of respondents (both participants and non-participants) mentioned they had little insight or influence on wages, which affects advancement. The reasons varied for lack of insight on wages; however, the most prominent explanation was that wage increases were determined by the union. This was especially notable in the institutional sector.

In agreement with NYSERDA, the Evaluation Team removed the questions on wage increases from the 2021 surveys. The Evaluation Team did have data on advancement of staff in 2021; however, those findings are also excluded given the unreliability of that metric as discussed in the baseline study.

#### ***2.1.3.6 Participant Feedback on the Benefits of Training and Challenges***

Twenty-four participating organizations provided feedback on the benefits of the program. The most commonly reported benefit was an increase in energy efficiency, and therefore monetary savings, reported by thirteen of the participating organizations. Additionally, nine survey respondents named that either they, or their staff, felt more knowledgeable and well-equipped to perform their jobs following the training.

Twenty-four participating organizations also provided feedback on the challenges. The most common response provided by survey takers was that not being able to complete training in person resulted in

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<sup>11</sup> 0-3 on a 0-to-10 scale, where 0 means “no problem at all” and 10 means “a very serious problem.”

setbacks. Eight responses noted a shift to virtual training caused either a full-stop or a delay in training. Additionally, five respondents noted that unemployment benefits may have played a role in the difficulty finding and retaining workers. Non-participants, in comparison, reported less difficulty in finding and retaining workers due to COVID-19 pandemic impacts. Thirty non-participating respondents reported that COVID-19 had no impact on their functions and processes. Only eighteen non-participants reported that COVID-19 had a sizeable impact on their normal hiring, training, and work.

#### **2.1.4 Conclusions and Recommendations**

##### **Conclusion 1: The partnership approach appears to be very successful element of the Program.**

Developing industry partnerships or engagement between training providers and the organizations receiving the training appears to be working well. One of the contracts leveraged an association to recruit 109 member locations, which resulted in 109 partnerships. Another four BOM-funded training providers developed partnerships with multiple building O&M organizations, which resulted in training of 27 organizations or 27 partnerships. Further, 21% of non-participating organizations and all participant organizations (which are about 2% of the market) worked with or without trainers to develop new or modified curricula. This proportion in the market that exposed their O&M staff to new or modified curricula is significantly higher than the percent from the baseline. It appears that the BOM-funded training contributed to that growth.

- **Recommendation:** The success of the association approach suggests the Program should continue to reach out to other trade organizations as a fruitful source of participants.
- **Response to Recommendation:** Implemented. Program is continuing and will continue to reach out to other trade organizations to promote participation. An outreach contractor has been retained to increase program education and outreach.

**Conclusion 2: The BOM accelerated O&M training among participating organizations.** The participating organizations trained a significantly higher proportion of their O&M staff (76%) than non-participants (34%), on average. This indicates BOM likely accelerated training of O&M staff among participants.

**Conclusion 3: The COVID-19 pandemic had a strong impact on the sectors often served by BOM,** such as education (K-12 and higher education) and offices. Participating university and K-12 organizations explained that New York universities and K-12 schools were shut down for a minimum of three months to over a year from the onset of the pandemic. Office vacancies are at a 40-year high even as COVID-19 pandemic effects (e.g., hospitalizations) are declining in 2022. Furthermore, the BOM enrollments exhibited a steep decline in encumbered savings in 2020 and have not yet rebounded to pre-

pandemic levels. When asked about the COVID-19 pandemic effect, participating organizations reported several different types of impacts: 1) delaying or canceling on-hands or in-person training; 2) experiencing higher than usual staff early retirements as well as difficulty in competing with the unemployment benefits for certain type of O&M staff; and 3) needing to freeze hiring and promotions. The non-participating organizations noted COVID-19 challenges as well, but at a much lower rate.

**Conclusion 4: There is evidence of the market change the program is aiming to accomplish.** The partnership approach discussed above (based on item #2 above) points to program success – that is, accelerating infusion of new and modified curricula/knowledge in the O&M building sector. The impact evaluation has also identified indirect annual savings associated with the BOM (discussed in Chapter 4), which is analogous to program spillover. Additionally, the BOM enrollment pipeline of training projects shows a huge backlog (due to COVID -19) indicating there is a strong demand for the program. Further, the COVID-19 impacts are abating, which increases the probability that the pre-encumbered projects will be completed and thus the program benefits may become more notable and detectable in the market in the near future.

**Conclusion 5: In reviewing the initiative logic model, several of the program market and output indicators need re-assessment.** Specifically:

1. There is a sub-metric for “Increase in number of workers trained” noting an “electrification” goal of 1,000 workers. The electrification goal may not be appropriate for BOM because the training is focused on the existing conditions of the buildings served by the staff. There is little building management value (and no savings) to training staff in systems that are not present in the buildings.

- **Recommendation:** Re-assess the need for the electrification target.
- **Response to Recommendation:** Pending. Program will work with NYSERDA management and DPS staff to revisit the electrification target in BOM.

2. The BOM logic model in the IP indicated the Program will develop and increase the number of new partnerships and also improve employee retention. Although the team gathered or examined data on these outcomes, there were no metrics listed in the IP measuring these particular logic model outcomes. The partnership and employee retention metrics are relevant to the existing workforce, which is BOM’s main target audience.

- **Recommendation:** The logic model should be re-visited to assess the importance of either keeping or de-emphasizing the employee retention outcome (if there is no metric for it in the IP) or alternatively include that metric in the IP.

- **Response to Recommendation:** Implemented. The outcomes of “new partnerships” and “employee retention” were removed from the most recent version of the BOM logic model because these outcomes were no longer the best indicators for this initiative. These and other metrics may be of interest to program staff as initiative objectives but were deemed less applicable as program metrics of success.

3. A few metrics and outcomes relevant to new workforce are not applicable to BOM since BOM focuses on training the existing workforce. The latest IP eliminated the non-applicable metrics.

- **Recommendation:** The BOM logic model should also eliminate outcomes that are not applicable to an existing (versus new) workforce including: 1) the time needed for employer to find and train new talent, 2) individuals placed into paid internships/apprenticeships, and 3) placement of disadvantaged workers in O&M careers. These outcomes are relevant for the Talent Pipeline and are included in that logic model.
- **Response to Recommendation:** Implemented. These outcomes were removed as part of the updated Compiled Investment Plan, dated May 20, 2022.

## 2.2 Talent Pipeline Outcomes and Performance Indicators

The following sections provide details on program data and data collected from surveys on the outcome indicators and additional topics identified in Chapter 1. This section is organized by these three objective areas:

- Offset or reduction in the cost and timeline of hiring and training new workers
- Expansion of training infrastructure within a company/portfolio
- The relevance and effectiveness of the training efforts and associated trainee learning

### 2.2.1 Reduce Costs and Timelines to Hire and Train New Workers

This section presents the findings, analysis, and metrics related to the objective to offset or reduce the cost and time of hiring a new employee. The primary data source for these findings are the participating and non-participating employer surveys and tracking data. The IP identifies specific cumulative changes between the 2018 (baseline) and 2021 to 2025. This report is based on data gathered in 2021, nominally three years through the period ending in 2025.

The first section summarizes the evaluation findings for the IP cost and timeline output and outcome metrics. The subsequent sections present additional details and findings for each metric.

### 2.2.1.1 Summary of Evaluated Metrics

**It appears that the program is impacting participants’ costs and time to hire new staff positively.**

Although not a goal of the initiative, the Talent Pipeline effect on the cost and time to hire new staff in the market has not yet been detected.

Table 2-8 summarizes the evaluation findings for key WFD Talent Pipeline IP market outcome indicators pertaining to cost and time to hire and train. The goals target specific cumulative program participant impacts for 2022 and beyond to reduce the cost and time associated with hiring new staff and bringing them up to full productivity. The table presents participant and non-participant employer responses for comparison, with separate sub-metrics for hiring and training. The measure of the New York labor market impact is based on non-participant findings, since the total number of program interns and OJTs is a small part of new hires in the clean energy sector. Per the “New York Clean Energy Industry Report<sup>12</sup>,” there were 157,700 clean energy workers in New York at the end of 2020. The 1,609 subsidized employees (subsidized via PON 3982 and 4000) together with 3,468 trained individuals (trained by those who received the PON 3981 funds) account for about 3% of the New York clean energy workforce.<sup>13</sup>

**Table 2-8. Reductions in the Costs and Timelines to Hire and Train New Workers (Source: Survey Data)**

	Metric	Participant Employer	Non-Participant Employer	New York Labor Impact	2022 Target (Cumulative, Base Year 2018)
<b>Outcome Indicators (Metrics)</b>	<b>Reduced cost to recruit and hire [and train]</b>			Increase: 26% <i>(Based on non-participant data)</i>	Reduction of 30%
	Hiring cost	No Evidence of Change from 2018 (baseline) to 2021 (No E of C) <b><i>This is a positive finding for the program since in the market costs have increased.</i></b>	Increase: 34%		
	Training cost		Increase: 22% <i>Explained by inflation.</i>		
	<b>Reduced time to hire and train</b>			No E of C <i>(Based on non-participant data)</i>	Reduction of 20%
	Hiring time	No E of C	No E of C		
	Training time*	Declined by about 19% from 2018 (baseline) to 2021 <b><i>Another positive finding for the program</i></b>	No E of C		

<sup>12</sup> <https://www.nyscrda.ny.gov/-/media/Files/Publications/Clean-energy-industry/2021-CEI-GEN-report.ashx>

<sup>13</sup> The Talent Pipeline also incentivizes training providers via PON 3981 to provide training and job placement assistance to both new and existing workers. Training providers placed about 148 individuals into clean energy internships by the end of 2021, per program records. Adding these 148 workers to 1,609 interns and OJT hires references above, equates to 1,757 new workers. 1,757 is still 1% of the total clean energy workforce in New York.

	<b>Metric</b>	<b>Participant Employer</b>	<b>Non-Participant Employer</b>	<b>New York Labor Impact</b>	<b>2022 Target (Cumulative, Base Year 2018)</b>
	<b>Reduced time to reach full productivity</b>				Reduction of 20%
	Time it takes to train to adequate skill level	Declined by about 19% from 2018 (baseline) to 2021 (Same metric as the one above flagged by “*”) <i>Another positive finding for the program</i>	No E of C	No E of C <i>(Based on non-participant data)</i>	
	Time it takes to make half the errors, interns	2021: 3 months or 25% less time when comparing to non-participants)	2021: 4 months	<i>Not key metric, additional analysis</i>	
	Time it takes to make half the errors, OJT hires	2021: 4 months No E of C, when comparing to non-participants	2021: 4 months	<i>Not key metric, additional analysis</i>	
	Time to finish tasks with little supervision, interns	2021: 5 months or 28% less time when comparing to non-participants)	7 months	<i>Not key metric, additional analysis</i>	
<b>New Data</b>	Reduction in hiring risk	17% reduction in risk	NA	<i>Additional analysis</i>	NA

The non-participant data (reflective of the market) cannot detect small effect. That is, non-participant results indicating no statistically significant change pertaining to indicators of interest (see Table 2-8) mean there is no statistically significant evidence of moderate change (whether positive or negative) in relevant indicators over time. As noted previously, the total number of program subsidized interns, OJTs, and individuals (trained by those who received the PON 3981) is a small part (or 3%) of new hires in the clean energy sector. This indicates that initiative effects on the market are likely small, since the workforce reach of those subprograms is small. This is expected since the Talent Pipeline aim is to impact the participants, not necessarily the market.

Participating organizations, which employ about 3% of the total clean energy workforce, have seen: 1) reduction in time to train new hires since participating in the program (or since 2018) and 2) no increase in the cost to recruit and train new hires when in the market (or among non-participants) the cost to recruit and train has significantly increased (see Table 2-8). Participants also noted that the Program was generally influential in helping them bring on interns and OJT hires.

Participating employers also reported that about one-third of interns and two-thirds of the OJT employees are retained as full-time hires. Both interns and OJT employees were not hired for a variety of reasons, including offers from other companies and, more rarely, the unsuitability of the candidate. Interns also



often leave the employer to complete their education. The conversion rate to long-term employment is based on the participating employer’s report of the number of interns or OJT employees directly hired and does not capture interns or OJT employees that may have been subsequently hired by another clean energy firm, which renders this estimate conservative.

Further, the NYSERDA Talent Pipeline electrification subgoals, noted in the IP, included the subsidized OJT employees sponsored by clean energy industries focused on heat pump implementation. Review of OJT and intern program tracking data revealed that about 30% of the OJT hires worked at businesses engaged with heat pumps.

Also note that the initiative is working against an unprecedented labor disruption due to COVID-19. COVID-19 has simultaneously reduced the number of jobs and created a tighter labor market in 2020 and 2021, as well as impacted inflation, potentially overwhelming the impact of a targeted workforce effort.

**2.2.1.2 Motivation to Hire Interns and Perceived Value of Internship Subprogram**

The Talent Pipeline Internship subprogram provides wage subsidies for interns to organizations in the clean energy industry. The aim is to provide funding support for new intern hires to introduce eligible individuals to jobs in clean energy careers. The team verified this activity occurred when interviewing participating businesses who hired interns.

The surveyed participant clean energy or technology employers (i.e., those receiving the intern wage subsidy) and non-participant clean energy or technology organizations, on average, reported hiring about 5.4 and 5.5 interns, respectively, since 2018.

About one-third of interns remain with the organization after the conclusion of the internship. This pattern is observed for both participating and non-participating organizations who brought on interns (Table 2-9). Since program sponsored internships are of short duration, it is not expected for the majority of interns to immediately get hired after the internship concludes, per program staff feedback.

**Table 2-9. Mean Number and Proportion of Interns that Organization Employs (Employer Survey Data)**

	Participants	Non-participants
Average number of interns brought on since 2018	5.4 (n=44)	5.5 (n=22)
Average percent who were hired after the internship concluded since 2018 <sup>a</sup>	36% (n=31) <sup>b</sup>	39% (n=14) <sup>b</sup>
Average percent who were offered the position but did not accept <sup>a</sup>	9% (n=31) <sup>b</sup>	9% (n=14) <sup>b</sup>
Average percent who were not offered a full-time position <sup>a</sup>	55% (n=31) <sup>b</sup>	52% (n=14) <sup>b</sup>

<sup>a</sup> Each respondent provided a percentage estimate for the three scenarios that summed up to 100%.

<sup>b</sup> A total of 44 and 23 participating and non-participant contacts, respectively, noted they hire interns. Of these respondents, 31 participating and 14 non-participating contacts provided a clear response on whether they hired interns into 1) a full-time position, 2) offered them a position but interns declined, 3) or not offered a position.

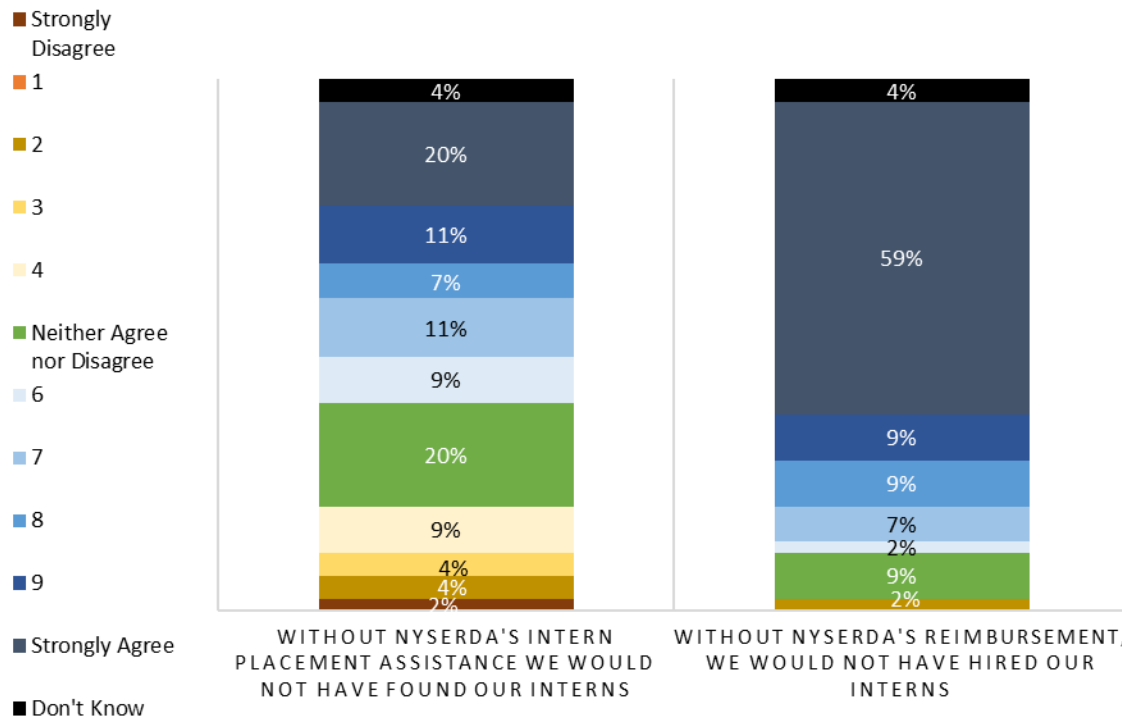
Participating employers reported three reasons why they hired interns (Table 2-10). The most common reason was to offer the interns a trial period that could lead to something more permanent, followed by wanting to mentor people early in their career or have an extra set of hands to help.

**Table 2-10. Reason(s) Participating Employers Brought on Intern (Employer Survey, Multiple Response)**

	<b>Participants, n = 44</b>
To offer a trial period that could lead to something more permanent	91%
To mentor people early in their career	48%
To have an extra set of hands	45%

Majority of participating surveyed employers strongly agreed that without NYSERDA’s reimbursement they would not have hired interns (Figure 2-1). There was less agreement with the statement indicating that without NYSERDA’s intern assistance, they would not have found their interns. These findings suggest that the NYSERDA’s Internship subprogram positively contributes to bringing new workers into the clean energy or technology job opportunities.

**Figure 2-1. Agreement with Statements Indicating NYSERDA Internship Subprogram Impacted Decisions to Bring on Interns (Employer Survey; n=46)**



Of the interns who were brought on since 2018 at participating organizations, the vast majority were enrolled in a four-year or two-year school at the time of the internship (Table 2-11). This is expected since eligible interns had to attend a degree program in New York State or reside in New York State if attending a degree program outside of New York State. The program also allowed military veterans and young adults attending a job preparedness program to be interns.

**Table 2-11. Reported Education or Training for Wage-Supported Interns (Employer Survey Data)**

	Participants, n = 43
Enrolled in a 4-year school	88%
Enrolled in a 2-year school	8%
Enrolled in a certificate or vocational program	<1%
Enrolled in a training program that does not offer a certificate upon completion	<1%
No recent training	3%

### 2.2.1.3 Motivation to Hire and Perceived Value of On-the-Job Training (OJT) Subprogram

The Talent Pipeline OJT subprogram provides wage subsidies for new hires to businesses in the clean energy industry to reduce the financial risk of hiring and training new workers. The reimbursement rates are based on size of company, type of company (technology focus and classification), and worker classification. The subprogram reimburses wages up to 16 weeks when an employee is a non-

disadvantaged worker and up to 24 weeks when an employee is a disadvantaged worker. The team verified this subprogram activity when interviewing participating businesses who hired new hires.

Surveyed participating organizations reported multiple reasons that they participated in the OJT subprogram. The most common reason was to grow their existing business or services by hiring new staff, followed by minimizing hiring and training costs and being able to hire more staff (Table 2-12).

**Table 2-12. Reason(s) Employers Participated in the OJT Subprogram (Employer Survey Data, Multiple Response)**

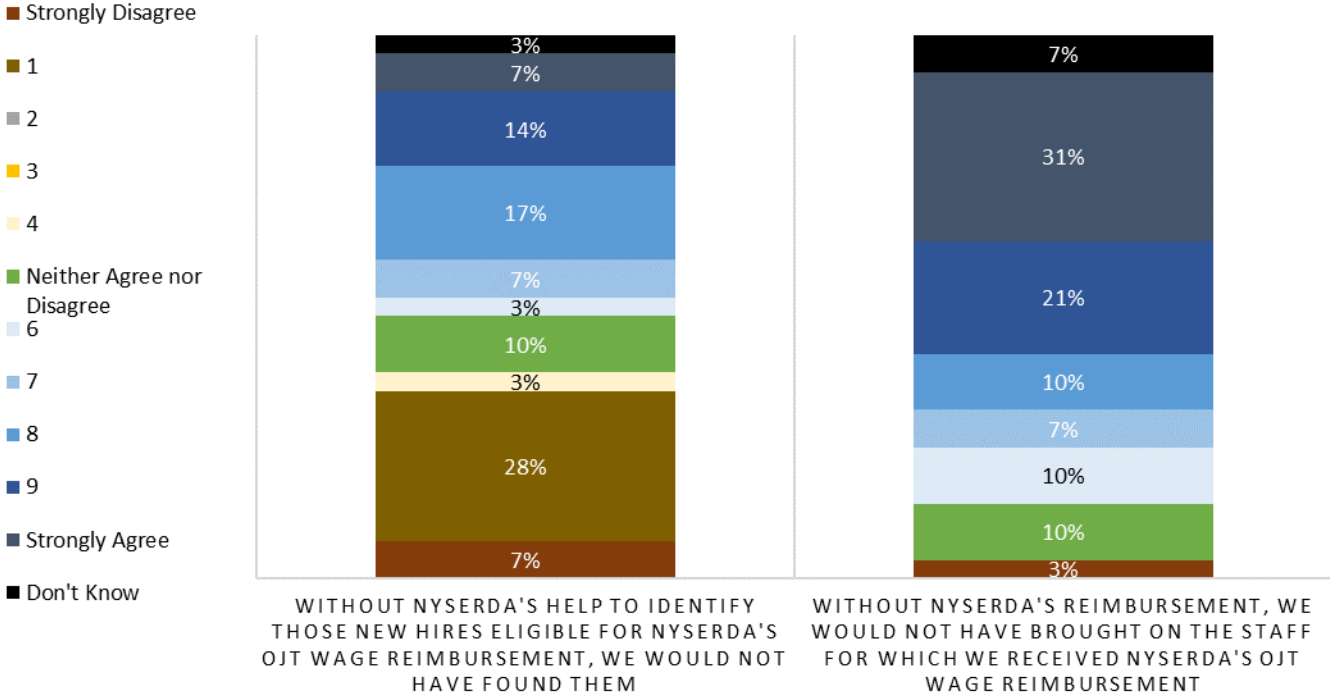
	<b>Participants, n = 29</b>
Wanted to grow existing business or service by hiring more staff	79%
Minimize hiring/training costs and be able to hire more staff	62%
Wanted to grow new business or service by hiring more staff	45%
To offer a trial period that could lead to something more permanent	41%
Other	3% <sup>a</sup>

<sup>a</sup> Other response: Wanted to spend more quality training time that they would otherwise not be able to afford.

Participating organizations (n=24) also reported that 65% of new hires with partially supported wages were still working with the company after disbursements ended. About 12 organizations reported that of the new hires who were still with the company after the OJT disbursements ended, 47% of them advanced into a higher position. Thirteen companies reported that very few (2%) of those new hires who stayed with the company after NYSERDA disbursements ended were terminated. When OJT-funded workers were not with the company after the wage disbursement ended, respondents most frequently cited that they had resigned.

Participating organizations generally agreed that without NYSERDA’s reimbursement, they would not have brought on the staff supported by wage reimbursement (Figure 2-2). There was less agreement with the statement indicating that without NYSERDA’s wage assistance, they would not have found their new hires. This data suggests that the OJT wage reimbursement positively contributes to bringing workers into clean energy or technology jobs.

**Figure 2-2. Agreement with Statements Indicating NYSERDA OJT Subprogram Impacted Decisions to Bring on New Hires (Employer Survey, n=29)**



**2.2.1.4 Effect of the Initiative on Hiring Time and Costs**

**2.2.1.4.1 Reduced Cost to Train New Workers**

**While there is evidence that the cost to train a new worker has increased in the market due to inflation, the cost to train a new worker has remained the same for participants since the launch of the OJT and Internship subprograms (a positive finding).**

For surveyed OJT and Internship subprogram participants, the cost of training a new hire remained the same from 2018 (the baseline period) to 2021 (Table 2-13; 2018 and 2021 reported training costs were not statistically significant when un-adjusted for inflation). There is high variability around the training cost mean estimate (see standard deviation values in Table 2-13), which indicates that training costs vary widely. This is expected, since the sample includes a variety of clean energy and technology businesses that will vary in how they train and the associated cost of that training.

When the reported training costs were adjusted for inflation, the cost of training a new hire was still not statistically significant for surveyed OTJ and Internship program participants despite a larger decrease in percent change in cost between 2018 and 2021 (Table 2-13; paired t-test was not significant at p=0.329). Due to the high variability around the training cost mean and small sample sizes, it is likely that the team

does not have enough data points to detect a significant decline in training costs among participants. At minimum, the team can conclude that training costs for participants have not increased.

For non-participants (i.e., clean energy or technology businesses that had not received an OJT or intern wage subsidy), the cost of training a new hire significantly increased from 2018 to 2021 (Table 2-13; paired T-test significant at  $p < 0.05$  for costs un-adjusted for inflation). Similarly, there is high variability around the training cost mean estimate (see standard deviation values in Table 2-13), which indicates that training costs vary widely.

When non-participant costs were adjusted for inflation, the increase in cost between 2018 and 2021 was no longer significant (paired t-test was not significant at  $p = 0.160$ ). This indicates that the training cost increase among non-participants between 2018 and 2021 was generally due to inflation – that is, when controlling or adjusting for inflation, the cost difference ceases to be significant.

Inflation is at least partly correlated with the COVID-19 pandemic. The pandemic impacted supply chains globally after March 2020. The demand for many goods initially dropped in 2020 and then increased in 2021 (U.S. Bureau of Labor Statistics). This impacted the supply. Inflation will occur when demand outpaces supply. Inflation ramped up substantially in 2021 and not so much in 2019 and 2020, per the U.S. Bureau of Labor Statistics. This larger economic trend likely limited the program’s ability to reduce the costs of training an O&M hire in the market.

**Table 2-13. Cost to Train a New Hire (Employer Survey Data)**

Group		n	Mean	Std. Deviation
Participants	2018 (Baseline)	21 <sup>a</sup>	\$13,119	\$13,805
	2021	22	\$12,875	\$12,826
	<b>Primary Indicator: 2018-2021 Percent Change in Cost (Un-adjusted for inflation)</b>			<b>-2%</b> No sig. difference in means.
	<b>Primary Indicator: 2018-2021 Percent Change in Cost (Adjusted for inflation)</b>			<b>-10%</b> No sig. difference in means.
Non-participants	2018 (Baseline)	52 <sup>b</sup>	\$7,744	\$11,566
	2021	54	\$9,457	\$13,188
	<b>Primary Indicator 2018-2021 Percent Change in Cost (Un-adjusted for inflation)</b>			<b>22%</b> Sig. difference in means.
	<b>Primary Indicator 2018-2021 Percent Change in Cost (Adjusted for inflation)</b>			<b>12%</b> No. sig. difference in means.

<sup>a</sup> One respondent did not provide a response for 2018 who provided a response for 2021.

<sup>b</sup> Two respondents did not provide a response for 2018 who provided a response for 2021.

To further understand the OJT subprogram effect on a new hire training cost, surveyed OJT and Internship subprogram participants were asked whether there was an increase, decrease, or no change in training cost when comparing OJT staff to a typical new hire. Most respondents reported that training

costs were the same or reduced for OJT subsidized staff compared to typical new hires (Table 2-14). The decrease in cost, when noted, was reported to be, on average, 47%.

**Table 2-14. Difference in Training an OJT versus a Typical New Hire (Employer Survey Data)**

Change in Cost Between OJT and Typical New Hire	Percent Reporting (n=28)	Average Reported Change
The same	43%	0%
Lower	46%	47% less (range: 10%-100%)
Higher	4%	25% more (range: 25%-25%)
Don't know	7%	n/a

**2.2.1.4.2 Reduced Time to Train New Workers**

**Only for participants has the time to train a new worker declined since the launch of the OJT and Internship subprograms.**

For surveyed OJT and Internship subprogram participants, the time to train a new hire decreased from 2018 (the baseline period) to 2021 (Table 2-15; paired T-test marginally approaching significance at  $p=0.07$ ). For surveyed non-participants (again, clean energy or technology organizations that had not received an OJT or intern wage subsidy), the time to train a new hire has remained the same from 2018 to 2021 (paired T-test was not significant). There is a high amount of variability around the mean estimate for the time to train (see standard deviation values in Table 2-15), which indicates time to train responses varied widely.

**Table 2-15. Time to Train a New Hire (Employer Survey Data)<sup>a</sup>**

Group		n	Mean	Std. Deviation
Participants <sup>a</sup>	2018 (Baseline)	21 <sup>b</sup>	7 months	3.8 months
	2021	23 <sup>c</sup>	6 months	2.4 months
	<b>Primary Indicator: 2018-2021 Percent Change in Time</b>		-19%	
Non-participants <sup>a</sup>	2018 (Baseline)	51 <sup>d</sup>	6 months	8.0 months
	2021	53	6 months	7.5 months
	<b>Primary Indicator 2018-2021 Percent Change in Time</b>		1%	

<sup>a</sup> Participants reported the average time to train a new hire. The non-participants reported the time to train a new junior hire separately from the time to train a senior hire. The team averaged the non-participant responses on the time to train junior and senior hires to estimate the average time it would take to train a new hire.

<sup>b</sup> Two respondents did not provide a response for 2018 but provided responses for 2021, and one respondent was removed for being an outlier – i.e., providing an answer of 90 months.

<sup>c</sup> One respondent was removed from the analysis for being an outlier – i.e., providing an answer of 90 months.

<sup>d</sup> Two respondents did not provide a response for 2018 but provided a response for 2021.

The team also inquired about the time to train a junior hire (separately from the time to train a new hire). There was no significant difference in time to train junior from 2018 to 2021 for either group (participants or non-participants). To phrase it differently, the average reported time to train a junior hire was similar across surveyed participants and non-participants (Table 2-16).

**Table 2-16. Time to Train a Junior Hire (Employer Survey Data)<sup>a</sup>**

Group		n	Mean	Std. Deviation
Participants <sup>a</sup>	2018 (Baseline)	37 <sup>b</sup>	6 months	4.5 months
	2021	41 <sup>c</sup>	5 months	4.0 months
	<b>Primary Indicator: 2018-2021 Percent Change in Time</b>		-13%	
Non-participants <sup>a</sup>	2018 (Baseline)	56 <sup>d</sup>	5 months	5.6 months
	2021	59	6 months	5.5 months
	<b>Primary Indicator 2018-2021 Percent Change in Time</b>		7%	

<sup>a</sup> Participants reported the time to train a junior hire and a time to train a new hire. The non-participants reported the time to train a junior hire and the time to train a senior hire. This table summarizes only the responses on the time to train a junior hire.

<sup>b</sup> Five respondents did not provide an answer for 2018 but provided a response for 2021.

<sup>c</sup> One respondent did not provide an answer for 2021 but provided a response for 2018.

<sup>d</sup> Two respondents did not provide an answer for 2018 and one outlier response was excluded from the analysis.

#### **2.2.1.4.3 Reduced Cost to Recruit and Hire New Workers**

**There is limited evidence suggesting that the cost to recruit and hire a new worker has declined since the launch of the OJT and Internship subprograms. However, there is evidence that the cost to recruit and hire a new worker has remained the same for participants since the launch of the OJT and Internship subprograms.**

For participants, cost to recruit a new hire remained the same from 2018 to 2021 (Table 2-17; 2018 and 2021 reported training costs were not statistically significant when un-adjusted for inflation). In contrast, non-participants reported a statistically significant increase in recruitment/hiring cost for new hires from 2018 to 2021 (Paired T-test significant at  $p < 0.05$  when un-adjusted for inflation).

When adjusted for inflation, the change in cost to recruit and hire a new employee still remained non-significant for participants from 2018 to 2021 (paired T-test significant at  $p = 0.807$ ). Also, there remained a statistically significant increase in cost to recruit and hire a new employee for non-participants when adjusting for inflation (paired T-test significant at  $p < 0.05$ ). This means that other reasons besides inflation affected these costs.



There is high variability around the recruiting/hiring cost mean estimates for both participants and non-participants (see standard deviation values in Table 2-17), which indicates that recruiting/hiring cost responses vary widely.

**Table 2-17. Cost to Recruit and Hire a New Employee (Employer Survey Data)**

Group		n	Mean	Std. Deviation
Participants <sup>a</sup>	2018 (Baseline)	19 <sup>c</sup>	\$7,989	\$11,956
	2021	20	\$8,860	\$11,610
	<b>Primary Indicator: 2018-2021 Percent Change in Cost (Un-adjusted for inflation)</b>		<b>15%</b> Not sig. difference in means.	
	<b>Primary Indicator: 2018-2021 Percent Change in Cost (Adjusted for inflation)</b>		<b>5%</b> Not sig. difference in means.	
Non-participants <sup>b</sup>	2018 (Baseline)	47 <sup>d</sup>	\$4,812	\$9,681
	2021	47 <sup>d</sup>	\$6,433	\$10,819
	<b>Primary Indicator 2018-2021 Percent Change in Cost (Un-adjusted for inflation)</b>		<b>34%</b> Sig. difference in means.	
	<b>Primary Indicator: 2018-2021 Percent Change in Cost (Adjusted for inflation)</b>		<b>22%</b> Sig. difference in means.	

<sup>a</sup> Question asked of the intern wage reimbursement participants.

<sup>b</sup> The non-participants reported the time to train a new junior hire separately from the time to train a senior hire. For each survey record, an average was taken of the values reported for senior and junior new hire to ascertain the cost of a new hire.

<sup>c</sup> One respondent did not provide an answer for 2018 who provided an answer for 2021.

<sup>d</sup> New hire average taken only for respondents who provided answers for recruiting and hiring time for junior and senior hires.

Similar patterns were observed with the cost to recruit and hire a junior employee when costs were adjusted or un-adjusted for inflation (Table 2-18). Additionally, a high variability in reported costs to recruit and hire a junior employee is present (see standard deviation values in Table 2-18).

**Table 2-18. Cost to Recruit a Junior Employee (Employer Survey Data)**

Group		n	Mean	Std. Deviation
Participants <sup>a</sup>	2018 (Baseline)	29 <sup>b</sup>	\$5,569	\$8,447
	2021	31	\$6,043	\$10,634
	<b>Primary Indicator: 2018-2021 Percent Change in Cost (Un-adjusted for inflation)</b>		<b>6%</b> Not sig. difference in means.	
	<b>Primary Indicator: 2018-2021 Percent Change in Cost (Adjusted for inflation)</b>		<b>-3%</b> Not sig. difference in means.	

Group		n	Mean	Std. Deviation
Non-participants	2018 (Baseline)	48 <sup>c</sup>	\$3,318	\$7,465
	2021	49 <sup>d</sup>	\$4,535	\$9,056
	<b>Primary Indicator 2018-2021 Percent Change in Cost (Un-adjusted for inflation)</b>		<b>37%</b> Sig. difference in means.	
	<b>Primary Indicator: 2018-2021 Percent Change in Cost (Adjusted for inflation)</b>		<b>25%</b> Marginally sig. difference in means (p=0.058)	

<sup>a</sup> Question asked of the new hire stipend participants.

<sup>b</sup> Two respondents did not provide answers for 2018 but provided a response for 2021.

<sup>c</sup> Three respondents did not provide answers for 2018 but provided a response for 2021.

<sup>d</sup> Two respondents did not provide answers for 2021 but provided a response for 2018.

#### 2.2.1.4.4 Reduced Time to Recruit and Hire New Workers

**There is no evidence that the time to recruit and hire new workers has declined.**

Participant and non-participant respondents were asked how long (in months) it took to find and recruit a new hire in 2018 and 2021. For participants and non-participants, the average time to recruit a new hire remained approximately the same from 2018 to 2021 (Table 2-19).

**Table 2-19. Finding and Recruiting Time (In Months) for NYSERDA Talent Pipeline Participants and Non-Participants (Employer Survey Data)**

Group		n	Mean	Std. Deviation
Participants <sup>a</sup>	2018 (Baseline)	21 <sup>c</sup>	4 months	4.4 months
	2021	22	5 months	4.3 months
	<b>Primary Indicator: 2018-2021 Percent Change in Time</b>		11% (but note not sig. difference in means)	
Non-participants <sup>b</sup>	2018 (Baseline)	44	6 months	5.8 months
	2021	41 <sup>d</sup>	6 months	2.6 months
	<b>Primary Indicator 2018-2021 Percent Change in Time</b>		-6% (but note not sig. difference in means)	

<sup>a</sup> Question asked of the intern wage reimbursement participants.

<sup>b</sup> The non-participants reported the time to recruit and hire a new junior hire separately from the time to recruit and hire a senior hire. Only half of the respondents were asked about the senior hires. For those who did not respond about a senior hire, the mean from the other half of the respondents was used. Then for each survey record, an average was taken of the values for senior and junior new hire to ascertain the cost of a new hire.

<sup>c</sup> One respondent did not provide a response for 2018 but provided a response for 2021.

<sup>d</sup> Three respondents did not provide a response for 2021 but provided a response for 2018.

Additionally, the Evaluation Team inquired about the time it took to find and recruit a junior hire. For the participant group, the time to recruit a new junior hire remained the same from 2018 to 2021. The non-

participant group recorded an increase in the number of months it took to find and recruit a new junior employee. This increase was statistically significant (paired T-test significant at  $p < 0.05$ ).

**Table 2-20. Time to Recruit a Junior Employee (Employer Survey Data)**

Group		n	Mean	Std. Deviation
Participants <sup>a</sup>	2018 (Baseline)	28 <sup>b</sup>	4 months	2.7 months
	2021	31 <sup>c</sup>	4 months	3.3 months
	<b>Primary Indicator: 2018-2021 Percent Change in Time</b>		-8%	
Non-participants	2018 (Baseline)	44	3 months	4.7 months
	2021	41 <sup>d</sup>	4 months	3.1 months
	<b>Primary Indicator 2018-2021 Percent Change in Time</b>		29%	

<sup>a</sup> Question asked of the new hire reimbursement participants.

<sup>b</sup> Four respondents did not provide a response for 2018 but provided a response for 2021.

<sup>c</sup> One respondent did not provide a response for 2021 but provided a response for 2018.

<sup>d</sup> Three respondents did not provide a response for 2021 but provided a response for 2018.

### 2.2.1.5 Decreased Time for New Workers to Reach Full Productivity

Survey respondents were asked how long it took their interns and new hires to make half as many errors as when they initially started. Surveyed OJT and Internship subprogram participants reported it took three months for their interns to make half as many errors, on average, whereas surveyed non-participants said it would take about four months, on average (these averages were statistically significant, with a p-value of 0.045).

Regarding new hires, surveyed OJT and Internship subprogram participants reported a similar number of months it took for new hires to make as half as many errors as non-participants.

**Table 2-21. Time to Make Half as Many Errors (Employer Survey Data)**

Group		n	Mean	Std. Deviation
Interns	Participants	39	3 months	2.2 months
	Non-Participants	22	4 months	3.5 months
	<b>Mean Difference (Sig. / Not Sig.)</b>		T-test Sig. at $p < 0.05$	
New Hires	Participants	24	4 months	1.9 months
	Non-Participants <sup>a</sup>	49	4 months	2.4 months
	<b>Mean Difference (Sig. / Not Sig.)</b>		Not significant	

<sup>a</sup> The non-participants reported the time for new hires to make half as many errors for a junior hire separately from a senior hire. Half of the respondents provided an answer for junior hires. For respondents with no response, the mean

from the other half of the respondents was utilized. For each survey record, an average was taken of the months for senior and junior hires to make half as many mistakes to ascertain that of a new hire.

Additionally, respondents were asked how many months it took for interns and new hires to accomplish tasks with little supervision. Participants reported that it took two fewer months, on average, for their interns to accomplish tasks with little supervision compared to the non-participant group.

**Table 2-22. Time to Accomplish Tasks with Little Supervision (Employer Survey Data)**

<b>Group</b>		<b>n</b>	<b>Mean</b>	<b>Std. Deviation</b>
Interns <sup>a</sup>	Participants	42	5 months	3.5 months
	Non-Participants	22	7 months	6.1 months
	<b>Mean Difference (Sig. / Not Sig.)</b>		T-test Approaching Sig. at 0.075	

<sup>a</sup> There was not enough data to provide a comparison for the new hire group.

### **2.2.1.6 Satisfaction**

Thirty-six participating organizations who received wage reimbursement from NYSERDA left feedback for the program. The most frequently cited topic (by 14 respondents) was a desire for easier reporting (with shorter or less company requirements) and more information and updates provided to the portal. Additionally, 11 of the 36 respondents noted that they thought NYSERDA’s wage reimbursement initiative was either excellent, great, good, or worked well. Last, eight of 36 respondents noted that they wished NYSERDA would provide more money to organizations and/or more time for NYSERDA to provide support to the organization.

### **2.2.1.7 Reduce Hiring Insecurity**

The surveyed clean energy business owners forecasted a substantial need for additional employees but also uncertainty that the new employees could be found and that they would have the training necessary to do the job. Insufficient staffing puts a business at risk that it will not meet its production, revenue, and profit objectives. The Talent Pipeline mitigates this risk by injecting new workers with training into the clean energy workforce, thereby offsetting this risk. This section introduces a new metric, the “reduction in hiring risk,” which quantifies the value of the Talent Pipelines in reducing business risk.

The “Hiring Insecurity” is quantified based on the business owner forecasts of the number of new hires they need to meet business goals and their expressed uncertainty of finding the hires with the appropriate skills. The Talent Pipeline sponsored interns and subsidized new workers that are retained for full time employment offset the number of hires that the business needs proportionally reducing risk.

**Workforce Projections.** Table 2-23 shows historical and projected number of employees on the payroll, and the average number of interns (for both participants and non-participants) and OJT employees (participant only) the business hired as full-time employees (FTE).

**Table 2-23. Employer Average Reported Current and Forecasted Payroll**

# Workers	Participant Average FTEs (n=54)	Participant Average Number of OJT and Intern Hired Fulltime	Non-participant Average FTEs (n=64)	Non-Participant Average Intern Hired Fulltime
Payroll 2019	11.2	2.2	25.6	5.5 – lower with 0s
Payroll 2020	13.7		25.9	
Payroll 2021	16.1		27.1	
Estimate 2022	18.9		36.3	
Estimate 2023	24.0		41.3	
Percent Growth 2021-2023	49%		52%	

Note: No comparison between participants and non-participants was significant, where comparison was applicable.

Participant and non-participant report on average a 50% increase in staff needed between 2021, when the surveys were conducted, and 2023. The interns and OJT hires offset about 5% of the expected 50% growth needed to meet business plans.

**Confidence.** Business owners were asked to rate how confident they were that they could acquire additional new hires and that the new hires would have the necessary training in 2022 and 2023. The responses indicated some level of uncertainty, which is the complement (1-confidence) of the confidence.

**Table 2-24. Employer-Reported Confidence that Qualified Hires Would Be Available**

Meeting Future Staffing Needs (0-10, not at all confident to fully confident) <sup>a</sup>	Participants (n=64), Mean Rating	Non-Participants (n=64), Mean Rating
2022 acquire additional new hires	6.5	6.0
2022 new hires will have necessary training	6.2	5.7
<b>2022 Average of hire and skills</b>	<b>6.3</b>	<b>5.9</b>
2023 acquire additional new hires	6.5	6.2
2023 new hires will have necessary training	6.4	5.8

Meeting Future Staffing Needs (0-10, not at all confident to fully confident) <sup>a</sup>	Participants (n=64), Mean Rating	Non-Participants (n=64), Mean Rating
2023 Average confidence of finding and hiring sufficiently skilled workers	6.5	6.0

Note: No comparison between participants and non-participants was significant

**Reduction in hiring risk.** The Hiring Insecurity reflects the percentage of the projected workforce that might not be available or trained in the future and is a function of the increase in staffing projected into the future and the uncertainty expressed by the business owners. Table 2-25 shows the result. An interpretation of the result is that the businesses may find themselves 17% short of the staffing they are projecting they require to meet their 2023 business objectives.

**Table 2-25. Calculation of Talent Pipeline Hiring Risk Reduction**

	Participant (n=64)
A – Participant payroll 2021 average (FTEs) (Table 3-25)	16.1
B – Participant estimate 2023 (FTEs) (Table 3-25)	24.0
C – Percentage increase in required staff (A / B)	49%
D – Staffing uncertainty factor: the complement of the confidence for 2023	35%
<b>E - Hiring Insecurity (C x D)</b>	17%
F – Number of interns and OJT hired (Participant new hires from Table 3-25)	2.2
G – Percentage of projected new hires (F / (B – A))	28%
Reduction in risk (E x G)	5% less hiring insecurity

The Talent Pipeline activity will not mitigate all the risk noted but will offset that risk proportionally to the contribution of the Talent Pipeline–sponsored interns and OJT permanent hires in reducing the risk.

### 2.2.2 Expand Training Infrastructure

This section presents the findings and analysis related to the objective to expand training infrastructure. The primary data source for this section is the participating and non-participating trainer survey and tracking data. The IP and NYSERDA identify specific cumulative changes between the base year of 2018 and 2022 and 2025. This report is based on data gathered in 2021, nominally three years or 75% through the period ending in 2022.

**2.2.2.1 Additional Program Background**

The Talent Pipeline Energy Efficiency and Clean Technology Training (PON 3981) and Clean Energy Training Services (RFQL 4145) subprograms provide funding to training providers, curriculum developers, and/or market and technical workforce experts in the clean energy industry. The aim is to provide training, hands-on experience, and job placement assistance to both new and existing workers in the clean energy industry.<sup>14</sup>

There are two additional subprograms (PON 4595 – Offshore Wind Training and 4463 – Career Pathway Training) that provide funding to training providers. There were no participating organizations under these two subprograms at the time of this study.

The next section summarizes the evaluation findings for the IP partnership outcome metric that addresses the objective of training infrastructure pertaining to training providers. The subsequent sections present additional analyses and insights on efforts to expand the training infrastructure.

**2.2.2.2 New Business and Training Provider Partnerships Through This Initiative**

This indicator measures the number of new partnerships that are created between businesses and participating training providers. Businesses partner with training partners to develop or receive training with the skills needed for business. Businesses also provide students with internships or job opportunities.

The number of industry partnerships generated through the Talent Pipeline training provider subprograms exceeded the 2022 goals.

**Table 2-26. Number of New Partnerships (Program Data)**

Primary Indicator	Baseline (2018)	Since subprogram launch to mid-2021	2022 Target (Cumulative)
Number of partnerships supported by PON 3981 and RFQL 4145	0 (By definition, none prior to the launch of the PON)	60	20

**2.2.2.3 NYSERDA Influence on Training Providers**

Per the PON 3981 and RFQL 4145 program tracking data, participating training organizations conducted numerous training sessions for new and existing workers or individuals. On average, participating

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<sup>14</sup> The NYSERDA PON/RFQL referenced above define clean energy areas broadly. Clean energy areas include high-efficiency heating, ventilation, and air conditioning (HVAC) and water heating; building electrification/heat pump technologies; insulation and air sealing; high-efficiency lighting and controls; building automation and controls; smart grid, energy storage, and renewable fuels; alternative transportation; and any related areas.

organizations have trained about 100 individuals per year. See Chapter 5 for details on the type of trainers the program funded.

Similarly, the survey data revealed that the participating training providers trained, on average, approximately 128 individuals through the PON 3981 and RFQL subprograms per year. There is high variability around this estimate (individual responses range from near zero to over 1,000 trained).

Surveyed participating training providers also reported training, on average, an additional 238 individuals outside of NYSERDA Talent Pipeline subprograms per year.

The non-participating training provider respondents were also asked to report the number of individuals they trained on clean energy technologies in New York in Year 2019 and Year 2020. They reported training approximately 88 individuals per year, on average.

While participating training providers trained an average of 47 individuals in 2019, that average rose to 210 in 2020, which is a 348% increase (Table 2-27). For participating training providers, this percent change in the number of trainees between 2019 and 2020 was larger than the percent change in the non-NYSERDA sponsored number of trainees between 2019 and 2020.

**Table 2-27. Mean and Percent Change of Trainees between 2019 and 2020 by Group (Trainer Provider Survey Data)**

	Participating Training Providers – Number of Trained Individuals <sup>a</sup>			Non-Participating Training Providers (n=16) – Number of Individuals Trained in Clean Energy <sup>b</sup>
	WFD Subprogram Training (n=17)	Non-NYSERDA Clean Energy Training (n=16)	Total (n=15)	
2019 average	47	210	265*	91*
2020 average	210	266	504†	85†
<b>Percent change</b>	<b>348%</b>	<b>27%</b>	<b>90%</b>	<b>-6%</b>

<sup>a</sup> Of 19 surveyed participating providers, only 15 estimated both the number of individuals trained through the Talent Pipeline sponsored training and the number trained outside of that training.

<sup>b</sup> Of 25 non-participating providers, 16 estimated the number of trained individuals receiving clean energy training.

\*. † Participant and non-participant means are statistically significantly different (T-test significant at p<0.05).

The non-participating training providers, on average, trained a similar number of individuals in 2019 as in 2020 (Table 2-27). Further, the non-participating training providers trained significantly fewer individuals compared to participating training providers, on average (T-tests significant at p<0.05).

Another desired goal of these trainer provider subprograms is to enhance the skills of (or to upskill) incumbent workers in the clean energy sector. One way to help upskill workers is through training. This hypothesis is supported by the survey data. About 80% of surveyed trainees noted that the training helped them achieve their goal of increasing their skills and industry knowledge.



Collectively, these findings indicate that the WFD trainer provider subprograms are accelerating clean energy technology training among providers that partner with NYSERDA.

#### 2.2.2.4 Curricula Changes

Survey data revealed that 75% of participating training providers stated that they either modified or developed entirely new curricula for their training sessions. The most common modifications to existing curricula were updating the topics covered in the training and making class format and content suitable for online or virtual training. Respondents listed several reasons for making modifications to existing curricula:

- Subject matter was outdated and needed to be updated to account for changes in technologies and industries.
- Certain topics were missing from the curriculum.
- Relevant details needed to be added to tailor the lessons to the audience.
- Adjustments to participant math and reading levels were needed in some cases.
- Existing curriculum was too broad and there was a need for hands-on training.

Some participating training providers also added new curricula. Per their comments, new curricula were generally developed when there was a need to cover new and niche technologies, incorporate a clean energy focus into training, or provide specificity to the training materials to develop trainee skills.

Overall, the trainer responses on curricula development and modifications were generally a result of subject matter coverage and not related to the timeframe – that is, the COVID-19 pandemic.

When asked what types of clean energy and technology curriculum are currently lacking that are needed to meet the business needs in New York State, participating training providers most commonly cited 1) energy management, 2) electrification, and 3) energy efficiency curricula (Table 2-28). Non-participating training providers most commonly said 1) electrification, 2) solar power, and 3) HVAC technician curricula.

**Table 2-28. Clean Energy and Technology Curricula that Is Lacking (Survey Data, Multiple Response)**

Type of clean energy curriculum	Participant training providers (n=19)	Non-participant training providers (n=25)
Energy management <sup>a</sup>	63%	24%
Electrification <sup>a</sup>	58%	32%
Energy efficiency <sup>a</sup>	58%	28%
Basic skills to prepare students for the above <sup>a</sup>	53%	20%
Solar power	42%	32%

Type of clean energy curriculum	Participant training providers (n=19)	Non-participant training providers (n=25)
Smart grid	42%	24%
HVAC technician	37%	<b>32%</b>
Off-shore wind	32%	20%
Engineering (mechanical, electrical, other)	32%	20%
Energy storage	32%	28%
Construction	26%	12%
Electrician	16%	12%
Hydropower	16%	16%
Safety	16%	12%
Biomass	5%	4%
Other	16%	28%
None	5%	12%

<sup>a</sup> Statistically significant difference between participating and non-participating respondents (Z-Test of Proportion significant at p<0.05)

**2.2.2.5 Ways to Support Clean Energy and Technology Workforce Development**

Among participating and non-participating training providers, sponsorship or funding for on-the-job training programs was the most common selection for actions or steps needed to address current business needs for supporting the workforce development pipeline for energy efficiency and clean energy businesses (Table 2-29).

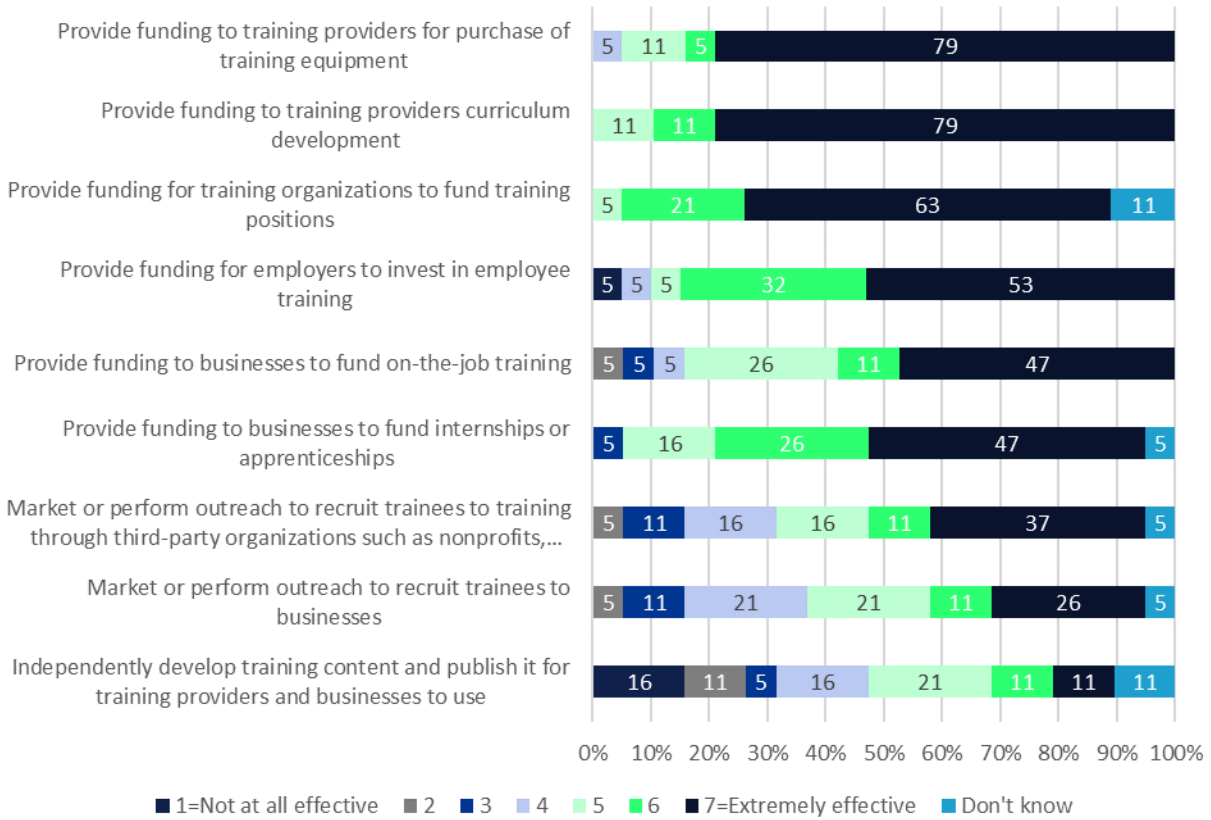
**Table 2-29. Supporting Business Needs to Develop Workforce Pipeline (Survey Data, Multiple Response)**

Actions or steps to address current business needs	Participant training providers (n=19)	Non-participant training providers (n=25)
There needs to be more state, local, or federal funding to sponsor on-the-job training or internships	79%	56%
Improve and update existing training curricula	68%	40%
Increase outreach and marketing efforts to recruit workers <sup>a</sup>	68%	48%
There needs to be more qualified training providers	32%	16%
Don't know <sup>a</sup>	5%	24%

<sup>a</sup> Statistically significant difference between participating and non-participating respondents (Z-Test of Proportion significant at p<0.05)

Participating training providers also value support from NYSERDA in developing training content (curricula and associated materials) and bolstering the training infrastructure (equipment and training staff). When asked what the most effective way for NYSERDA to support training providers would be, 79% of participating training providers said that funding for the purchase of training equipment and curriculum development would be the most effective support (Figure 2-3).

**Figure 2-3. Effective Ways to Support Participant Training Providers (n = 19)**



Participating training providers also highlighted the need for funding in other areas to support their work in fostering the growth of the clean energy and energy efficiency workforce, including funding for:

- Paying trainees stipends or wages during training
- Continuing education and improved wages to improve industry retention
- Joint labor management programs
- Physical training space

### 2.2.2.6 Type of Training Offered

Among both participating and non-participating training providers, the two most popular methods for training individuals were in-class sessions and instructor-guided online courses (Table 2-30). Participating training providers cited offering the two training options referenced above more frequently than non-participating training providers (Table 2-30, Z-Test of Proportion significant at  $p < 0.05$ ).

**Table 2-30. Training Delivery Methods (Trainer Provider Survey Data, Multiple Response)**

Training delivery and assistance provided	Participant Training Provider (n=19)	Non-Participant Training Provider (n=25)
In-class training	100% <sup>a</sup>	76% <sup>a</sup>
Online courses (instructor guided)	95% <sup>a</sup>	60% <sup>a</sup>
Train-the-trainer (prepares companies to train their own in-house staff)	53% <sup>a</sup>	24% <sup>a</sup>
Placement assistance	53%	44%
Assistance with getting internships or on-the-job training	47%	56%
Online courses (self-guided)	32%	28%
Other	32%	28%

<sup>a</sup> Z-Test of Proportion statistically significant between participant and non-participant responses.

Instructor-guided online courses were the most popular activity that surveyed trainees chose to complete their training (Table 2-31). While “hands-on training with equipment” saw lower participation rates among trainees, this was one area for improvement and development that the trainees and training providers brought up when responding to other questions in the surveys. Note that most training did occur during the Covid-19 pandemic period which could explain this pattern. When asked about needs for funding curriculum development, the need for more funding support for hands-on training was the most common theme identified by participating training providers. Other reported pressing curriculum development needs were related to providing more opportunities for certification and career advancement and ensuring that subject material keeps up with the rapid evolution of clean energy technology.

**Table 2-31. Training Type or Activity Participation (Trainee Survey, n=24, Multiple Response)**

Training program options provided	Trainee participation in
Online courses (instructor guided)	79%
In-class training	38%
Assistance with getting internships or on-the-job training	21%
Placement assistance	17%
Online courses (self-guided)	13%
Hands on training with equipment	13%
One to ten-day stand-alone training at an employer’s premises	13%
Train-the-trainer – prepares companies to train their own in-house staff	4%
Course within a larger curriculum	4%
Other	13%

### 2.2.3 Relevant and Effective Training

This section presents the findings, analysis, and metrics related to the objective to provide relevant and effective training. The primary data source for the findings are the trainee surveys, and to a lesser extent,

the trainer surveys. The first section summarizes the evaluation findings related to this goal, while subsequent sections expand on the findings.

### 2.2.3.1 Summary of New Evaluated Metrics

The IP does not specify numeric goals related to the relevance and effectiveness of the training. However, NYSERDA’s study research questions suggest the potential indicators summarized in Table 2-32. The findings are based on trainee surveys.

The Evaluation Team leveraged the Kirkpatrick Model<sup>15</sup> to assess relevance and effectiveness of training. This model examines four training domains: 1) reactions to training; 2) learning or acquisition of knowledge/skills; 3) application of what was learned to the job; and 4) whether targeted outcomes occur as a result of training. To gather data for applying the Kirkpatrick model, the evaluation included in the trainee surveys questions on their current job placement, application of training in their job, and to what degree trainees find the training engaging and relevant to their job or prospective job.

The first two domains of the model (reactions to learning and acquisition of knowledge) will be assessed by the implementation contractor for the Talent Pipeline initiative. Thus, the Evaluation Team provides limited (supporting) information only on these two topic areas in Table 2-32.

The evaluation mainly focused on collecting training data related to the behavior change (applying knowledge on the job) and the outcome results that occur as a result of the training (Table 2-32).

**Table 2-32. Training Relevance and Effectiveness Indicators (Source: Trainee Survey)**

Topic Areas Investigated (Based on the Kirkpatrick Model)	New Indicators	2021 Results
Reactions to training – supporting data	Trainees are satisfied (1-5 scale)	4.7 (mean) or 96% very or somewhat satisfied
Knowledge acquisition – supporting data	Trainees achieved their goals in the training	79% of trainees reported training helped them achieve their goal of improving their skills and knowledge
<b>Application of training in the job</b>	Trainees apply skills and knowledge to job	63% reported
	Trainees use the skills daily	11% reported
	Trainees are sharing information with colleagues	75% reported
<b>Did outcomes occur because of training</b>	Trainees working at a new job related to training within 12 months of completing the training	42%
	Trainees working at a new job related to training AND reside in disadvantaged community areas	8%

<sup>15</sup> <https://www.kirkpatrickpartners.com/Our-Philosophy/The-Kirkpatrick-Model>). In the past, NYSERDA has evaluated Workforce Development activities using an adapted version of this model.

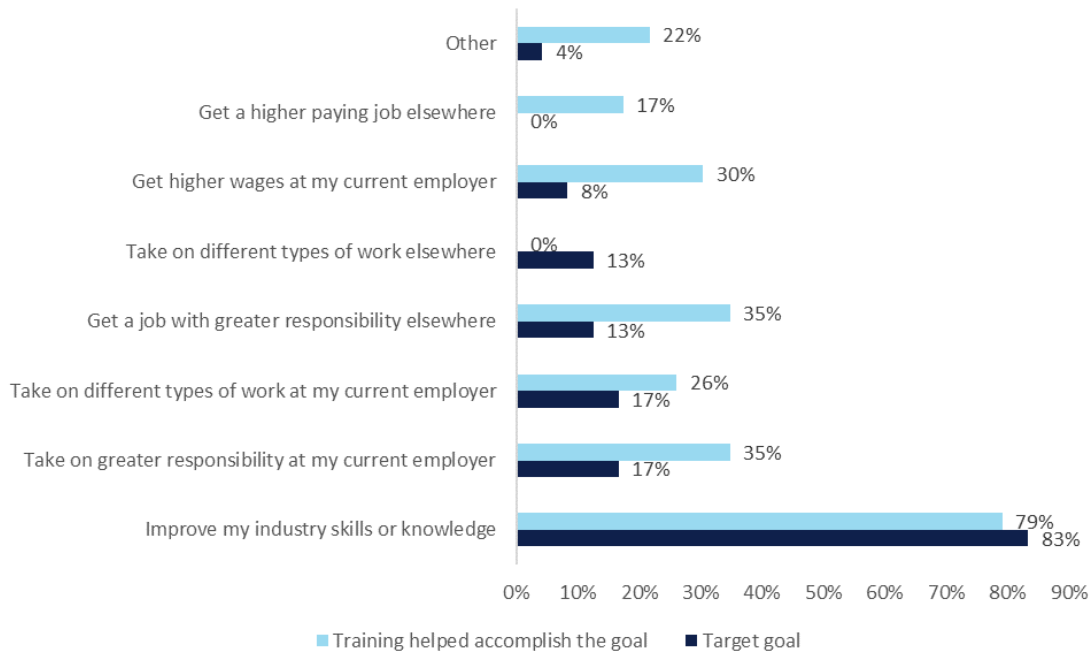
From the perspective of the trainees, the training largely met their goals to expand their industry knowledge and their career opportunities, and they were highly satisfied with the training. The majority could directly apply the learnings to their jobs and share what they learned with colleagues. Trainees also expressed interest in additional training outside their field. Further, nearly half reported working in a new job for which the training was pertinent, within a year of training completion. These findings indicate that training helped trainees acquire a clean energy job (which is an important short-term outcome).

### 2.2.3.2 Job Preparedness

In general, survey responses indicate that trainees were presented with appropriate training activities and topics to improve their skills and prepare them for the jobs they were seeking. About 63% of trainees have applied skills and knowledge obtained through the training on the job at varying degrees. Of the 63% of trainees who transferred their training skills to their job, 17% of them use the skills daily.

The most common goal that trainees hoped to achieve by participating in the Talent Pipeline sponsored training was improving their skills and knowledge – 83% of trainees aimed to achieve this goal and 79% of trainees felt that the training helped them achieve that goal. While other goals were not popular target areas for trainees, they did report that the Talent Pipeline training helped them accomplish even those less popular goals.

**Figure 2-4. Reported Reasons (Target) of Training and Whether Training Helped Achieve Target (Trainee Survey, n=24)**



Within 12 months of completing the Talent Pipeline sponsored WFD training, 42% of surveyed trainees were working at a new job related to the training, and 54% were not (note that some were already employed at the time of the training). Of the trainees who did secure jobs within 12 months in roles that were relevant to their NYSERDA WFD training, it took them an average of four months to secure their position.

Some trainees, upon completing the NYSERDA-sponsored training program, chose to continue their education and development through other on-the-job training options:

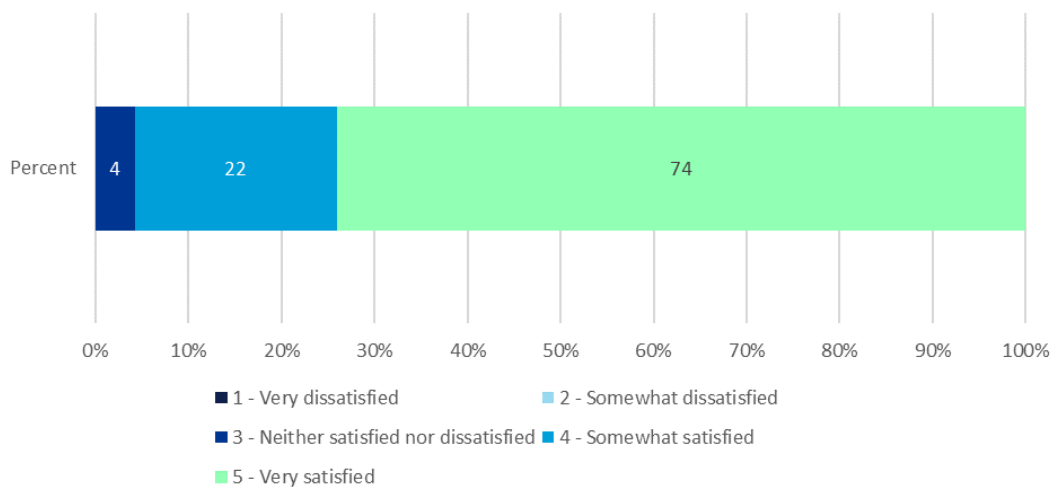
- 17% of trainees participated in an internship with their current employer
- 8% of trainees participated in an internship with a different employer
- 8% of trainees participated in an apprenticeship with their current employer
- 8% of trainees participated in an apprenticeship with a different employer

Survey data also revealed that the knowledge and benefits of the NYSERDA-sponsored training is reaching an additional audience beyond the trainee group. About 75% of trainees said that they have shared the skills and knowledge obtained through NYSERDA-sponsored training with their coworkers and/or colleagues. Of those 75% of trainees who shared their knowledge with others, nearly half of them spent over an hour doing so.

### 2.2.3.3 Satisfaction with Initiative-Funded Training Efforts

Of the 23 trainees who responded, the majority said that they were very satisfied with their overall training experience, and no trainees expressed dissatisfaction with their training experience.

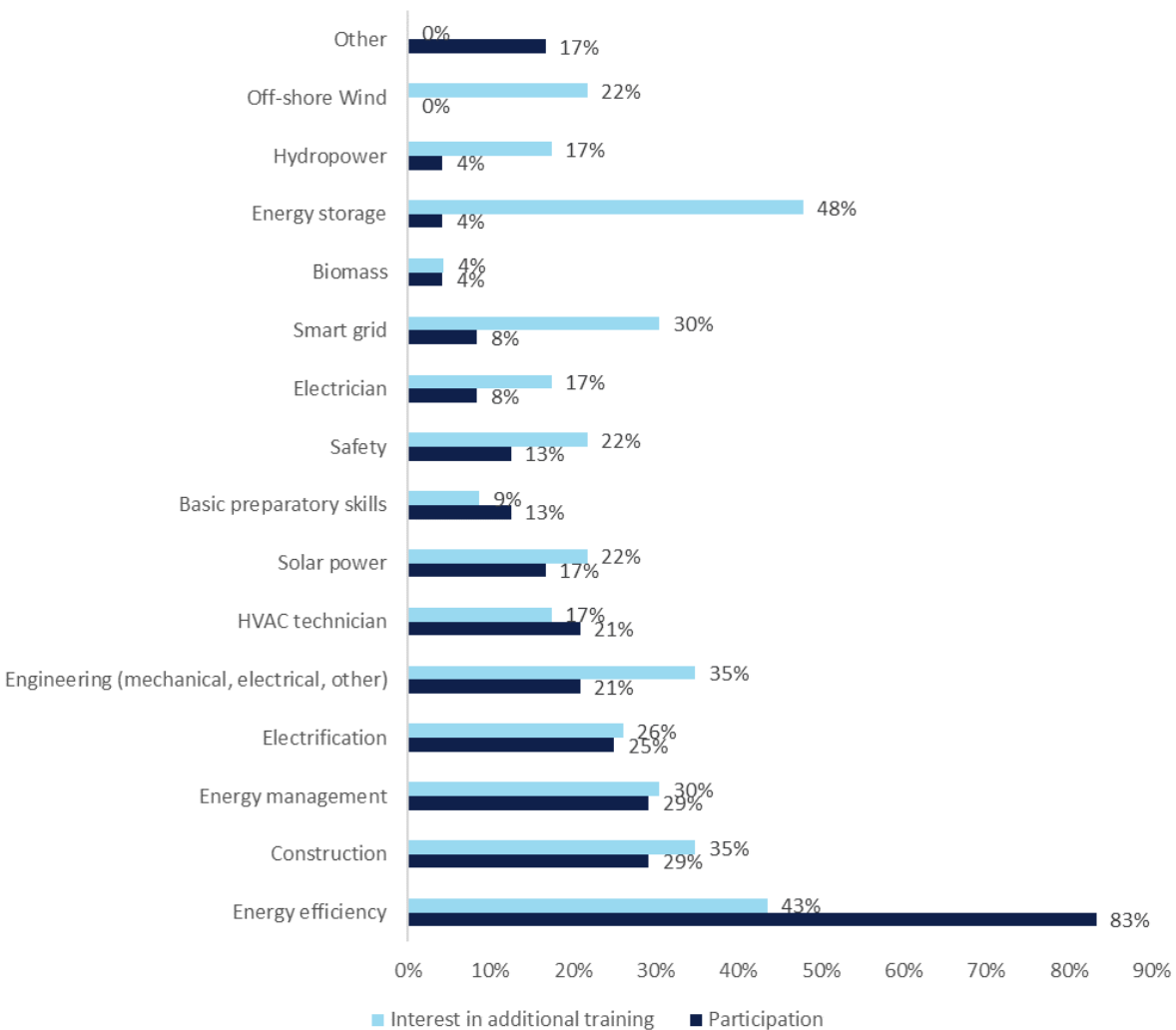
Figure 2-5. Trainee Satisfaction with the Training (n=25)



### 2.2.3.4 Trainee Training Interests

In addition to confirming which types of training trainees participated in, the survey also asked respondents to comment on additional training or instruction that would help them advance in their careers or perform better in current or future roles. The vast majority (83%) of trainees completed energy efficiency training and 43% of them have an interest in continuing their growth in that area through additional training (Figure 2-6). While only 4% of trainees participated in energy storage training, that training topic was the most popular area of interest for trainees, at 48%. Given the wide gap between trainee participation and interest in training on energy storage, this is an important area for both NYSERDA and training providers to consider offering within their curriculum.

**Figure 2-6. Trainee Participation and Interests by Training Type (n=19)**





### 2.2.3.5 Workers From Disadvantaged Communities

**Program and survey data indicate that the program is reaching those who are low-income or reside in disadvantaged community areas (DACs).**

PON 3981 program data indicates that 9% of trained individuals were considered low-income.<sup>16</sup> Very few trained individuals (less than 1%) were veterans, homeless, previously incarcerated, individuals with disabilities, or part of other priority groups that NYSERDA has been trying to serve.

Just over half of the surveyed trainees entered their addresses into the survey. Of that group, 31% reside in a DAC, 46% do not reside in a DAC, and the remainder (23%) do not reside in New York at this time. About 33% of surveyed trainees also stated that their annual household income was less than \$68,486.

A minority of surveyed trainee respondents also stated that they receive household assistance that is often associated with low-income earners (Table 2-33).

**Table 2-33. Low-Income Assistance Provided to Trainees (Trainee Survey Data, n=24, Multiple Response)**

<b>Types of Assistance</b>	<b>Percent Reporting</b>
Supplemental Nutrition Assistance Program (SNAP)	8%
Home Energy Assistance Program (HEAP)	4%
Temporary Assistance for Needy Families (TANF)	4%
Other benefit program	0%
None of the above	58%
Don't Know	13%
Prefer Not to Say	8%

### 2.2.4 Conclusions and Recommendations

Based on the initiative's findings presented above, the Evaluation Team offers the following conclusions and recommendations.

**Conclusion 1: Program positively impacted participants despite labor disruption due to the COVID-19 pandemic.** The sponsored interns and OJT hires are the one activity by which the Talent Pipeline is introducing new workers into the clean energy sector. The program is also subsidizing placement of interns and training of individuals or students for placement into a clean energy job. The measure of the market response to the new workers is through, lower costs to hire and train workers.

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<sup>16</sup> Low-income are those with household's total income at or below 60% of the State medium income, or households determined to be eligible for or are receiving assistance through the Home Energy Assistance Program (HEAP), Temporary Assistance for Needy Families (TANF), Supplemental Nutrition Assistance Program (SNAP), or other human service benefit programs.

Participant research offer evidence that the program likely had a small and positive effect on the market. Participating organizations, which employ about 3% of the total clean energy workforce in New York, have seen: 1) reduction in time to train new hires since participating in the program (or since 2018) and 2) no increase in the cost to recruit and train new hires when in the market (or among non-participants) the cost to recruit and train had significantly increased since 2018. Participants also noted that the program was generally influential in helping them bring on interns and OJT new hires.

Note that the non-participant market research showed no evidence of reduction in time and cost to hire and train new staff. When controlling for inflation, the cost to recruit and train (the program market outcome indicators noted in the IP for Talent Pipeline) increased by 22% and 12% respectively (for training) from 2018 to 2021 among non-participating clean energy employers (a group representing the market). The increase in the cost to recruit was significant whether adjusted or not adjusted for inflation, indicating other factors besides inflation affected this cost. The increase in the cost to train was only significant when cost was not adjusted for inflation, which meant inflation (or controlling for inflation) fully explained the increase. Inflation (which is partly a function of COVID-19 pandemic effects) likely limited the program's ability to impact the market. The time to recruit and train has held steady from 2018 to 2021 among the same group – i.e., no market movement observed.

It is also important to note that the initiative is working against an unprecedented labor disruption due to COVID-19. COVID-19 has simultaneously reduced the number of jobs and created a tighter labor market in 2020 and 2021, as well as affected the broader economy (e.g., inflation), potentially overwhelming the impact of a targeted workforce effort.

**Conclusion 2: A notable proportion of program supported workforce do not end up in a clean energy job after training or OJT wage support concludes.** About half of the trainees were no longer working in the areas where they trained after twelve months. A significant proportion of the subsidized interns (65%, which is expected) and OJT hires (35%) do not become permanent hires. Little over one-half of trainees trained by NYSERDA-funded training providers (colleges/universities, unions, industry consultants, etc.) reported not working in a job relevant to the training they received within 12 months of completing that training. Program sponsorships will include a natural attrition rate that should be considered when setting goals and budgets.

- **Recommendation 1:** The Talent Pipeline's sponsorship of interns and OJT hires was highly valued by the participants and was successful at introducing workers into the clean energy workforce. The Program could consider doubling or tripling the number of individual placements to account for natural attrition.

**Response to Recommendation 1:** Rejected. Increasing placements directly corresponds with an increased cost in program incentive budgets. The Program has been adding supplemental non-CEF funding to support the hiring of additional interns and OJT hires to support the market, however significant additional funding is needed to double or triple the number of placements/new hires.

- **Recommendation 2:** The Program might also consider increasing the number of OJT hires. This would help in two ways. First, the OJT hires have high retention rate. Secondly, increasing the OJT hires would more directly increase the installer pool.

**Response to Recommendation 2:** Rejected. Increasing placements directly corresponds with an increased cost in program incentive budgets. The Program has been adding supplemental non-CEF funding to support the hiring of additional OJT hires to support the market.

- **Recommendation 3:** The Program should consider alternative metrics for measuring progress. While the evidence indicates the Talent Pipeline intern and OJT hire activity is valuable to the participants and brings new workers into clean energy workforce, it is not clear that the cost and time of onboarding is the only or best measure of program impact. As New York has seen especially after the COVID-19 pandemic, hiring and training metrics are sensitive to larger economic forces, which reduces their reliability as an indicator of program progress. Other metrics that might be more appropriate for measuring progress could be centered on increasing the permanent placement rates or on targeting specific job areas (like installers), as well as tracking whether training developed is being leveraged outside of the NYSERDA program.

**Response to Recommendation 3:** Pending. Staff will further evaluate this recommendation.

**Conclusion 3: There is a need for increased field training.** From the perspective of the trainees, the training largely met their goals to expand their industry knowledge and their career opportunities, and they were highly satisfied with the training. However, in the participant and non-participant market employer surveys, responders were vocal about the state of training and the preparedness of hires. While somewhat anecdotal, since training assessment was not an objective of the employer survey, a consistent message came through the open responses in the surveys. Employers report that new hires, especially in installation (or jobs that require hands-on knowledge), are not being adequately prepared by the existing education and training systems.

Additionally, both employers and trainers noted that the current level of hands-on training is not adequate, and they expressed a desire to see hands-on training opportunities increase. In the trainer surveys, only 13% of the providers noted that their curricula include hands-on training (although the COVID-19

pandemic may have been a limiting factor for the low volume of hands-on training being offered). COVID-19 likely caused a simultaneous pivot toward online training while also limiting the feasibility of hands-on training to be added into a modified curriculum. Training providers identified training equipment as their highest priority for funding, which typically refers to hands-on learning apparatus. As a final observation on trainers, few if any of the training organizations appear to be technical high schools, which are a recognized source of new hire tradespeople.

- **Recommendation 1:** The Talent Pipeline should continue to encourage hands-on components in trainer curricula, expanding trainee exposure to this learning modality. Excluding career type of training (e.g., internships), hands-on training should be incorporated into curriculum not reserved for a few specialized “training labs.” The hands-on component is especially important for installers.

*Response to Recommendation 1:* Implemented. As the severity of the COVID-19 pandemic has eased, training partners have been eager to return to in-person, hands-on training for new worker training and have been doing so in many cases. NYSERDA will continue to encourage hands-on training as it was a key element of training models, by design, pre-COVID-19.

- **Recommendation 2:** The Talent Pipeline should encourage hands-on components in a partnership with technical high schools. It is likely that these schools would welcome an injection of clean energy optimism and opportunity for their students. The technical/vocational high schools are a primary starting point for a career in the trades, thus an important resource for clean energy new hires. The school facilities could also be a resource for hands-on component of the training for other training providers. One final benefit is that technical/vocational trade school graduates may be more likely to stay local, increasing the job retention rate.

*Response to Recommendation 2:* Implemented. NYSERDA has started several new training projects with technical high schools and will continue to promote the funding opportunities to this category. Additionally, NYSERDA is coordinating its Workforce and P-12 Schools activities to integrate clean energy education and awareness in high schools located in disadvantaged communities.

### 3 BOM Impact Evaluation Results, Conclusions, and Recommendations

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The WFD development training is intended to empower individuals with the skills and motivation to improve building operations through a combination of low-cost measures and best practices behaviors resulting in reductions in energy consumption. The WFD training and related activities were delivered to O&M staff serving a wide range of facilities, from military housing upstate to high-rise medical research facilities in Manhattan. Each training package was tailored to the individual customer with curriculums ranging from a 1,200 hour in-classroom apprenticeship to the production of videos with step-by-step procedures for repairing water heaters. Given this variability in customers and training, each site was independently assessed, considering all the available evidence including project file documents, billing analysis, site interviews and the results of subsequent analysis. The site report produced for each of the evaluated projects is included in Appendix A.

The primary method of determining savings at each site is a billing analysis. Behavior-related impacts are ideally captured using whole building 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 corroborate the magnitude of the savings with bottom-up engineering analysis. This was attempted at each site; however, due to data limitations the bottom-up engineering analysis was not possible for many of the projects.

#### 3.1 WFD Projects

Table 3-1 summarizes the projects assessed in this impact evaluation. Those assessed include all those noted as “Complete” in the NYSERDA’s Clean Energy Fund Report 17 (known as the “Scorecard”) and four of 44 encumbered projects where the training was substantially complete and where billing data was released by the customer. Each of the thirteen projects was further classified by the Program Staff as “typical” of the current program implementation or “atypical”. The table also notes the five projects included in the calculation of the VGSRR; these projects are highlighted in subsequent tables.

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<sup>17</sup> The Scorecard included projects completed by September 30, 2021.

**Table 3-1. Evaluated Projects**

Site ID	Scorecard Status	Typical or Atypical	Included in VGSRR
SID-88	Complete	Typical	Included
SID-44	Complete	Atypical	Included
SID-99	Complete	Typical	Included
SID-61	Complete	Typical	
SID-17	Complete	Typical	
SID-29	Complete	Typical	Included
SID-78	Complete	Typical	
SID-18	Complete	Atypical	
SID-67	Complete	Typical	Included
SID-28	Encumbered	Typical	
SID-06	Encumbered	Typical	
SID-62	Encumbered	Typical	
SID-09	Encumbered	Typical	

### 3.2 Project Characterization

This section presents summaries of key characteristics of the projects and of the data that was available to support the analysis. This section also discusses the project timeline and the selection of the baseline and performance periods. Each of the projects was unique, varying widely in the number of buildings included in the project (1 to 4,000+), the building area encompassed by the project (from 100 thousand to 22 million square feet), building function (medical research to multifamily), fuels (electricity, gas, chilled water, oil, and district steam), and the sophistication of the staff. Each of the training program and ancillary activities was tailored to each site. Training activities included in-classroom and field instruction, mentoring, training videos, coaching, and “Green Team” formation and participation. The training activities were mixed and matched at each site. Given the diversity of the population and the differences in implementation, each project was independently evaluated using all the available evidence for that project including project file documents, consumption data, site interviews, and the results of subsequent analyses using billing analysis corroborated with an engineering analysis.

Please note, these findings are based on the project file material delivered to the Evaluation Team, consumption data, and the site contact interviews.

A project site report with expanded details can be found in Appendix A for each of the projects in Table 4-1.

#### 3.2.1 Consumption Data

The savings estimate was determined using a billing analysis approach, which, of course, depends on energy consumption billing data. The Evaluation Team used these sources of consumption data described as follows:

**BOM Report consumption data.** Participants were required to provide two years of past energy consumption data for all fuels (baseline) and two years of performance data in the NYSERDA-defined BOM Report. The BOM Report is a spreadsheet with an input structured to capture all fuels in six-month intervals aggregated across the buildings within the project portfolio. 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. All the project files included the BOM Reports. Most were well populated.

**Utility consumption data.** In addition to the BOM Report, the Evaluation Team attempted to acquire a billing release (if there was not one already signed) for each of the evaluated projects so that NYSERDA could request historical monthly billing data. The billing data is a superior analytic dataset compared to the BOM Report consumption data because it is provided in monthly intervals rather than every six-months and by building, rather than aggregated across the portfolio. Billing data also distinguishes between estimated and actual monthly values.

**Unregulated fuels.** The BOM report included consumption of district steam and chilled water imported from neighboring facilities and oil consumption.

Table 3-2 summarizes the consumption data that was included in the analysis by source. Note that not all the data could be used; for example, the performance period was typically the twelve months before COVID-19 lockdown although many sites had utility billing data through early 2022. Projects included in the VGSRR computations are highlighted.

**Table 3-2. Billing Data Collection Summary**

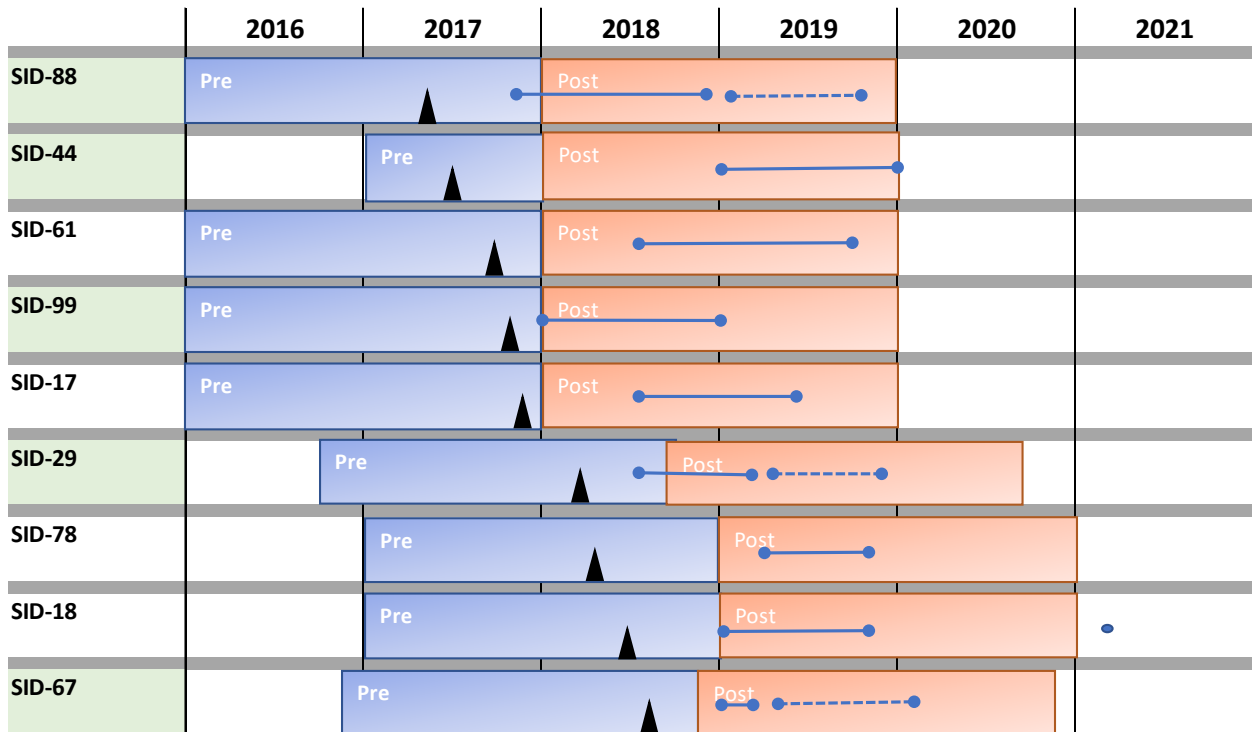
Project ID*	BOM Report Usage			Utility Provided Usage			
	Data Period	Fuels	Number of Months	Data Period	Fuels	Number of Months	Num Accts
SID-88 C/T	Jan 2016 to Dec 2018	E, NG, DS	36	None acquired	-	-	-
SID-44 C/A	Jan 2017 to Dec 2019	E, NG, #20	36	None acquired	-	-	-
SID-61 C/T	Jan 2016 to Dec 2018; For limited number of properties	Various, NG	26	Dec 2017 to Feb 2022	E, NG	87	45
SID-99 C/T	Jan 2016 to Dec 2020	E, NG	48	None acquired	-	-	-
SID-17 C/T	Jan 2016 to Dec 2020, less 6 months	E, NG	54	Jan 2018 to Feb 2022	G	39	1
SID-29 C/T	Apr 2019 to Mar 2020	E, NG, DS, CW	48	Dec 2017 to Feb 2022	E, NG	50	9
SID-78 C/T	Jan 2017 to Sep 2020	E, NG	45	None acquired	-	-	-
SID-18 C/T	Jan 2017 to Jun 2020	E, NG	42	None acquired	-	-	-
SID-67 C/T	Nov 2016 to Apr 2020	E, NG, DS	42	Dec 2014 to Feb 2022	E, NG	87	6
SID-28 E/T	Oct 2016 to Mar 2020	E, NG	48	Dec 2014 to Feb 2022	E, NG	87	21
SID-06 E/T	Oct 2016 to Sep 2019	E, NG	36	Dec 2017 to Feb 2022	NG	51	101
SID-62 E/T	Jan 2017 to Sep 2020	E, NG	42	Dec 2017 to Feb 2022	E, NG	63	101
SID-09 E/T	Jan 2017 to Sep 2020	E, NG	42	Dec 2017 to Feb 22	E, NG	51	3

\*Legend: C/E Scorecard status of Completed/Encumbered; A/T Atypical or Typical Project;

### 3.2.2 Project Baseline and Performance Periods

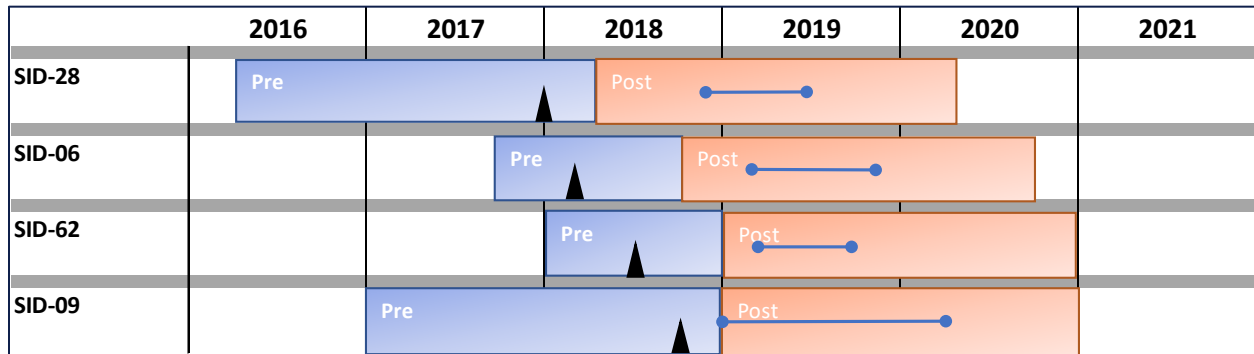
Figure 3-1 and Figure 3-2 present the timelines for each of the projects in two groups, first the Completed (Figure 3-1) followed by the Encumbered projects (Figure 3-2). The timelines illustrate the baseline and performance periods as defined in the BOM Reports, the contract effective date (the black triangle) and the period of most intense training (the solid blue bar) and less intense training (dotted blue bar). It is immediately apparent that COVID-19 lockdown closely follows the delivery of training for majority of the projects. It is also apparent that training was typically not completed until the second year of the performance period and therefore the full benefit of the training may not have been observed in either the billing or engineering analysis. COVID lockdown immediately followed or overlapped the performance period, making post performance period analysis untenable for any of the projects. Projects included in the VGSRR computation are highlighted.

Figure 3-1. Completed Project Timelines





**Figure 3-2. Encumbered Project Timelines**



While the BOM Report defined a baseline and performance period, the billing analysis periods did not always map directly to these dates. In some cases, the BOM Report (or utility data) did not include the data covering the full period, or it included the COVID-19 shutdown period, or the data had irregularities, reducing the baseline or performance period. Attempts were made to align the BOM and utility analysis periods, although that could not be done in every case.

The length of the final analysis periods (in months) used in the billing analysis is noted in Table 3-3. This table also noted obvious impacts of COVID-19 at the property. More discussion about COVID-19 impacts follows.

**Table 3-3. Billing Analysis Periods**

Project ID*	BOM Baseline Months	Utility Data Baseline Months	Agreement Effective Date	Performance Period Commences	BOM Perf. Months	Utility Data Per Months	COVID Impact
SID-88 C/T	24	No data	5/1/2017	1/1/2018	12	No data	None reported
SID-44 C/A	24	No data	6/1/2017	1/1/2019	12	No data	Campus shutdown
SID-61 C/T	Not used	36	9/15/2017	12/1/2017	Not used	12	Six to twelve month shut down
SID-99 C/T	24	No data	10/1/2017	1/1/2018	18	No data	Campus shutdown
SID-17 C/T	24	Not used	11/1/2017	1/1/2018	Not used	Not used	None reported
SID-29 C/T	12	9	3/22/2018	9/1/2018	12	12	50% reduction in occupancy and increases in ventilation
SID-78 C/T	24	No data	4/4/2018	1/1/2019	12	No data	None reported
SID-18 C/T	12	No data	7/11/2018	1/1/2019	12	No data	In NYC, shed half of properties and staff
SID-67 C/T	24	Not used	10/1/2018	1/11/2018	12	Not used	Campus shutdown
SID-28 E/T	12	41	1/1/2018	4/1/2018	12	12	Campus shutdown
SID-06 E/T	12	10	3/28/2018	10/1/2018	12	12	None reported
SID-62 E/T	12	13	6/1/2018	1/1/2019	12	12	None reported
SID-09 E/T	24	12	9/1/2018	1/1/2019	12	12	None reported

\*Legend: C/E Scorecard status of Completed/Encumbered; A/T Atypical or Typical Project

Highlighted projects were included in the VGSRR.

**Black-Out Period.** The analysis does not incorporate 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,” because the install date of the widget is clear, and the widget performance should be sharply different in the pre- and post-installation period. The impact of training is more diffuse and will start with the first day of training and accumulate in an unpredictable way overtime.
- The practice of defining the performance period beginning immediately from project start is observed in other whole building behavioral programs and evaluations, like the California’s industrial behavioral program and it is consistent with the BOM Report. However, the training period for WFD was often protracted. Typically, core training occurred early in the project. However, many of the sites followed the core training with coaching or in-depth training for select individuals which did not wrap-up until the end of the performance period.
- Ultimately, a very practical reason for not using a black-out period is the COVID-19 pandemic event. The COVID-19 lockdown had an abrupt and substantial impact on building operations at most sites and adding a black-out period would have eliminated any performance period.

**COVID-19.** The COVID-19 lockdown that began in early March 2020 had a measurable impact on building energy consumption as well as on the ability of the training providers to deliver in-classroom and field training. The following figures present examples of the COVID-19 impact on consumption. The examples include a college campus (most impacted by COVID-19 pandemic) and a multifamily building. The install period encompasses the period during which training occurred.

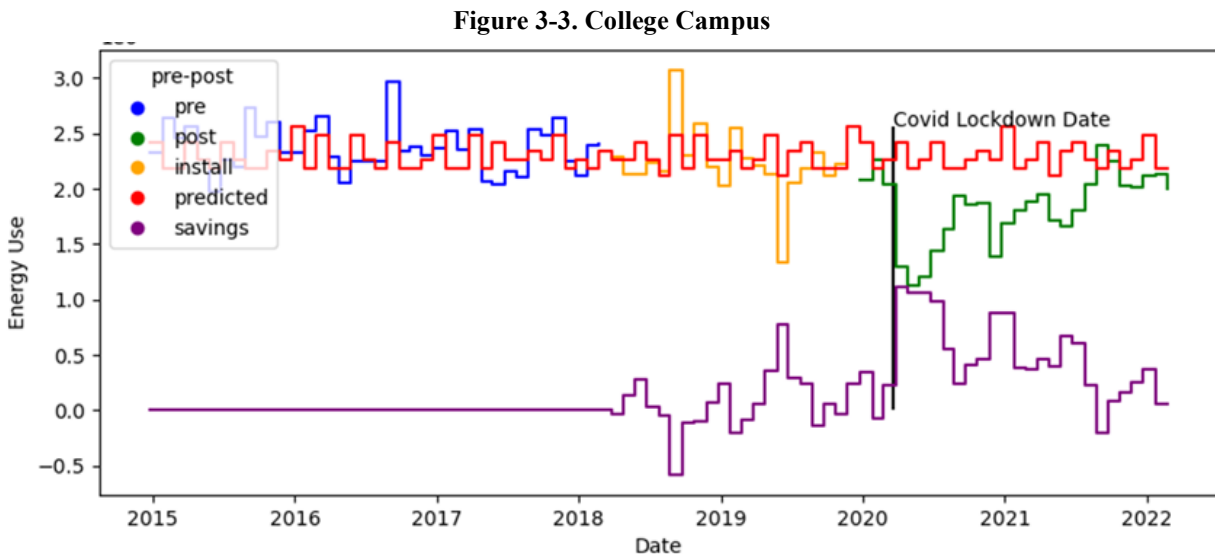
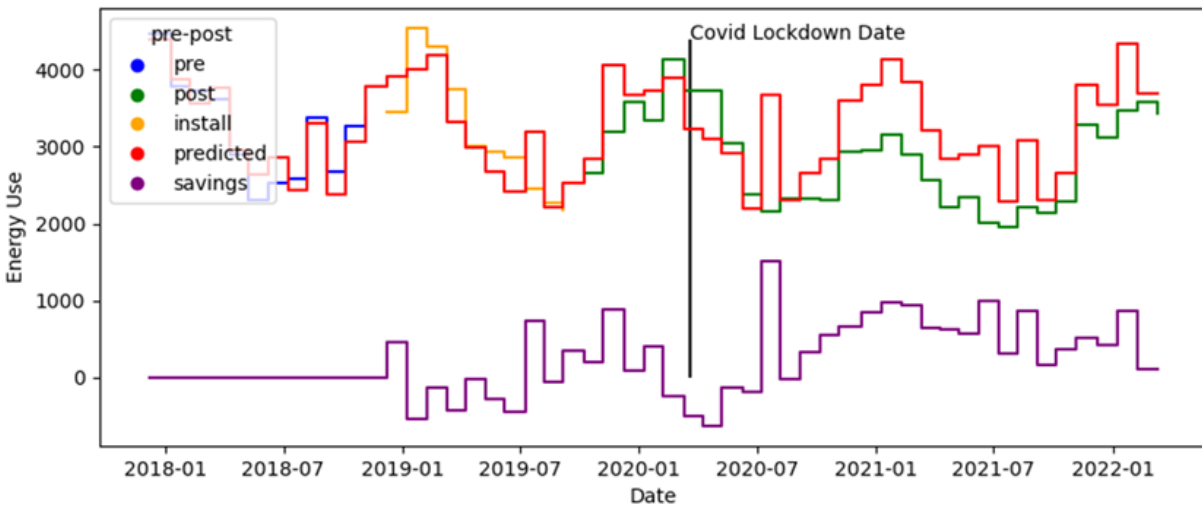


Figure 3-4. Multifamily



While many of the energy streams reviewed do not show the dramatic changes illustrated in the figures above, one cannot conclude that there is no impact. Hence, the evaluated results reported in this study exclude consumption after February 2020 with a few exceptions noted in the individual site reports. The utility billing analysis includes computations for billing results including COVID-19, but the savings impacts from 2020 and afterward are not included in the final realization and savings rates and therefore the full benefits of the training may not have been observed.

### 3.2.3 Combining Thermal Fuels

Three project sites used district steam, which was compiled and reported in the BOM Report but not in the Scorecard. Steam usage contributed to between 55% and 97% of the thermal consumption at these project sites. The training curricula at all these sites had a significant focus on thermal energy, thus the training-induced savings would be expected to impact the district steam usage as well as electricity and natural gas. Complicating matters further, two of the sites imported district steam from a neighboring facility, and one purchased steam from ConEdison.

Natural gas impacts are presented in two ways. In the first approach, natural gas impacts are based on the reported natural gas purchase, ignoring district steam impacts (referred to as “Purchased Natural Gas” impacts). While this method does accurately report changes in natural gas purchases, it does not account for all thermal energy impacts at the site.

In the second approach, district steam impacts are converted to equivalent natural gas usage assuming a 75% overall efficiency delivered at 150 psi, typical of district systems. This second method captures the impacts of all contributing energy streams and is referred to as “Contributing Natural Gas” impacts. This second method may have been applied to project SID-29 in the Scorecard since the Scorecard savings for

that project would have required savings over 90% of the site's natural gas purchases, although this was not explicitly noted in the project files.

### **3.2.4 Engineering Estimates of Savings and Evidence of Implemented Measures**

The purpose of the engineering estimates was to corroborate the magnitude of the savings from the billing analysis with a high-level engineering-based estimates of savings. This can provide confidence that the savings are the results of the program activity and not some other random event. The savings result from an accumulation of smaller measures and the baseline and performance conditions were not easily characterized using an engineering approach. As an example, one topic included in most training was air-sealing. Since it is not practical to measure infiltration rates in a commercial building, an engineering estimate would rely more on guesswork than engineering.

An engineering estimate requires first the identifications of measures or actions implemented and the key pre and post characteristics of those measures. Documents in the project files and interviews of site staff provided evidence of energy efficiency actions. The quality of the evidence of implementation varied.

In the best case, the project file included an "Opportunity Log" which tracked candidate energy efficiency opportunities, estimates of their savings and progress to implementation. The Opportunity Logs were produced by a cross-functional "Green Team", initiated as part of the training, tasked with identifying and implementing energy savings measures.

Another source of potential measures were energy audit reports, which listed low-cost/no-cost retro-commissioning recommendations of the type that a trained staff could implement. While the audit reports provided detailed estimates of savings, whether the measures had been implemented was not always clear.

Some project files included facility-produced summaries of energy efficiency and carbon neutral accomplishments which could be inferred as installed measures likely implemented by the trained staff.

Site contacts confirmed activities of the staff more generally, as the training activities had occurred two to three years prior. Site contacts sometimes referenced the audit reports as the best source of installed measures.

Calculating a ground-up, engineering-based estimate of behavioral and low-cost/no-cost measures required significant site-specific detail. The best sources of these estimates were the audit reports, which included detailed savings estimates based on extensive site observations by the engineering firms that produced the audit report. Another good source of estimates was an Opportunity Log, which included a brief description of the measure and in some cases estimated savings. When the Log did not include

estimated savings, the Evaluation Team calculated savings assuming typical building usage and savings fractions for the measures installed.

Unfortunately, for about half of the projects, there was no evidence of actions taken by trained staff to reduce energy consumption in the project files, nor would the site contact agree to be interviewed about specific actions taken in even a subset of buildings. Table 3-4 summarizes the sources of corroborating evidence that are available for each of the sites.

**Table 3-4. Summary of Corroborating Evidence of Efficiency Actions**

Project ID*	Interview of knowledgeable staff	Opportunity Log	Audit Reports	Installed measure estimates	Corroborating Estimates
SID-62 E/T	No	No	No	None noted	None possible
SID-88 C/T	No	No	Yes	Yes	Audit report estimates
SID-44 C/A	Yes	No	No	No measures installed	None required, no measures implemented
SID-17 C/T	No	No	No	None noted	None possible
SID-99 C/T	Yes	No	Yes	Yes	Audit estimates
SID-78 C/T	No	No	No	None noted	None possible
SID-18 C/T	No	No	No	None noted	None possible
SID-28 E/T	No	Yes	No	Yes	Opportunity Log estimates
SID-29 C/T	Yes	No	Yes	Yes	Audit report estimates
SID-67 C/T	Yes	Yes	No	Yes	Opportunity Log estimates
SID-06 E/T	No	No	No	None noted	None possible
SID-61 C/T	No	No	No	None noted	None possible
SID-09 E/T	No	No	Yes	Yes	Audit estimates

\*Legend: C/E Scorecard status of Completed/Encumbered; A/T Atypical or Typical Project  
Highlighted projects were included in the VGSRR.

**Overlap with Other Programs.** Some projects noted participation in other NYSERDA programs such as the “Campus Energy Challenge,” and other projects noted that other program incentives would be tapped for certain measure implementation. It would appear to be appropriate to assume there is overlap with other programs and for NYSERDA to apply the portfolio overlap factor to these savings.

### 3.2.5 Scorecard Energy Usage Assumptions

Each project enrollment requires an estimate of the project’s expected savings, which program staff computed as the product of the annual energy usage for the buildings included in the project and a savings fraction. Since the project’s annual energy usage is not readily available at enrollment, the annual energy usage is derived from the customer estimate of the total cost of their annual energy. Estimates of electric and natural gas consumption are made using an assumed relationship between energy cost and energy use.

While the project annual energy usage is not readily available at the project initiation, it is readily available in the baseline consumption reported in the first BOM Report provided about six months into the project. Table 3-5 compares the annual usage reported in the BOM Report to the initial estimate of annual usage. Electricity was underestimated in the initial estimate by about 40%. While the total natural gas use estimated initially was the same as reported in the BOM Reports in total, individual project usages did not match. Projects are highlighted that were included in the VGSRR calculation.

**Table 3-5. Comparison of Program Estimated Use versus BOM Reported Use**

Project ID*	BOM Reported Electricity Use (MWh)	Initial Estimated Electricity Use (MWh)	PCT	BOM Reported NG MMBtu	Initial Estimated Use	Pct.
SID-88	128,316	8,294	6%	33,976	73,910	218%
SID-61	55,613	55,613	100%	495,601	495,601	100%
SID-99	5,726	8,270	144%	50,542	73,699	146%
SID-17	76,987	68,856	89%	481,970	613,616	127%
SID-29	68,237	42,505	62%	12,211	378,783	3102%
SID-06	76,233	29,398	39%	797,592	261,982	33%
SID-78	2,318	5,685	245%	15,022	50,665	337%
SID-62	3,855	8,582	223%	138,420	76,481	55%
SID-09	14,870	24,388	164%	149,571	217,334	145%
SID-67	11,293	8,700	77%	36,493	77,527	212%
SID-44	68,585	44,733	65%	401,567	398,641	99%
SID-28	25,453	23,858	94%	172,157	212,610	123%
SID-18	26,206	15,748	60%	290,566	140,343	48%
<b>All Projects</b>		61%			100%	

### 3.3 Evaluated Results

This section presents the VGS at the project and aggregated level and the VGSRR following DPS guidelines<sup>18</sup>. The purpose of the evaluation is to verify that savings reported to the DPS in Scorecards are being realized. While the initial plan had been to use all nine completed projects to compute the VGSRR, the final analysis included four projects where a) the training had been substantially completed by early 2019; b) billing data was available; c) there was corroborating engineering evidence for the billing results; and d) the projects was noted as Complete in the Scorecard. A fifth “Complete” project was included to ensure as representative a sample as possible and because the savings outcome was conclusive and not uncertain. These five projects account for 36% of the CEF reported electricity and contributing natural

<sup>18</sup> CE-08 Gross Savings Verification Guidance 2019-08-23

gas savings for Completed projects. While this approach mitigates some of the uncertainty introduced by COVID and led to inclusion of more corroborating evidence, it does introduce a potential selection bias.

### 3.3.1 Site Specific Results

This section presents the site-specific results from the billing analysis for all the sites, including those sites where the findings were compromised by Covid or other factors.

Table 3-6 presents the electricity billing analysis results for all thirteen assessed projects. The base electrical usage is the weather-normalized annual usage from the BOM Report.

**Table 3-6. Electricity Billing Results (MWH)**

Project ID*	Base Electricity Annual Usage	Scorecard Electricity Annual Savings	Tracked Saving Fraction	Evaluated Electricity Annual Savings	Evaluated Savings Fraction
SID-88 C/T	128,316	415	0.3%	1,857	1.4%
SID-61 C/T	55,613	5,561	10.0%	1,872	3.4%
SID-99 C/T	5,726	599	10.5%	392	6.8%
SID-17 C/T	76,987	1,721	2.2%	(4,023)	-5.2%
SID-29 C/T	68,237	1,275	1.9%	2,734	4.0%
SID-06 E/T	76,233	2,159	2.8%	1,549	2.0%
SID-78 C/T	2,318	127	5.5%	(183)	-7.9%
SID-62 E/T	3,855	121	3.1%	207	5.4%
SID-09 E/T	14,870	1,951	13.1%	114	0.8%
SID-67 C/T	11,293	261	2.3%	743	6.6%
SID-44 C/A	68,585	2,237	3.3%	-	0.0%
SID-18 C/A	26,206	945	3.6%	(156)	-0.6%
SID-28 E/A	25,453	2,531	9.9%	575	2.3%
			3.5%		1.0%

\*Legend: C/E Scorecard status of Completed/Encumbered; A/T Atypical or Typical Project  
Highlighted projects were included in the VGSR.

Table 3-7 presents the purchased natural gas billing analysis results for all thirteen projects. The base natural gas usage is the weather-normalized annual usage from the BOM Report. As noted in Section 3.2.3, natural gas impacts in this table are based on natural gas purchases, and do not account for all thermal energy impacts at the site.

**Table 3-7. Purchased Natural Gas Billing Results (MMBTU)\***

Project ID*	Purchased NG Annual Usage	Scorecard NG Annual Savings	Tracking Annual Savings Fraction	Evaluated Purchased NG Savings	Evaluated Savings Fraction
SID-88 C/T	33,976	3,695	11%	(690)	-2.0%
SID-61 C/T	495,601	49,560	10%	9,313	1.9%

Project ID*	Purchased NG Annual Usage	Scorecard NG Annual Savings	Tracking Annual Savings Fraction	Evaluated Purchased NG Savings	Evaluated Savings Fraction
SID-99 C/T	50,542	4,716	9%	5,069	10.0%
SID-17 C/T	481,970	15,340	3%	-29,654	-6.2%
SID-29 C/T	12,211	11,363	93%	977	8.0%
SID-06 E/T	797,592	24,008	3%	42,192	5.3%
SID-78 C/T	15,022	674	4%	1,456	9.7%
SID-62 E/T	138,420	7,512	5%	7,330	5.3%
SID-09 E/T	149,571	17,387	12%	6,821	4.6%
SID-67 C/T	36,493	2,326	6%	556	1.5%
SID-44 C/A	401,567	19,932	5%	0	0.0%
SID-18 C/A	290,566	8,421	3%	-10,499	-124.7%
SID-28 E/A	172,157	16,297	9%	5,650	34.7%
			5.9%		1.3%

\*Legend: C/E Scorecard status of Completed/Encumbered; A/T Atypical or Typical Project  
Highlighted projects were included in the VGSR.

\* Natural gas impacts are based on the reported natural gas purchase, ignoring district steam impacts (“Purchased Natural Gas”).

Table 3-8 presents the contributing natural gas billing analysis results for all thirteen projects. The contributing natural gas usage is the weather-normalized annual usage from the BOM Report. As noted in Section 3.2.3, natural gas impacts in this table include the impacts of district steam savings.

**Table 3-8. Contributing Natural Gas\* Billing Results**

Project ID*	Contributing NG Annual Usage	Scorecard NG Annual Savings	Tracking Annual Savings Fraction	Evaluated Contributing NG Savings	Evaluated Savings Fraction
SID-88 C/T	1,091,227	Not reported		96,938	8.9%
SID-61 C/T	495,601	49,560	10%	9,313	1.9%
SID-99 C/T	50,542	4,716	9%	5,069	10.0%
SID-17 C/T	481,970	15,340	3%	(29,654)	-6.2%
SID-29 C/T	609,801	Not reported		(52,460)	-8.6%
SID-06 E/T	797,592	24,008	3%	42,192	5.3%
SID-78 C/T	15,022	674	4%	1,456	9.7%
SID-62 E/T	138,420	7,512	5%	7,330	5.3%
SID-09 E/T	149,571	17,387	12%	6,821	4.6%
SID-67 C/T	95,427	Not reported		3,011	3.2%
SID-44 C/A	401,567	19,932	5%	-	0.0%
SID-18 C/A	290,566	8,421	3%	(10,499)	-3.6%
SID-28 E/A	172,157	16,297	9%	5,650	3.3%
			5.9%		1.8%

\*Legend: C/E Scorecard status of Completed/Encumbered; A/T Atypical or Typical Project  
Highlighted projects were included in the VGSR.



### 3.3.2 Program-Level Savings and VGRSS

The VGRSS was computed for the five projects with a Scorecard status of Complete by September 30, 2021 and that met the selection criteria for reliability. Table 3-9 summarizes the impacts by project and for the program achievements to date. The ratio of the sum of the evaluated savings divided by the sum of the Scorecard estimates savings is the VGSRR. As noted in the previous section, the natural gas VGSRR is presented in two ways, in the first, considering only impacts on purchased natural gas, while the second includes the impacts of significant district steam consumption impacts that would not otherwise be accounted for.

**Table 3-9. Program VGRSS Development**

Project ID*	Scorecard Elec (MWH)	Evaluated Elec (MWH)	Scorecard Purchased NG (MMBTU)	Evaluated Purchased (MMBTU)	Evaluated Contributing NG (MMBTU)
SID-88	415	1,857	3,695	(690)	96,938
SID-99	599	392	4,716	5,069	5,069
SID-29	1,275	2,734	11,363	977	(52,460)
SID-67	261	743	2,326	556	3,011
SID-44	2,237	-	19,932	0	-
<b>Total</b>	<b>4,786</b>	<b>5,726</b>	<b>42,033</b>	<b>5,912</b>	<b>52,559</b>
<b>VGRRS</b>		<b>120%</b>		<b>14%</b>	<b>125%</b>

Table 3-10 and Table 3-11 present the VGSRR values in the format required by the DPS.

**Table 3-10. Direct Impact Reporting Table 1**

Type (VGSRR/APRR)	Effective from date (Year Quarter)	Effective until date (Year Quarter)	Electricity Savings Annual MWh (Realization Rate)	Natural Gas Savings Annual MMBtu (Realization Rate)
VGSRR	2017 Q1	2021 Q3	120%	125%

**Table 3-11. Direct Impact Reporting Table 2**

Parameter (Description of strata)	Realization Rate Analysis Type - Weighted/Unweighted	Realization Rate - by Strata	Confidence Interval/ Relative Precision (by strata)	Sample Size (n) (by strata)	Population Size (N) (by strata)
<b>Program</b>	Unweighted	Program	±70% (Electric) ±272% (Gas) at the 90% confidence level	5	9

### 3.3.3 Limitation of Billing Analysis and Engineering Approach

There are limitations to both the billing analysis and engineering estimates of savings which are discussed in this section.

**Billing Analysis Limitations.** The evaluated savings used two methods of billing analysis. For those energy streams with utility-provided monthly data, the billing analysis followed the CalTrack methodology. The rest of the energy streams were analyzed using the six-month interval BOM Report billing data applying an energy adjustment.

The consumption data analysis (billing analysis) is an important, empirical approach to estimating change in consumption over time with weather effects removed. Utility billing analysis – in this case, using the CalTRACK method – tracks the whole building energy consumption in the pre-program period and uses the model results to estimate baseline consumption in the post-program period. The difference between model-based baseline consumption and actual post-program consumption does not separate the program impacts from other non-routine events or other natural trends on the building’s energy consumption. The facilities included in this analysis are dynamic, with fluctuations in occupancy and modification of space and function occurring continuously. While the analysis has controlled for COVID-19 lockdown effects by excluding lockdown periods from the analysis, other non-routine events are not accounted for with the exception of a known combined heat and power failure at one project site. Further, site contacts had difficulty recalling specific changes that may have occurred during the baseline and performance periods and were reluctant to even attempt to gather specifics like occupancies or major construction. This means that a pre-post estimate of savings also includes non-program effects and may over- or under-estimate savings as a result.

The issue is not necessarily one of insufficient data. Based on the information included in Table 3-12, fitted models for 54% of the billing accounts have an R-squared value greater than 0.7, which indicate that the quality of some of the models is reasonable and the billing consumption of the majority of the impacted buildings significantly correlate with outside air condition. However, for most of the buildings included in this study, we would expect this correlation with weather, and the lack of correlation is likely an indication that not enough data were available to establish that correlation. Utility billing data, usually consisted of monthly data, hide a lot of information about building operation and energy usage pattern. More granular energy consumption data such as daily or hourly data could solve this challenge. Regardless, improved data alone would not address the challenges of this evaluation.

Table 3-12 presents the distribution of the model fitness across all impacted buildings

**Table 3-12. Distribution of model fitness across all impacted buildings**

Report ID	Number of Models	R-squared distribution (as a fraction of the number of models)				
		>0.9	>0.7	>0.5	>0.3	0
<b>SID-62</b>	108	24%	20%	15%	10%	31%
<b>SID-29</b>	10	60%	0%	30%	0%	10%
<b>SID-67</b>	7	14%	14%	14%	14%	44%
<b>SID-06</b>	104	51%	22%	16%	3%	8%
<b>SID-09</b>	3	100%	0%	0%	0%	0%
<b>SID-28</b>	21	5%	10%	19%	14%	52%
<b>SID-61</b>	45	36%	11%	24%	18%	11%
<b>All Projects</b>	298	36%	18%	17%	9%	21%

There are two common and accepted ways of addressing non-routine events in commercial buildings. The first, developing a comparison group which consists of matched non-participants, is difficult in New York given the challenges of accessing non-participant data. The comparison group approach works on the assumption that the matched comparison group, on average, has non-routine events and other non-program impacts that are equal to those the participants experience. Those exogenous consumption effects estimated for the comparison group are combined with the participant pre-post estimate to provide the final non-routine-event-adjusted savings estimate. Comparison groups can be challenging in non-residential applications as good matches are hard to find, consumption tends to be relatively variable, and the number of participants is too small to support a reasonable level of precision in the aggregate result.

A more common and practical approach is the SEM approach, which maintains a close relationship with the personnel at the site. The ongoing relationship makes it possible to track non-routine events that will affect the pre-post savings estimates. However, SEM is usually based on more granular data than monthly. As with all consumption data, SEM generally recognizes that savings of less than 5% are difficult to estimate reliably in a pre-post billing analysis context.

Last, when leveraging the BOM data, 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. This approach is similar to engineering calculations in that there are no statistical reliability indicators.

**Engineering Analysis Limitations.** Engineering estimates rely on first identifying the specific measures or actions that occurred as a function of the training and then with gathering sufficient details to characterize the measures parameters to estimate savings. Very few projects included Opportunity Logs or audit reports which identified measures and either estimated the impacts or provided enough measure description to estimate savings. Site contacts had difficulty recalling specific actions two to four years after the events.

### 3.3.4 BOM Savings Compared to Other Similar Programs

**Performance of Other Similar Programs.** The WFD program resembles other programs that have been delivered and evaluated in other jurisdictions. These programs have in common the following: the participant is provided with information which is expected to induce behavior at the site to reduce energy usage. A Home Energy Report (HER) program provides information that while specific about the site (usage), does not direct site specific actions. The Building Operation Certification (BOC) targets increasing the knowledge and skills of individuals in operating buildings with the expectation the principles could be applied at any buildings. A SEM program targets increasing the capabilities and commitment of the organization to reduce energy use at the facility. Because SEM typically targets industrial facilities, the staff have had the fundamental training to operate the equipment. Table 3-13 summarizes the characteristics of the similar program models and includes a link to an illustrative impact evaluation.

**Table 3-13. Summary of Evaluated Findings for Similar Program Models**

Program type	Description	Savings fraction
<b>Home energy report</b>	Provides customers a hardcopy or emailed comparison of their energy use compared to their ‘neighbors’ and includes general recommendations and links to programs. This program has been widely deployed and evaluated using sophisticated statistical analysis <a href="https://pda.energydataweb.com/api/view/2144/CPUC_GroupA_Res_PY2017_HER_DRAFT_20190301_toPDA.pdf">https://pda.energydataweb.com/api/view/2144/CPUC_GroupA_Res_PY2017_HER_DRAFT_20190301_toPDA.pdf</a>	~1%
<b>Building Operator Certification</b>	NEEA license a training curriculum with classroom materials and administers an exam. Certification requires many classroom hours and passing an exam. <a href="https://www.theboc.info/wp-content/uploads/2020/08/2020-BOC-Energy-Savings-FAQ_1.0.pdf">https://www.theboc.info/wp-content/uploads/2020/08/2020-BOC-Energy-Savings-FAQ_1.0.pdf</a>	~2.5%
<b>Strategic Energy Management</b>	Targets industrial customers with technically proficient staff and trains to identify, meter and quantify energy savings. Includes on-going engagement with activities including “Treasure Hunts” (escorted walk-throughs of facilities to identify measures), monthly update of the Opportunity Log, and regular Green Team meetings. A core element of SEM programs is the rigorously developed energy models which begin with a “hypothesis model” that statistically matches the baseline conditions by incorporating other independent variables such as weather, production, product type and facility schedule. <a href="https://pda.energydataweb.com/api/view/2582/GroupD-SEM%202018-19%20Impact%20Evaluation%20PDF%20Final.pdf">https://pda.energydataweb.com/api/view/2582/GroupD-SEM%202018-19%20Impact%20Evaluation%20PDF%20Final.pdf</a>	~5%

The WFD is most like the BOC certification training, since the content was designed to increase the knowledge and skills of the individuals with the expectation that they will implement energy efficiency actions at the site. While WFD training was like BOC certification, it was usually less comprehensive. Of the approximately five hundred individuals trained in the reviewed projects, very few BOC certifications were earned as a result of this training although there are other certifications awarded. While some projects adopted elements of the BOC curriculum, classroom hours were much less, in the order of 12 hours per trainee compared to the 60 hours of classroom BOC certification training. A few of the sites implemented SEM elements, most notably the Opportunity Log and Green Teams, however, those were the exception. The WFD program also does not require rigorous statistical modeling of the facility, a key focus of SEM since performance is tied to billing analysis.

### 3.4 Conclusions and Recommendations

Based on the initiative's findings presented above, the Evaluation Team offers the following conclusions and recommendations.

**Conclusion 1: There is uncertainty in the estimates of savings.** The billing analysis relied on six-month data intervals provided through the BOM Program about half of the time and monthly billing data for the balance. The project files rarely noted non-routine events which is critical in these dynamic properties.

The corroboration of savings was significantly hampered by the lack of supporting information in the project files for some of the projects. Detailed training curricula and related materials can be used to identify the kinds of actions staff were trained to conduct; however, these documents were not routinely included in the project files. A record or log of actions taken by staff during the two-year post period can be used to identify specific measures implemented by staff, but this type of information was not routinely included in the files.

- **Recommendation 1:** Acquire billing release and account data with regular utility billing updates. At project initiation, obtain program billing release and account numbers for all delivered fuels for all buildings participating in the program. NYSERDA should test and confirm the accounts by requesting the historical data for all accounts from the applicable utilities. Accounts that fail to be acquired can be cross-checked and corrected with the participant while NYSERDA has leverage. NYSERDA should request updates of billing data via EDI every six to twelve months as the project proceeds through the performance period. At this stage, only a confirmation of utility data received is required, not a detailed analysis.
- **Response to recommendation 1:** Implemented. Program staff and evaluation have already begun the process of getting the utility bills collected. Staff will collect the release forms and provide

them to evaluation. Evaluation will then add the WFD projects to the python program created for collecting EDI data. The data will be collected every 6 months.

- **Recommendation 2:** Report usage in monthly intervals in the BOM Report. Capturing billing data continuously improves the availability of billing data, however, the BOM Report has its own value and should continue. The BOM Report includes unregulated fuels, which can be significant energy streams; it provides a cross-check to the utility billing data; and it allows the participant to observe progress. However, the current BOM design aggregates billing data into six-month intervals aggregated across the portfolio, which degrades the billing analysis. Monthly intervals by building will markedly improve the reliability of the analysis. Properties are billed by energy providers, so it is reasonable to ask for the monthly resolution and it was not uncommon to see monthly data included as a tab in the BOM Report. The Program can still maintain a six-month interval for providing updated data, however, the resolution of the data in the spreadsheet should be at the same resolution as the source billing data.
- **Response to Recommendation 2:** Implemented. With the transition to the collection of utility data release forms and the regular pulls of monthly utility data in coordination with the NYSERDA Evaluation team, projects will no longer be required to submit the compiled 6-month data metrics as part of the BOM reporting process.
- **Recommendation 3:** Include a more expansive (and required) non-routine event log in the BOM Report. The BOM Report does include a section for reporting non-routine events, however, it was rarely used. In these dynamic properties, something is always changing, although it is not possible nor necessary to track every change in the facility. However, the BOM Report could be modified to request input by building if undergone significant changes during the reporting period, such as “No longer in the portfolio,” “Percent under major renovation,” or “Percent repurposed.”
- **Response to Recommendation 3:** Implemented. The Program is collecting information with quarterly reports to identify any changes in the building list included in the project. The Program will update the data requested in the quarterly reports to encourage participants to provide a greater level of detail about major physical or operational changes occurring in the impacted buildings.
- **Recommendation 4:** Include a detailed description of the training curricula and its content in the project file. The training curricula provides a basis for corroborating engineering estimates of savings by identifying the types of actions staff were trained to do.

The program reporting should also include regular reporting of the energy reduction actions taken by trained staff (sometimes referred to as an Opportunity Log). This record of actions forms a basis for corroborating engineering estimates, but it also can help focus and motivate trained staff to identify and implement measures.

**Response to Recommendation 4:** Implemented. Participants for active projects are required by their contractual Scope of Work to submit detailed descriptions of training content, including curricula as well as electronic versions of training materials, as a deliverable to NYSERDA, so this information will be available for future engineering analyses.

Regarding part 2 of this recommendation, proposers structure their training programs in different ways to best meet the needs of the particular building owner/portfolio manager customer. In some cases, incorporating the tracking of completed actions is a valuable part of the training effort, but in other cases, factors such as the organizational structure, existing activity tracking strategies already employed, use of outside consultants for various services, etc., may result in this type of deliverable not being a good fit for a project. NYSERDA will recommend this as a valuable project activity and one that may leverage existing tracking systems already used by facilities to track their activities. NYSERDA will not collect individual maintenance logs for each building for each project, however, participants will be notified that this information should be made available upon request.

- **Recommendation 5:** Require program participants to continue to meet program reporting requirements for at least one year after the conclusion of training. While the benefits of training may begin to accrue from the first day of training, the full benefits may not appear until after training has been completed and put into action.
- **Response to recommendation 5:** Implemented. With the new process to collect utility data via data release authorizations and the EDI tool, evaluation staff will be able to access data for at least one year after the conclusion of the training.

**Conclusion 2: The evaluation has confirmed positive changes in terms of energy savings, across all the projects** and robust average savings for the five sites included in the VGSRR. However, the small sample size and highly variable results led to poor precisions. There is also uncertainty introduced by the non-random selection of projects for inclusion that is not reflected in the precision. While the findings do not meet the precision targets, they reflect the best available data for this set of projects, especially given the impact of COVID and the limitation of collecting information from 2018 and 2019.

- **Recommendation 1:** Apply the VGRSS identified in Table 3-10 and b to report Complete project evaluated gross savings.
- **Response to Recommendation 1:** Implemented. The savings have been applied to the VGRSS.
- **Recommendation 2:** Improving the certainty of the results will require additional documentation corroborating the impacts of the training as recommended above. Since it is unrealistic to expect that these varied and sometimes subtle actions can be recalled accurately years later, it is also recommended that the necessary corroborating project data is collected and undergoes a quality assurance review at regular intervals soon after the reporting period has concluded. The BOM program may be a good candidate for a ‘real time’ or embedded evaluation approach, where the evaluator collects some of the required data directly from the customers and conducts primary research of in-progress projects at regular intervals. The evaluator, for example, could collect the billing data and add follow-up questions about apparent non-routine events observed in recent billing data or confirm actions noted in an Opportunity Log.
- **Response to Recommendation 2:** Implemented. The evaluation team is conducting a “real time” evaluation as recommended. As a part of this, the evaluation team will also be collecting EDI data for the program on a regular basis (6-month intervals).

**Conclusion 3: It appears the savings estimates are not updated when the project is complete with readily available baseline annual usage from the BOM Report.** Project savings are estimated early in the customer enrollment as a function of the participant’s reported energy bills (in dollars), conversion of bills (in dollars) to energy use, and a saving fraction assumption proposed by the contractor. In the current estimates, annual usage that is factored into the estimate of the project savings understates the actual electric usage by about 40%. Neither the gas nor electric actual annual usage corresponds well to the annual usage assumed by NYSERDA in the initial estimates of savings. As another issue, some of the projects did not report district steam or fuel oil impacts, even though they are included in the BOM Report, and the training activity will impact these streams.

- **Recommendation 1:** Revise project savings prior to reporting as Complete in the Scorecard. Prior to closing a project and reporting the savings as Complete in the Scorecard, the energy use should be updated with the BOM Report annual baseline usage.
- **Response to Recommendation 1:** Implemented. The savings have been applied to the VGRSS.



- **Recommendation 2:** Report all savings streams. The program did not report all the fuels noted in the BOM Report. Utility provided district steam and fuel oil should be reported in the Scorecard in the appropriate columns. Energy imported from a non-utility provider, such as steam or hot water, can be converted to equivalent natural gas.
- **Response to Recommendation 2:** Implemented. The evaluation team is conducting a “real time” evaluation as recommended. As a part of this, the evaluation team will also be collecting EDI data for the program on a regular basis (6-month intervals).

## 4 Indirect Savings Findings and Recommendations

This section presents findings on BOM indirect savings. The indirect savings capture market diffusion and associated indirect impacts that occur over the mid to long term with a market transformation program. The BOM indirect savings methodology follows NYSERDA’s indirect savings framework described in the “Indirect Benefits Evaluation Framework”. The Evaluation Team found no indirect savings for the Talent Pipeline.

### 4.1 BOM

To estimate indirect savings for the BOM, the Evaluation Team used the survey and program data inputs to determine the magnitude of the causal linkage between program activities and a market response. These linkages, along with other findings, determined the segmentation of the New York building space served by the target population. Program savings impacts overlaid the segmentation to determine the evaluated indirect savings.

#### 4.1.1 Program Activities and Expected Outcomes

The Partnerships program theory and logic were reviewed to theorize linkages and causality between program activities and expected outcomes. Table 4-1 summarizes the four pathways hypothesized as leading to indirect savings as well as the questions in the survey that may provide evidence of the pathway.

**Table 4-1. Indirect Savings Causation Analysis for Achieving Direct and Indirect Energy Savings**

Program Activities	Expected Outcomes	Survey Questions
Develop sustainable in-house training infrastructure via Train-the-Trainer (NYTTs) and direct training of staff	Extends training to additional staff increasing the savings captured by the owner.	Participants were asked to what extent they conducted internal training of staff that was influenced by the NYSERDA WFD experience.
	Employer sponsors additional third party non-NYSERDA sponsored training leading to more staff trained	Owner reported number of staff receiving third party non-NYSERDA training that was influenced by the NYSERDA WFD experience.
	Trainees carry learning when taking a new job.	Rate of staff turnover reported by owners in surveys.
Competitive solicitations for innovative approaches to intervention	Solicitations expand the capabilities of third party contractors so they can train more workers.	Participating training providers were asked about the number of staff trained without NYSERDA funding and how that was influenced by NYSERDA WFD experience.

#### 4.1.2 Quantitative Inputs

This section describes the quantitative inputs that were used to calculate indirect savings.

**Total building area** served by O&M staff in New York. Value: 6.148 billion square feet.

The latest WFD PON 3715 notes, “This program targets the operations and maintenance workforce employed in the following building types: multifamily housing, office buildings, retail, colleges and universities, hospitals and health care facilities, state and local governments, not-for-profit and private institutions, industrial facilities, and public and private K-12 schools.” Based on this definition, the non-participant sample of facility managers was selected from across these sectors, including the industrial sector. The sample frame was the Trade Press Media (“TPM”) list of owners and facility maintenance executives at commercial, institutional, and industrial facilities in New York and provides the square-footage of the area served, which is 6.1 billion square feet. This figure was used as the estimate of the total area served by the target population in New York rather than the 5.2 billion square feet estimated by NYSERDA, which did not include the industrial sector.

Responses were expanded to the populations (either participant or non-participants) by applying stratum case weights and the building area served by the organization.

- **Participating square footage.** Value: 22 million square feet and 327 million square feet of completed and encumbered building area served by the participating organizations.

This area is the sum of the total square-footage recorded in the NYSERDA’s WFD “Budget and Benefits Assumptions Impacts and Fuel Neutrality” excel workbook (or “BAB”). Missing project square footage was imputed using the population average square-footage.

- **Percentage of O&M staff trained statewide.** Percentage of staff trained: Participants (67%), non-participants (45%) and combined (46%) as of 2020.

The percentage of staff trained is based on the participant and non-participant responses to the questions asking for the number of total O&M staff and the percentage that had received formal O&M training sponsored by the organization. Participants included encumbered and completed projects.

- **Non-NYSERDA-sponsored training:** Percentage of participant staff offered non-NYSERDA-sponsored formal internal training and third-party training (41%) as of 2020.

The percentage of the workforce offered non-NYSERDA-sponsored training was based on participant response to the questions about the percentage of the staff that had received formal internal training or third-party training without NYSERDA incentives.

- **NYSERDA influence:** For participating owners, the influence factor of NYSERDA on offering non-NYSERDA-sponsored training (12%).

Participating owners that provided non-NYSERDA sponsored training to their staff were asked how the experience with NYSERDA influenced the decision to offer that training on a 0-10 scale where 0 means the experience with NYSERDA was not at all influential to 10 means it was highly influential.

- **Staff turnover:** Percentage of participants’ employees taking a new job (2.1%)

The percentage of the participant workforce that took new jobs in 2019 is based on the participant response to question of how many of the O&M staff left to work elsewhere, not including those who were terminated, laid off, or were retired. This factors into trained staff bringing training to their new job.

- **Training providers.** Percentage of training providers reporting training of non-NYSERDA trainees and whether the training was influenced by the participation in WFD (0%).

This metric was intended to account for non-NYSERDA sponsored training by NYSEDA influenced trainers. No trainers reported that they provided training to non-NYSERDA trainees and that they were influenced by the experience with the program.

- **Average savings per square-foot:** Electricity savings (kWh/sq ft) and thermal savings (MMBTU/sq ft) derived from the impact evaluation.

### 4.1.3 Indirect Impacts

Leveraging the inputs referenced above, calculating the indirect savings was a two-step process. The first step was to establish the total area of buildings served by the O&M staff associated with the segments shown in Table 4-2, and expressed in square feet. In the second step, the segment associated with indirect savings was multiplied by the average savings per square foot determined in the impact evaluation, yielding the indirect savings for electricity and natural gas.

**Table 4-2. Partnerships Adopter Groups with Employer-Sponsored Training**

Segment	Savings type	Trainee Type	Total Building Area	Data source for revised values
Served by Un-trained O&M staff	No savings	Area served by untrained staff	3,320,457,823	Participant and non-participant surveys
All Trainees (25% in BAB)	Direct	Area served by staff trained under the WFD program	22,665,629	BAB reported areas
	Indirect	Area served by staff receiving formal non-NYSERDA training that was influenced by the WFD program	5,479,608	Participant surveys
		Area served by staff trained under the WFD program that now work at another property	475,978	Participant surveys
	No savings	Area served by trained staff without WFD influence.	2,799,916,931	Participant and non-participant surveys
Total Market			6,148,995,969	Trade Press Media Sample Frame Sq-ft

Table 4-3 presents the indirect annual savings associated with projects with a Complete and Encumbered status in the Scorecard as of September 30, 2021. Program reported direct annual savings are provided for comparison. This represents the accumulated program indirect savings since program inception.

**Table 4-3. Indirect Savings Summary**

	<b>Electric Savings</b>	<b>Units</b>	<b>Natural Gas Savings</b>	<b>Units</b>
<b>Indirect Area</b>	5,955,586	Square feet (sqft)	5,955,586	sqft
<b>Average savings/sqft</b>	0.77	kWh/sqft	7,200	BTU/sqft
<b>Indirect annual savings</b>	4,628	MWh	43,109	MMBTU
<b>Direct annual reported savings of completed projects</b>	13,141	MWh	116,028	MMBTU
<b>Indirect annual savings as percentage of direct</b>	35%		37%	

The indirect savings represents an additional program contribution primarily arising from the extension of the participant training to other staff within the participant organization and through staff bringing their training to new employers.

## 4.2 Talent Pipeline

The IP states that “Energy savings are not calculated for the Talent Pipeline initiative” and “No Realization Rate will be determined for this initiative as there are no energy savings.” However, without a sufficient workforce, the clean energy sector will miss company sales goals or incur higher costs, therefore, fewer savings will be achieved. The Talent Pipeline program activity reduces the risk that the workforce will be insufficient to meet statewide clean energy goals.

While workforce capacity is critical to meeting goals, how the State progresses to its goals is charted by counting the number of measures installed (e.g., 1,000 MW of wind turbines capacity installed in 2025). That progress is accounted for in other NYSERDA programs through direct and indirect impact estimates. Thus, adjusting the capacity to 1,100 MW because Talent Pipeline supported the hiring of 10% of the workforce would misinform progress toward the goals because of the overlap with other savings claims.

Furthermore, the Talent Pipeline sponsors new hires in the clean energy workforce and does not sponsor the implementation of specific activities or measures at a physical location. Tracking of trained workers’ job location and whether they implemented specific activities at a physical location over time is very difficult and not done. Thus, there is no possibility of tying a project to an indirect savings estimate.

## 5 Methods

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This chapter describes the methods used and the methods that will be used to develop estimates of WFD program market indicators and impact estimates for the BOM Only participant population from project years 2017 through 2021.

### 5.1 Performance Indicator Assessment Methodology

#### 5.1.1 BOM

##### 5.1.1.1 Secondary Data Review

The Evaluation Team reviewed secondary data to inform the indicator estimates NYSERDA wanted to measure. The secondary data sources aided in the following:

- The development of participant and non-participant survey instruments
- Identifying the contact information for participants and non-participants
- The refinement of a sampling strategy for non-participants
- Identifying any information to use for estimating the baseline program performance indicators and change in indicators over time

Table 5-1 summarizes the documents the team reviewed.

**Table 5-1. Documents Reviewed for Secondary Data**

Documents	Summary Content	File Type
CEF Workforce Development Industry investment plan	NYSERDA investment plan outlining workforce development and training initiatives. Specifically, it details Building O&M approach to workforce training and includes a description of target market characterization, stakeholder/market engagement, theory of change, budgets and expenditures, and progress and performance metrics.	PDF
Program Opportunity Notice (PON) 3442 and 3715	Reviewed the latest Building O&M 3715 PON as well as the original 3442 PON. The latest PON included PON summary, eligibility criteria, budget allocated, and proposal instructions.	PDF
Program Files	The team received an Excel files of all participants and documentation participants provided to NYSERDA (e.g., quarterly reports, attendance sheets). The Excel and other data included limited contact information; names and count of participants (organizations, trainers); contract date; and characteristics of participating organizations (type of company, etc.).	PDF, Word, PPT, and Excel files

While most data for participants were derived from the semi-structured interviews, some data were extracted from the program files themselves.

##### 5.1.1.2 Primary Research: Participant Surveys/Interviews to Gather Data for Program Indicators

Since 2017, when the initiative launched, and through August 2021, NYSERDA has funded 46 contracts across 20 Building O&M applicants (Table 5-2). Applicants were either owners or property managers of

O&M staff, professional organizations facilitating training, or actual training providers working with owners or property managers.

Most contracts (36 out of 46) were executed under the PON 3715. Additionally, the majority of PON 3715 contracts were held by training providers. There were eight training providers who held contracts with NYSERDA directly, and two of them held 25 of the total 46 contracts.

The program tracking data also revealed that all contracts are multi-year contracts (lasting for about 2 years on average).

**Table 5-2. Building O&M Contracts and Applicants (Source: Program Data Through Q3 2021)**

Participant Groups	Type of Applicant	Count of Complete or Active Contracts	Count of Unique Applicants Across Contracts	Count of Impacted Bldgs.
PON 3442	Owner/Property Manager	9	9	472
PON 3442	Professional Association <sup>a</sup>	1	1	72
PON 3442	Training Provider	-	-	-
PON 3715	Owner/Property Manager	3	2 <sup>b</sup>	97
PON 3715	Professional Association <sup>a</sup>	1	See Table Note “a”	
PON 3715	Training Provider	32	8	4,673
<b>Total</b>		<b>46</b>	<b>20</b>	<b>5,314</b>

<sup>a</sup> The same professional organization that applied and won the NYSERDA contract under the PON 3442 applied and won the second contract with NYSERDA under the PON 3715. Note that this organization facilitated WFD-sponsored O&M training for school districts.

<sup>b</sup> Three owner/property manager applicants won a contract under the PON 3715. One of these three applicants also received a contract under the PON 3442, and thus were counted under that category.

Note that certain training providers held multiple contracts where training was provided to the same organization. For example, one training provider held four contracts where training was provided to the same property management company. Each of these four contracts represented one asset (either a large building or a set of buildings) and each asset was under a separate legal entity (or an LLC). However, the same property management company managed all four assets. Given this context, the team observed that the 46 contracts referenced above resulted in training of 33 unique owner/manager organizations and a group training of about 109 school districts through a professional association.

Table 5-3 lists the participant groups the team interviewed and the total number of completed interviews and/or surveys. Note that the team reached out to all contacts.

**Table 5-3. Summary of Participant Data Collection**

Participant Groups	Population	Completed Interviews	Confidence / Precision	Data Collection Approach
Owner/property manager – i.e., sent O&M staff to WFD Building O&M funded training	45 contracts which resulted in training of 33 unique organizations with O&M staff	13 with unique organizations <sup>a</sup>	85% / 15%	Phone semi-structured interview

Participant Groups	Population	Completed Interviews	Confidence / Precision	Data Collection Approach
School Districts with O&M staff	1 contract with an association facilitating training for 109 school districts	32 with school district O&M supervisors/staff <sup>b</sup>	90% / 12%	Web survey
Training providers – i.e., those who conducted the training <sup>c</sup>	~13 <sup>c</sup>	8	90% / 15%	Phone semi-structured interview

<sup>a</sup> Twelve completed the whole interview and one answered 50% of the questions asked.

<sup>b</sup> The responses to this survey were summed and counted as the responses for one participant since this group was represented under one contract with NYSERDA.

<sup>c</sup> The team counted training providers who held WFD Building O&M contract(s) (n=8) as well as training providers who were subcontracted by owner/property managers and did not hold WFD Building O&M contract (n=5). The team counted only those who provided at least one training session to date.

The interviews assessed participant characteristics: job title, number and organization of O&M staff and whether they are employees of the participant or a third-party provider, number and square footage of buildings, building class, and number of clients of participants that are property management firms. The interviews also assessed the initiative’s indicators and/or assumptions: O&M staff skills and training received; number of paid O&M internships and apprentices, and number of interns advanced to full-time employment; number of O&M staff that received promotions or advancements; number of disadvantaged workers hired into O&M jobs; number of O&M staff that left the company and degree to which turnover was a problem; and the time needed to find and hire new talent. Finally, the interview assessed whether the plan for the new training was to use existing curricula without modification, to modify existing curricula, or to develop entirely new curricula. And if modifications or new curricula, what were they and why were they needed? Training providers answered questions related to training and curricula; all other respondents responded to all other O&M workforce questions referenced above.

The team completed interviews from September 2021 to March 2022. The interviews were combined with impact evaluation interviews to minimize the number of times the Evaluation Team reached out to participants.

**5.1.1.3 Primary Research: Non-Participant Surveys to Gather Data for Program Indicators**

The non-participant survey was designed to be analogous to the participant survey. This was done so the non-participant responses could be compared to the participant responses. The only difference between the participant and non-participant surveys was that the non-participant survey did not include questions related to training.



During the WFD Building O&M baseline study<sup>19</sup>, the NYSERDA program staff indicated that the WFD target population for the initiative is organizations that own or manage big buildings or substantial square footage (50,000 square feet or more) and employ at least two O&M staff. The baseline study team used this information to define the target population for the non-participant survey. During the project initiation meeting for this study, the program staff indicated that they require the minimum threshold or energy expenditure of at least one million dollars for organizations to be eligible for Building O&M NYSERDA-funded training. A building of less than 50,000 square feet is unlikely to spend that amount of energy; however, one can have a lot of little buildings that an owner or property management firm manages that would fit the description of at least one million of energy spent.

The team examined the building square footage information of participating buildings (i.e., buildings managed by those who attended the WFD Building O&M funded training) to assess the size of the buildings affected by the program. Based on 159 buildings for which we had data, the average square feet per building was 300,000. The smallest building affected by the program was about 11,000 square feet and the largest was about 2,800,000 square feet. Out of 159 buildings, only 20 (13%) were below 50,000 square feet in size. This indicates that buildings affected by the program were generally larger than 50,000 square feet. Thus, the team continued with the baseline study approach, targeting 50,000 square feet or larger buildings and leveraging the Trade Press Media (“TPM”) list to identify non-participant facility and O&M staff of those buildings.

The TPM is a subscriber list of ~3,600 building owners and facility engineering and maintenance executives at commercial and institutional facilities in New York. During the baseline study, it was ascertained that the TPM represented the target population. The team purchased the TPM list and randomly sampled from this list. Note that the team did not exclude multiple contacts for the same organization because it was possible that the multiple contacts in some of the cases might have responsibility over separate properties and each contact might be able to provide information only for a given property or set of properties. The team like in the baseline study decided that excluding multiple contacts for the same organization would risk biasing the sample.

Survey fielding occurred from November 2021 to January 2022. The team attempted to contact each non-participating organization in the sample at least five times or until a final disposition (e.g., survey completion or refusal) was reached. To increase the response rate, the team also offered respondents a \$50 gift card for completing the survey. Table 5-4 provides a disposition summary from the non-participant

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<sup>19</sup> Clean Energy Fund Workforce Development and Partnerships Baseline Study. Retrieved from:

survey. Of 277 contacted non-participating organizations, the team was able to complete the survey with 72 respondents to achieve an 26% response rate.

**Table 5-4. Non-Participant Survey Disposition**

<b>Disposition</b>	<b>Count</b>
Number of contacts called	277
Survey completions	72
Scheduled - Not completed (Cancellations/No Shows)	32
Bad Number/Wrong Number	81
Refused	93

#### **5.1.1.4 Indicator Estimation Analysis Methods**

The Evaluation Team followed the methods from the baseline study. The following section provides details of the team’s analysis methods for each outcome indicator the evaluator examined.

**Increase in percent of trainees with national certifications:** The team did not estimate this indicator because the program staff tracks this information. The team did provide additional findings in the results sections on the certifications inquired. The team asked about eight certifications:

- Northwest Energy Efficiency Council (NEEC) Building Operator Certification (BOC)
- Building Performance Institute (BPI) Multifamily Building Analyst
- North American Technical Excellence (NATE) certification for heating, ventilation, air conditioning and refrigeration (HVACR)
- HVAC Excellence Certification for HVACR
- U.S. Environmental Protection Agency (EPA) Section 608 Technician Certification for proper refrigerant handling techniques<sup>20</sup>
- Association of Energy Engineers Certified Energy Manager certification, covering electrical, mechanical, process, and building infrastructure systems
- Association of Energy Engineers Certified Energy Auditor certification, covering evaluation and analysis of facility energy use and identification of energy conservation opportunities
- Refrigeration Engineers & Technicians Association (RETA) certifications – Certified Assistant Refrigeration Operator (CARO); Certified Industrial Refrigeration Operator (CIRO); or Certified Refrigeration Energy Specialist (CRES).

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<sup>20</sup> For this certification, EPA established the requirements and standards but does not administer the test. EPA approved certifying organizations administer the test.

**Increase in staff qualified to train others:** The research team summed respondents' reported counts of staff qualified to train others, divided by the total sum of respondents' reported O&M staff.

**Increase in number of new curricula:** For participants, the research team took a qualitative approach to the number of new curricula, since it is a metric that is difficult to quantify. The team reported the number of participating training organizations that indicated they would be using new curricula (completely new or old curricula with modifications).

**Internships or apprenticeships:** The team summed respondents' reported counts of internships/interns and apprenticeships promoted to regular full-time employment.

**Number of LMI workers placed in O&M positions:** The team summed respondents' reported counts of LMI workers placed in O&M, divided by the sum of respondents' reported O&M staff.

**Improved employee retention:** The team summed respondents' reported counts of employees that left of their own volition. For the question posed to respondents of "How much of a problem was turnover on a scale from 0 to 10?," the team combined responses into the following categories: 0-3 "not much of a problem," 4-6 "a moderate problem," and 7-10 "a serious problem." For the participant that had many school districts, the team took the maximum rating across all school districts.

**Decreased time to find and train new talent:** The team assessed the answers to this question from the interviews and determined the time (in months) respondents indicated it would take to find, hire, and adequately train a new O&M staff member if a senior O&M staff member left. To represent the participant that consisted of multiple school districts, the team took the mean length reported by all school districts. If respondents provided a range in their response, the team took the midpoint of that range.

#### ***5.1.1.5 Extrapolating from the Non-Participant Sample to the Population***

The Evaluation Team extrapolated the results of the non-participant survey to the entire target population to provide estimates of the total population counts for the various indicators. If the non-participant sample is representative of the entire population, the most straightforward extrapolation approach is to base the extrapolation on the ratio of the number of organizations in the population to the number in the sample. The sample estimates of the various indices (e.g., number of staff with a given type of training) are then multiplied by this ratio to estimate the quantity of that index in the population.

The Evaluation Team followed this extrapolation approach because the baseline study established that the TPM (contact list) total square footage was so close to NYC total square footage and the distribution of TPM square footage between NYC and upstate was consistent with the distribution of the state residential

population. This indicated that TPM did capture a large portion of the New York building square footage. For these results, see the baseline study.

Table 5-5 shows that the distribution of building total square footage over building types in the current sample is similar to that in the TPM population. Two exceptions are that the sample somewhat overrepresents educational buildings and somewhat underrepresents commercial buildings, relative to the population.

**Table 5-5. Building Square Footage by Type**

<b>Building Type</b>	<b>Population/Sample Frame (TPM)</b>	<b>Sample</b>
Commercial Buildings	46%	23%
Medical Buildings	17%	16%
Educational Buildings	23%	47%
Government Buildings	10%	18%
Industrial	4%	1%

#### **5.1.1.6 Extrapolating from the Participant Sample to the Population**

Similarly, the Evaluation Team extrapolated the results of the participant survey to the entire participant population to provide estimates of the total population counts for the various indicators. If the participant sample is representative of the population, which it was, the most straightforward extrapolation approach was to base the extrapolation on the ratio of the number of organizations in the population to the number in the sample. The sample estimates of the various indices (e.g., number of staff with a given type of training) are then multiplied by this ratio to estimate the quantity of that index in the population.

### **5.1.2 Talent Pipeline**

#### **5.1.2.1 Secondary Data Review**

The Evaluation Team reviewed secondary data to identify the information needed to estimate the indicators NYSEERDA wanted to measure, including which data to collect through primary research activities. The secondary data sources aided in the following:

- The development of participant and non-participant survey instruments
- Identifying the contact information for participants and non-participants
- The development of a sampling strategy for non-participants
- Identifying information to use for estimating the baseline program performance indicators and change in indicators over time

Table 5-6 summarizes the documents the team reviewed.

**Table 5-6. Documents Reviewed for Secondary Data**

Documents	Summary Content	File Type
CEF Workforce Development Industry investment plan	NYSERDA investment plan outlining workforce development and training initiatives. Specifically, it details talent pipeline approach to workforce training and includes a description of target market characterization, stakeholder/market engagement, theory of change, budgets and expenditures, and progress and performance metrics.	PDF
Program Opportunity Notice (PON) 3442 Contracts	Reviewed the latest Talent Pipeline PONs: PON 3981, 3982, 4000, 4463, 4595, and RFQL 4145. Each PON included PON summary, eligibility criteria, budget allocated, and proposal instructions. At the time of evaluation, there were no participants under PON 4463 and 4595.	PDF
Program Data	For each PON, the team received an Excel file(s) of all participants. In addition, the team received PDF files of pre- and post-training surveys of those trained by the participant training providers. The Excel data included contact information; names and count of participants (organizations, on-the-job hires, interns); type and number of trainings provided to date by training providers; characteristics of participating organizations (geography, type of company, etc.); and summary of metrics that program staff are tracking.	PDF and Excel files

While most data for participants were derived from the semi-structured interviews, some data were extracted from the program files themselves.

**5.1.2.2 Primary Research: Participant Surveys**

The Evaluation Team attempted to complete surveys with various participant groups (see Table 5-7). The team reached out to all in the population during the data collection phase.

The survey interviews generally assessed participant characteristics (job title, organization type, or firmographic/demographic characteristics) and the initiative’s indicators and/or assumptions: number of workers attending the training; curriculum developed or modified; existing workers upskilled through the initiative; whether train-the-trainer goals were achieved; the effect of the initiative on time and cost to hire and train; and time for new workers to reach full productivity.

The team completed interviews from August 2021 to January 2022.

**Table 5-7. Summary of Participant Data Collection**

Groups	Population	Sample: Number of Completed Surveys	Confidence / Precision	Data Collection Approach
Participant Businesses – i.e., received on-the-job and/or intern wage reimbursement from the WFD program	250	64	90% / 10%	Email / online survey <sup>a</sup>
Participant Training Providers – i.e., received funding to offer training from NYSERDA	24	19	90% / 10%	Mixed-mode: email/online and telephone survey <sup>b</sup>

Groups	Population	Sample: Number of Completed Surveys	Confidence / Precision	Data Collection Approach
Trainees – individuals who attended participant training provider training	~400	26 <sup>c</sup>	90% / 15%	Email / online survey <sup>c</sup>

<sup>a</sup> Email addresses were available for all contacts. The team sent email survey invites to all in the population.

<sup>b</sup> Email addresses were available for all contacts. The team sent email survey invites to all in the population and followed up with non-respondents over the phone.

<sup>c</sup> Email addresses were available for all contacts. The team sent email survey invites to all in the population. Twenty-four answered all survey questions and two answered more than half of the questions.

### 5.1.2.3 Primary Research: Non-Participant Surveys

The Evaluation Team attempted to complete surveys with two non-participant groups (see Table 5-8). The team reached out to all in the sample frame during the data collection phase.

The non-participant surveys asked the same or comparable questions as the participant surveys. That is, the interviews generally assessed participant characteristics (job title, organization type, or firmographic/demographic characteristics) and the initiative’s indicators and/or assumptions.

The team completed non-participant surveys from August 2021 to January 2022.

**Table 5-8. Summary of Non-Participant Data Collection**

Groups	Sample Frame	Sample: Number of Completed Surveys	Confidence / Precision	Data Collection Approach
Non-participant Clean Energy and Technology Businesses – i.e., no on-the-job and/or intern wage reimbursement from NYSERDA	~6,000 <sup>a</sup>	66	90% / 10%	Mixed-mode: email/online and telephone survey <sup>b</sup>
Non-Participant Training Providers – i.e., providing clean energy or technology training with no funding from NYSERDA	~130 <sup>c</sup>	25	90% / 15%	Mixed-mode: email/online and telephone survey <sup>c</sup>

<sup>a</sup> The Evaluation Team first identified the NAICS codes of participating businesses. The team then provided those codes to DataAxle, which collects NAICS and other information on millions of businesses in North America. The team received from DataAxle a list of businesses under the desired NAICS codes in New York. The team cross-referenced that list with the participant records to exclude any participating businesses from the list. This cleaned list constituted the non-participant sample frame.

<sup>b</sup> Since a mix of email addresses and telephone numbers were available for contacts, the team leveraged a mixed mode approach to reach out to those in the sample frame. The team sent an email survey invite to those with the email address (about 1,900 contacts) and contacted a random sample of 108 organizations over the phone. This resulted in 60 survey completes via the email channel and six completes via the telephone channel.

<sup>c</sup> The Evaluation Team first identified the NAICS codes of participating training providers. The team then provided those codes to DataAxle. The team received from DataAxle a list of organizations under the identified training provider NAICS codes in New York. The team cross-referenced that list with the participant training providers to exclude any participating providers from the list. This cleaned list constituted the non-participant sample.

Both non-participant and participant business samples included responses from a wide range of clean energy organizations (Table 5-9). The non-participant sample was designed to represent NYSERDA’s target population. NYSERDA’s WFD Talent Pipeline PONs 3982 and 4000 (which target clean energy and technology businesses) define clean energy areas broadly. Clean energy areas include high-efficiency heating, ventilation, and air conditioning (HVAC) and water heating; building electrification/heat pump technologies; insulation and air sealing; high-efficiency lighting and controls; building automation and controls; smart grid, energy storage, and renewable fuels; and any related areas.

**Table 5-9. Reported Clean Energy/Technology Type of Company (Survey Data, Multiple Response)**

<b>Products and services provided by the organization or business unit</b>	<b>Participating Organizations (received wage reimbursement) (n=64)</b>	<b>Non-Participating Organizations (n=66)</b>
High-efficiency heating, ventilation, and air conditioning (HVAC)	31%	44%
Heat pumps	34%	36%
High-efficiency water heating	17%	35%
High-efficiency lighting and controls	19%	35%
Insulation and/or air sealing	22%	32%
Solar electric and/or related areas	27%	32%
Energy storage	17%	21%
Building automation and controls	14%	20%
Other renewable heating and cooling	16%	15%
Renewable fuels including wind	14%	9%
Smart grid	11%	8%
Alternate transportation	5%	3%
Professional services – architects, engineering, consulting, raters, designers	9%	0%
Other answers – unique <sup>a</sup>	8%	0%

<sup>a</sup> Carbon capture, net zero home builders, alternative food processing, and semiconductor/manufacturing that supports clean energy products and services.

Both non-participant and participant training provider samples included responses from a range of trainers that offer clean energy and technology training (Table 5-10). The non-participant sample was designed to represent NYSERDA’s training provider target population. That is, NYSERDA offers training assistance to any trainers that offer clean energy or technology education, such as unions, colleges or universities, community groups, industry groups, and private or non-profit educational clean energy consultants. Further, NYSERDA’s WFD Talent Pipeline Training Provider PONs define clean energy areas broadly. Clean energy areas include high-efficiency heating, ventilation, and air conditioning (HVAC) and water heating; building electrification/heat pump technologies; insulation and air sealing; high-efficiency lighting and controls; building automation and controls; smart grid, energy storage, and renewable fuels; alternative transportation; and any related areas.

**Table 5-10. Type of Training Providers in the Samples (Trainer Provider Survey Data)**

	<b>Participating Organizations (received training funding) (n=19)</b>	<b>Non-Participating Organizations (n=25)</b>
Community Organization	21%	28%
College / University	21%	24%
Union	16%	4%
Training Provider Clean Energy/Tech. Consultant	32%	32%
Industry Group	11%	12%

**5.1.2.4 Inflation Adjustment**

The Evaluation Team performed calculations to remove the effect of price inflation from the reported costs pertaining to training, recruiting, and hiring new employees and junior employees for both participants and non-participants. To complete this task, the team reviewed the U.S. Bureau of Labor Statistics data for the Northeast region<sup>21</sup> and estimated the 12-month percentage change in inflation (i.e., the Consumer Price Index or CPI) from December of 2018 until December of 2021. The Northeast CPI changed by 9.2% —that is, the CPI which measures the average change over time in prices paid by consumers for a basket of goods and services rose by 9.2% from December 2018 to December of 2021 in the Northeast. Each reported 2021 cost data point for training and recruiting or hiring was divided by 1.092 to adjust for inflation (i.e., remove the effect of price inflation from the 2021 data). An example calculation is shown below.

**Table 5-11. Example Inflation Adjustment Calculation**

<b>Reported 2021 Survey Value</b>	<b>Inflation Rate in 2021 (as compared to 2018)</b>	<b>2021 Survey Value/Inflation Rate in 2021 (as compared to 2018)</b>	<b>Adjusted 2021 Value</b>
\$40,000	1.092	\$40,000/1.092	\$36,630.04

**5.2 Impact Evaluation Methodology – BOM Only**

**5.2.1 Caltrack Billing Analysis Methods**

For utility billing data, the team conducted the billing analysis using CalTRACK methodology. This write-up is based on documentation from caltrack.org.<sup>22</sup> This methodology consists of a set of methods

<sup>21</sup> [https://www.bls.gov/regions/mid-atlantic/news-release/consumerpriceindex\\_northeast.htm](https://www.bls.gov/regions/mid-atlantic/news-release/consumerpriceindex_northeast.htm)

<sup>22</sup> CalTRACK Methods: <http://docs.caltrack.org/en/latest/methods.html>



for estimating avoided energy use (AEU), related to the implementation of one or more energy efficiency measures. The CalTRACK method yields a whole-building, site-level savings output by subtracting the actual billing consumption from the modeled values in the reporting period.

The CalTRACK method outlines the following steps:

1. Use utility billing data and hourly dry-bulb temperature data of the closest weather station to the impacted facility to create average usage, heating, and cooling degree days per day for each billing period. Heating and cooling degree days were calculated from outside air temperature ranging from 30 to 90 degree.
2. Identify baseline period
3. Create a fitted model (using weighted least squares regression) with the baseline average billing usage per day as the independent variable and heating and cooling degree days per day as the dependent variables.
4. Select the best fitted model among all heating-cooling degree day combination (the model with the highest R-squared value)
5. Compute modeled average usage per day for the reporting period
6. Compute avoided energy use per day by subtracting the average billing usage per day from the modelled value for the reporting period

For this evaluation, the team calculated the avoided energy use as a fraction of the modelled usage in the reporting period. The team calculated the savings fraction for each impacted building and aggregated the results for all evaluated buildings.

The following inputs were provided to the CalTRACK model:

1. Utility billing data, provided by NYSERDA
2. Hourly National Oceanic of Atmosphere Administration (NOAA) weather data, obtained via NOAA application programming interface. Using the dry-bulb temperature, the CalTRACK method developed a matrix the heating degree day (HDD) and cooling degree day (CDD) at each temperature base ranging from 30 to 90 degree. This matrix is used in CalTRACK engine to determine the best fit model.
3. Start date of the earliest training conducted at each impacted building
4. BOM baseline period

In the CalTRACK method, the average billing usage per day is calculated using the following formula:

$$UDP_p = \frac{1}{n_p} \times U_p$$

where,

$UDP_p$  = actual average use per day during period p

$n_p$  = number of days in period p

$U_p$  = total billing consumption in period p

The baseline period was defined by the team as the following:

- The billing period that matches with the BOM baseline period
- If BOM report is not available or outside of the billing period, the baseline period is the period from the start date of the utility billing data to the start date of the earliest training conducted at the impacted building

Using the usage per day, HDD and CDD in the baseline period, the CalTRACK method created a best fit model that estimates the following parameters:

$\mu_p$  = the mean use during period p, or intercept of the model, representing the base load, determined by the CalTRACK model

$\beta_H$  = heating coefficient, representing the incremental change in energy use per day for every additional heating degree day, determined by the CalTRACK model

$\beta_C$  = cooling coefficient, representing the incremental change in energy use per day for every additional cooling degree day, determined by the CalTRACK model

The reporting period was defined by the team as the following:

- The period immediately after the start date of the earliest training.

Using the parameters in the best fit model, the modeled average usage per day in the reporting period was calculated using the following formula:

$$UDP_{p\text{-modeled}} = \mu_p + \beta_H \times HDD_p + \beta_C \times CDD_p$$

where,

$UDP_{p\text{-modelled}}$  = modeled average use per day during period p

HDD<sub>p</sub> = heating degree day in period p

CDD<sub>p</sub> = cooling degree day in period p

Avoided energy use in the reporting period for each impacted building was calculated using the following formula:

$$AEU_p = UDP_{p\text{-modeled}} - UDP_p$$

where,

AEU<sub>p</sub> = avoided energy use during period p

Savings fraction was calculated using the following formula:

$$Sv_{g\text{frac}} = \sum_1^{n_p} \frac{AEU_p}{UDP_{p\text{-modeled}}}$$

where,

Sv<sub>frac</sub> = savings fraction

n<sub>p</sub> = number of periods in the reporting period

The team calculated the savings fraction for each impacted building and aggregated the results for all impacted buildings to calculate the VGSRR for the program.

### 5.2.2 BOM Data Billing Analysis

The BOM data was provided in six-month intervals. When using this data source, 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.

### 5.2.3 Engineering Approach

The team also conducted engineering analysis by estimating savings from actions implemented because of the training. The team reviewed project files (generally logs of actions and audit reports) and collected interview data from project site contacts/O&M managers on training and actions in the post-period. As already discussed in Chapter 3, the team used engineering estimates to corroborate the magnitude of the savings from the billing analysis with a high-level engineering-based estimates of savings. Each site report summarized the measures contributing to energy reductions and the estimates of savings.

## 5.3 Indirect Savings Methodology

### 5.3.1 BOM

The BOM indirect savings methodology follows NYSERDA’s indirect savings framework described in the “Indirect Benefits Evaluation Framework”<sup>23</sup> (Framework). The Framework outlines a methodological approach for evaluating indirect savings. In addition to the Framework, the approach is informed by NYSERDA’s “Budget and Benefits Assumptions Impacts and Fuel Neutrality” Excel workbook (or “BAB”), which documents the direct and indirect savings estimates presented in the Clean Energy Funds Investment Plan<sup>24</sup> or IP for WFD.

#### 5.3.1.1 Causal Logic in Indirect Savings

The BOM program theory and logic were reviewed to theorize linkages and causality between program activities and expected outcomes. Table 5-12 lists program activities and outcomes from the IP and proposed metrics and their role on achieving savings. Table 5-12 also lists several new paths that can lead to indirect savings, discussed more in detail below.

**Table 5-12. Indirect Savings Causation Analysis for Achieving Direct and Indirect Energy Savings**

Program Activities	Expected Outcomes	Evaluation Metric	Savings impact
Work with 3P contractors to develop curriculums.	Curriculums adapt to technology changes	Number of new curricula as reported in surveys.	Not factored into indirect or direct impact.
Develop sustainable in-house training infrastructure via Train-the-Trainer (NYTTs) and direct training of staff	Extends training to additional staff increasing the savings captured by the owner	Number of NYTTs. Owner reported number of staff trained by NYTTs. Program influence.	Increases direct savings. Increases indirect savings. Increases NOMAD.
	3P contractors directly train O&M staff	Number of workers trained in tracking	Increases direct savings. Increases NOMAD.
	<u>New outcome:</u> Trainees carry learning when taking a new job.	Rate of staff turnover reported by owners in surveys.	Increases indirect savings
	<u>New outcome:</u> Employer sponsors additional non-NYSERDA sponsored training leading to more staff trained	Owner reported number of staff receiving non-NYSERDA training. Program influence.	Increases indirect savings. Increases NOMAD.
	Advance’s skills of existing workers		Not factored into indirect or direct savings.
	Career path for new workers		Not factored into indirect or direct savings.

<sup>23</sup> <https://portal.nyserdera.ny.gov/servlet/servlet.FileDownload?file=00Pt000000HIyBmEAL>

<sup>24</sup> <https://www.nyserdera.ny.gov/-/media/Files/About/Clean-Energy-Fund/CEF-Workforce-Development-and-Training.pdf>

Program Activities	Expected Outcomes	Evaluation Metric	Savings impact
Competitive solicitations for innovative approaches to intervention	<u>New outcome:</u> Solicitations expand the capabilities of 3P contractors so they can train more workers.	3P contractor reported number of staff trained without NYSERDA funding. Program influence.	Increases indirect savings. Increases NOMAD.

As noted in Table 5-12, the evaluation team postulates that there are additional outcomes leading to increased adoption of practices reducing building energy use that are not explicitly identified in the IP.

These are:

Third-party contractors expand their capacity for training through development of new curriculum and instructors. As a result of the expanded capacity, the third-party contractors successfully provide O&M best practices training to O&M staff that are not sponsored by NYSERDA.

After a positive experience with NYSERDA, participating employers sponsor non-NYSERDA training for their staff without NYSERDA incentives (for example, an employer enrolls a staff member in chiller or EMS manufacturer training).

Trained individuals transfer to another company bringing their training with them and leading to improved operations at a non-participating facility. In modeling this mechanism, we assume the savings do not decrease at the host facility.

The team collected primary data to support estimates of these new savings mechanisms.

### 5.3.1.2 Segmentation of Building Served by Trained and Untrained Staff

The indirect savings is calculated by segmenting the total building area served by O&M staff (in square-footage of building space served) into the percentages served by trained and untrained staff. The trained staff segmentation is further subdivided into participating and non-participating, and program-influenced and non-program-influenced segments. Table 5-13 summarizes the NYSERDA assumptions noted in the BAB for the BOM program.

**Table 5-13. Partnerships Adopter Groups with Employer Sponsored Training**

	Savings type	Trainee Type	NYSERDA Assumed BAB: Pct% of Total Building Area	Data source for revised values
Served by untrained O&M staff	No savings	Percentage of all space that is served by workers that are not trained	75%	Estimate total market through Participant and non-participant surveys
All Trainees (25% in BAB)	Direct	P - trainee with incentives. (P-IY)	8.8%	Program tracking
	Indirect	P – trainee with no incentives and program influenced them. (P-IN)	2.6%	Participant surveys

	Savings type	Trainee Type	NYSERDA Assumed BAB: Pct% of Total Building Area	Data source for revised values
		NP – trainee, with no incentives and program influenced them (NP-IN)	13.3%	Total market minus other adopters
	No savings	P and NP – trainees without program influence. NOMAD	0.3%	Participant and non-participant surveys; secondary data
Total Market		Total Space Served by Trained and untrained O&M staff	100%	Participant and non-participant surveys; secondary data

The segment associated with indirect savings was multiplied by the average savings per square foot determined in the impact evaluation yielding the indirect savings for electricity and natural gas.

**5.3.2 Talent Pipeline**

No indirect savings were claimed for this program.