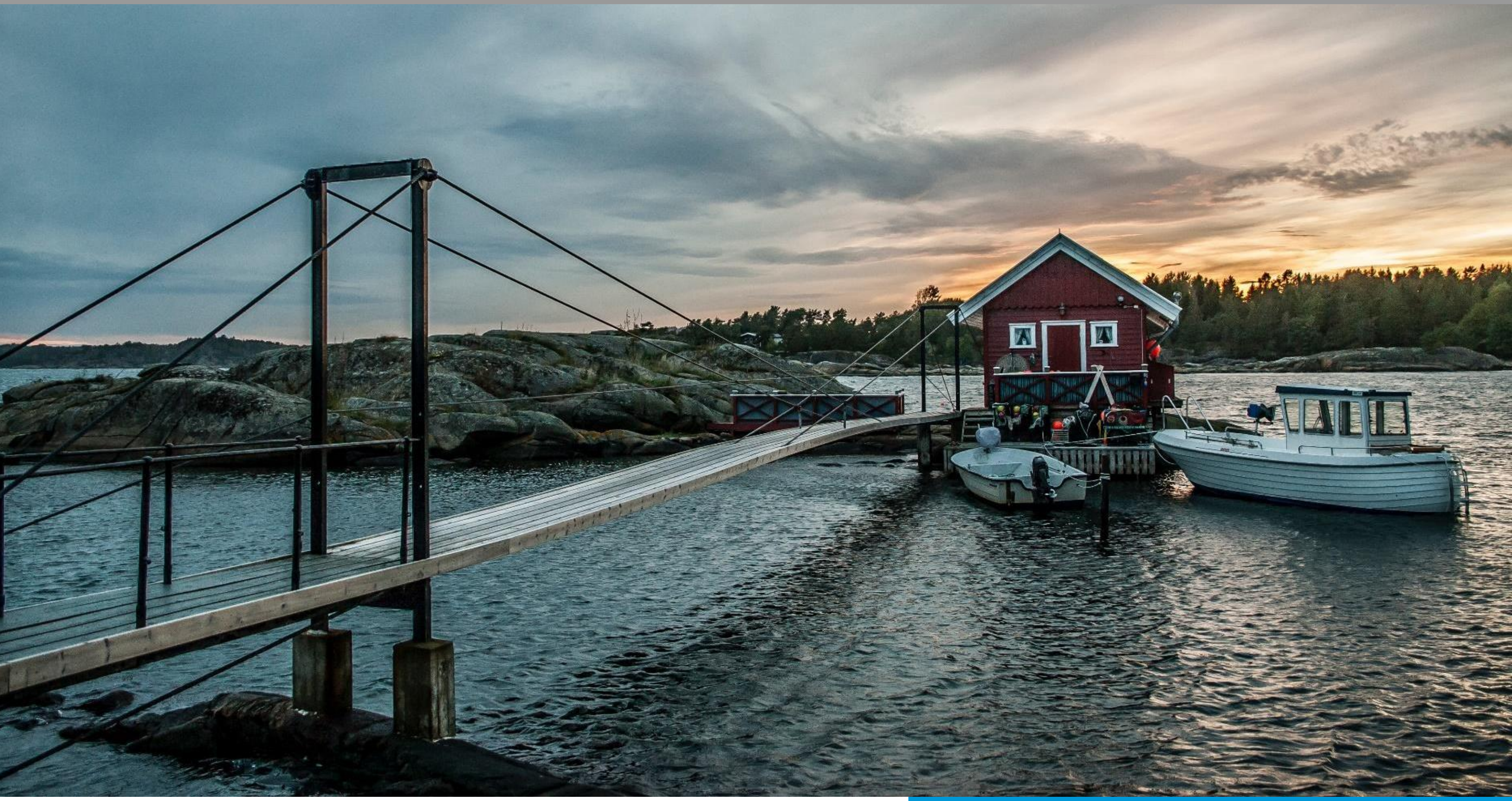
Report

SMALL BUSINESS INITIATIVE IMPACT EVALUATION



Prepared for Efficiency Maine

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February 2021

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1 EXECUTIVE SUMMARY

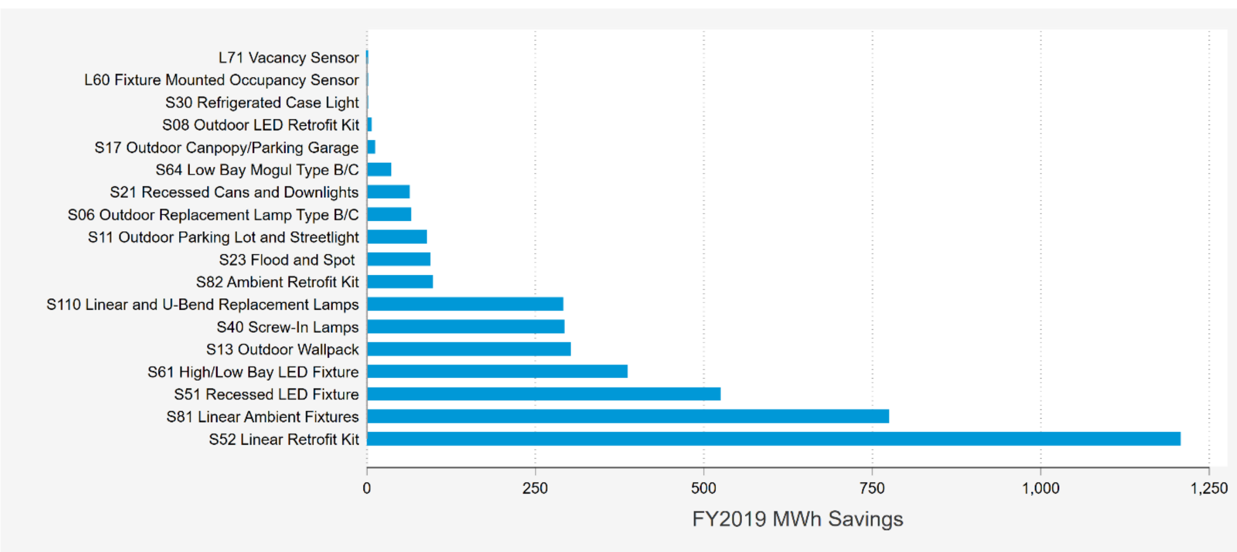
In June 2019, Efficiency Maine selected Demand Side Analytics and Ridgeline Energy Analytics (the Evaluation Team) to perform an impact evaluation of its Small Business Initiative (SBI) lighting program. This program delivers LED lamps, fixture retrofit kits, new fixtures, and controls to small businesses in Maine. Table 1 summarizes the unadjusted gross SBI energy impacts for Fiscal Year 2019 (FY2019) based on a data extract pulled from the Efficiency Maine Reporting and Tracking system (effRT). Efficiency Maine measures the impact of the program through a blend of calculations, site-specific data, and Technical Reference Manual (TRM) assumptions about the operating characteristics of the lighting equipment.

Table 1: SBI Annual Energy Impacts – Fiscal Year 2019

Year	kWh	Winter kW	Summer kW	Natural Gas (MMBtu)	Propane (MMBtu)	Heating Oil (MMBtu)
FY2019	4,247,958	967.9	1,188.9	-241	-874	-2,868

Figure 1 shows the relative contributions of different measures to the FY2019 annual MWh savings of the SBI program. There were 42 unique measure names in SBI for FY2019 due to a mid-year update of the SBI measure taxonomy in the TRM and effRT. For simplicity we group the pre-update and post-update measures into a single category in Figure 1 and elsewhere in this report. Interior fixtures account for approximately 80% of program savings. Exterior fixtures and indoor screw-in lamps account for another 20%. Controls and refrigerated case measures are part of the SBI catalog but accounted for minimal savings in FY2019.

Figure 1: FY2019 MWh Savings by Measure Name – Small Business Initiative



The SBI program delivery team collects detailed information on the installed and removed lighting equipment for each project in a Microsoft Excel lighting tool as completed by a Qualified Partner.[1] This information is later stored in the effRT program tracking system. The goals of the evaluation were to independently verify the equipment counts and properties recorded by the program delivery team and assess the accuracy of assumptions regarding the operating parameters of LED lighting equipment participating facilities. This was accomplished via installation of approximately 350 lighting loggers in 49 businesses that received lighting upgrades through SBI during FY2019. Table 2 lists the key impact factors and summarizes our impact evaluation approach to review and potentially update them. In subsequent sections of this report, the evaluation approaches are laid out in greater detail.

Table 2: Evaluation Method by Impact Factor

Impact Factor	Evaluation Approach
Wattage (Baseline and LED)	Site visits and review of project documentation, spot checks during site visits. Lumen-based sanity check of baseline assumption.
Hours of Use	Data loggers deployed at sampled businesses
Summer and Winter CF	Data loggers deployed at sampled businesses
Energy Period Factors	Data loggers deployed at sampled businesses
Waste Heat Factors	Engineering analysis using information about HVAC system types and efficiency gathered while on site.
Measure Life	Calculated using rated life from cut sheets divided by annual hours of use
In-service Rate	Field verification of equipment counts during site visits
Realization Rates	Calculated using stratified ratio estimation
Freeridership	Scoring algorithm applied to SBI participant survey

The SBI impact evaluation was conducted in parallel with impact evaluations of the Retail Lighting and Distributor Lighting programs. The evaluation team used common data collection procedures and lighting logger analysis methods for SBI and the 45 commercial businesses sampled from the Distributor Lighting program. Although this report focuses on the results of the SBI impact evaluation, in places the description of methods covers both commercial lighting data collection efforts.

1.1 IMPACT EVALUATION RESULTS

Table 3 shows the unadjusted gross impacts for FY2019 with the primary outputs of the evaluation applied. In its annual reports and ISO New England filings, Efficiency Maine reports adjusted gross savings, which are calculated by applying an in-service rate and prior realization rates to the unadjusted gross impacts. For SBI in FY2019, the in-service rate was 1.0 and the realization rates were also 1.0 – meaning that the unadjusted gross and adjusted gross savings were identical.

[1] Qualified Partners are lighting contractors that have completed qualifications to participate in the Small Business Initiative. The SBI program delivery team assists in identifying and recruiting small businesses. The qualified partners are responsible for scoping the project, applying for rebates and completing the installation of new lighting measures.

Table 3: SBI Impact Evaluation Results for FY2019

<table>
<tr><th>Resource</th><th>Unadjusted Gross</th><th>Realization Rate</th><th>Gross Verified</th><th>NTGR</th><th>Net Verified</th></tr>
<tr><td>kWh</td><td>4,247,958</td><td>85.2%</td><td>3,621,299</td><td rowspan="8">91.4%</td><td>3,309,867</td></tr>
<tr><td>Winter kW</td><td>967.9</td><td>34.8%</td><td>336.9</td><td>307.9</td></tr>
<tr><td>Summer kW</td><td>1,188.9</td><td>88.5%</td><td>1,052.1</td><td>961.6</td></tr>
<tr><td>Natural Gas (MMBtu)</td><td>-241.4</td><td rowspan="5">78.5%</td><td>-189.5</td><td>-173.2</td></tr>
<tr><td>Propane (MMBtu)</td><td>-873.7</td><td>-685.7</td><td>-626.7</td></tr>
<tr><td>Heating Oil (MMBtu)</td><td>-2,867.9</td><td>-2,250.7</td><td>-2,057.2</td></tr>
<tr><td>Kerosene (MMBtu)</td><td>-33.9</td><td>-26.6</td><td>-24.3</td></tr>
<tr><td>Wood (MMBtu)</td><td>-128.8</td><td>-101.1</td><td>-92.4</td></tr>
</table>

Program attribution was high with a free ridership rate of just 8.6%. The gross verified electric energy and summer peak demand savings were reasonably well aligned with claimed savings, but the realization rate for winter peak demand was quite low. Figure 2 plots the average summer and winter weekday interior lighting load shape in Eastern Prevailing Time (EPT)[2] across all SBI loggers to illustrate the core driver of the low realization rate for winter demand. The ISO-NE definition of summer peak is 1pm to 5pm on non-holiday weekdays June-August and the winter peak definition is 5pm-7pm in December and January. Lighting operation in the SBI evaluation sample was consistent across seasons and fell sharply from 4pm to 6pm, leading to low coincidence with the ISO-NE definition of winter peak.

[2] Eastern Prevailing Time reflects the local time during the season being presented. The summer weekday load shape and ISO-NE summer peak hours are in Eastern Daylight Time and the winter weekday load shape and ISO-NE winter peak hours are in Eastern Standard Time.

Figure 2: SBI Weekday Interior Lighting Load Shape During Peak Months

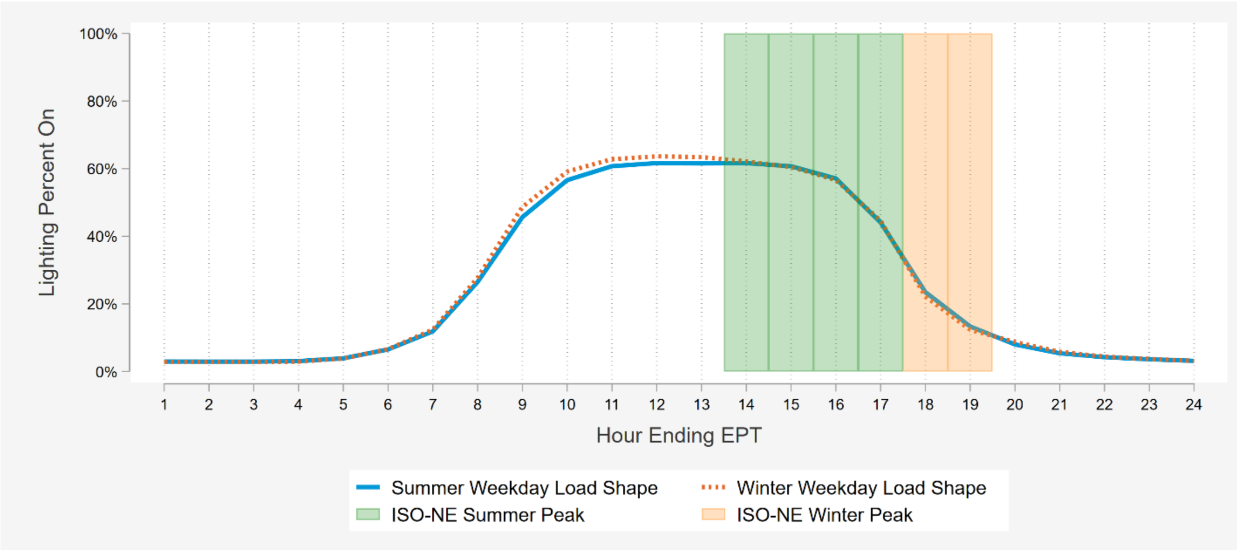


Table 4 shows the relative precision of each of the core impact evaluation outputs at the 80% confidence level. The precision of the evaluation results is particularly important for summer and winter peak demand because ISO-NE has strict precision requirements for recognition of passive demand resources in the forward capacity market. This evaluation was designed to deliver results with at least ±10% relative precision at the 80% confidence level for all outputs.

Table 4: Relative Precision of Evaluation Results at the 80% Confidence Level

Evaluation Result	kWh	Winter kW	Summer kW	Fossil Fuel
Gross Realization Rate	± 5.5%	± 13.9%	± 6.4%	± 7.9%
Net to Gross Ratio	± 1.5%			

The missed precision target for winter demand impacts comes from both higher than expected variance and a lower than expected realization rate. The ISO-NE precision requirements are based on the relative precision of the evaluation results. When designing an evaluation and setting sample sizes we assume that the realization rate will be close to 100% and target ±10% absolute precision based on the expected variance. Absolute precision is the margin of error of the realization rate expressed as a percentage. To calculate relative precision, the absolute precision is divided by the realization rate. If the realization rate is 100%, the absolute precision and relative precision are equal. If the realization rate is less than or greater than 100%, the two precision metrics will differ. For this evaluation, dividing the absolute precision of the winter demand realization (± 4.8%) by the realization rate of 34.8% returns a relative precision estimate of ±13.9% at the 80% confidence level.

1.2 COST-EFFECTIVENESS RESULTS

The evaluation team used the results of the gross and net impact evaluations in combination with two different sets of avoided costs and methodology and assumptions (M&As) to compute a total of ten benefit-cost scenarios for Efficiency Maine's primary benefit cost test.

- **Retrospective Scenarios:** Utilize the avoided costs and M&As in place during FY2019. FY2019 was the last year of the Trust's 2017-2019 Triennial Plan (Triennial Plan III, or TPIII).
- **Prospective Scenarios:** Utilize the avoided costs and M&As in place for Efficiency Maine's 2020-2022 Triennial Plan[3] (Triennial Plan IV, or TPIV).

Table 5 summarizes the cost-effectiveness findings and Section 5 provides a full discussion of the methodology and results. SBI was cost-effective for each of the ten scenarios examined with the net present value of the benefits exceeding the net present value of the costs.

Table 5: FY2019 Benefit-Cost Ratios by Scenario

Scenario Number	Inputs and Assumptions	Impacts Used to Calculate Benefits	Benefit-Cost Ratio
1	Retrospective	Verified Gross	1.36
2	Prospective	Verified Gross	1.13
3	Prospective	Verified Gross: Lower Bound of Realization Rates	1.07
4	Prospective	Verified Gross: Upper Bound of Realization Rates	1.18
5	Retrospective	Verified Net	1.27
6	Prospective	Verified Net	1.11
7	Prospective	Verified Net: Lower Bound of NTGR Confidence Interval	1.11
8	Prospective	Verified Net: Upper Bound of NTGR Confidence Interval	1.12
9	Prospective	Verified Gross + $100 per short Ton Added Co2 Impact	1.44
10	Prospective	Verified Gross + Evaluator Recommended EUL Assumptions	1.35

1.3 FINDINGS AND RECOMMENDATIONS

Efficiency Maine uses evaluation results in two ways. One is to look retrospectively at how the verified savings compare to what was claimed. The other way is to use the evaluation results prospectively to improve the accuracy of future savings claims. Section 1.1 presented the retrospective impact estimates for FY2019 and this section lays out how we recommend the Trust incorporate findings into the TRM and effRT. During FY2019, SBI transitioned from a legacy Energy Assessment Tool (EAT) to a new Small Business Lighting Investment Calculator (SLIC). Both applications are Microsoft Excel lighting calculation tools used by the program delivery team to capture the details of each lighting retrofit. The SLIC tool has several useful enhancements compared to its predecessor EAT, but both tools provide robust facility, equipment, and cost data.

[3] https://www.efficiencymaine.com/triennial-plan-iv/

Our site visits determined that program tracking records (collected in EAT/SLIC and loaded into effRT) were remarkably accurate with respect to equipment counts, types, and wattages so our recommendations deal exclusively with assumptions about lighting equipment operating characteristics. Table 6 summarizes our recommended updates to the TRM factor schedule for SBI by measure category. The interior lighting factors come from a composite 8760 load shape developed using light logging conducted for the SBI sample as well as the "Small" stratum of the companion Distributor Lighting evaluation. Exterior lighting equipment was not metered for either evaluation, so the exterior factors are based on operating schedules provided by participants during site visits.

Table 6: Recommended Updates to SBI Impact Factors

Measure Category	Annual Hours of Use	Summer CF	Winter CF	Energy Period Factors			
				Winter On	Winter Off	Summer On	Summer Off
Interior	Apply 81% RR_e to SLIC value	60.8%	26.7%	49.4%	18.0%	24.5%	8.0%
Exterior	4,248	6.6%	82.4%	27.3%	45.0%	9.5%	18.2%

Although we produced a single weighted average annual hours of use value for small business interior lighting (2,517), we believe the current SBI framework should be preserved. In SLIC, users can enter custom operating schedules at the space level or utilize default assumptions based on facility and space type. This customization is valuable for screening the economics of a project for the program and the participant. However, our metering efforts indicate that the current framework tends to overstate annual hours of operation by approximately 19%. Our recommendation is set the RR_e term to 81.0% for all interior lighting measures in SBI. A mathematically equivalent approach would be to apply the 81% adjustment factor to energy savings calculation in the SLIC tool.

The net impact evaluation results discussed in Section 3 are based on an online survey fielded with participants following completion of the SBI project. Our analysis of the attribution battery returned an estimated free ridership rate of 8.6%. The survey did not include spillover questions, so the net to gross ratio is simply 1 – free ridership = 91.4%. We recommend adopting these values in the TRM for all measures in the SBI catalog.

Additional findings and recommendations from the evaluation include:

- **Satisfaction:** Evaluation team technicians did not field a formal battery of satisfaction questions during site visits, but we did have informal discussions with participants and the feedback was overwhelmingly positive. Additionally, 100% of respondents to the online participant survey indicated that they would recommend the program to other businesses and 162 of 164 (99%) respondents preferred the light quality in their business after the SBI retrofit.
- **Measure Life:** The Efficiency Maine TRM currently assumes a measure life of 13 years for all interior and exterior fixtures in SBI. The typical rated life for LED fixtures is 50,000 hours so we recommend calculating updated integer measure life assumptions using the composite lighting profiles developed for this evaluation. Directionally, measure life would increase for interior

lighting measures and decrease for exterior measures. In aggregate, this change would improve the benefit cost results for the program.

- **Interior Measures** = 50,000/2,517 = 20 years
- **Exterior Measures** = 50,000/4,248 = 12 years

- **Operation and Maintenance (O&M):** Efficiency Maine does not currently assign any O&M benefits to LED lighting installed through SBI. For the Retail Lighting and Distributor Lighting programs, assumptions about avoided O&M lower the net present value costs in the benefit cost calculation. Given the long rated life of the LED equipment installed under SBI and the real impact these impacts have on cash flow for participating businesses, we recommend aligning O&M assumptions for the SBI measure catalog with the Distributor Lighting measure roster and claiming the cost of avoided future baseline lamp replacements for SBI fixtures. For example, an SBI project that replaces T8 linear fluorescent fixtures with LED retrofit kits will avoid the purchase of T8 replacements tubes over the lifetime of the LED retrofit kit. Avoided future replacement costs for SBI measures could be aligned with the baseline lamp replacement costs used to develop O&M values for the Distributor Lighting measures in the TRM.

2 GROSS IMPACT ACTIVITIES AND FINDINGS

2.1 OVERVIEW

The SBI lighting program is a targeted offering for Small General Service businesses in Maine to retrofit inefficient lighting with high efficiency LED equipment. The program has a regional focus with program services available for limited durations in specific cities and towns. SBI works through a network of qualified contractors to identify and implement projects. The lighting equipment installed in participating businesses is sourced from Maine distributors at negotiated pricing.

There are two central research areas for the impact evaluation:

1) **Equipment Properties** – for SBI projects, savings calculations rely on the number of fixtures replaced, the wattage of the baseline equipment, and the wattage of the efficient equipment. Efficiency Maine selects approved LED lighting equipment for installation and executes a Memorandum of Understanding (MOU) to secure pricing. For each program product, Efficiency Maine knows the actual LED wattage from manufacturer specifications and uses it in the savings calculations. Program delivery staff and lighting contractors record the existing (removed) equipment and a TRM-based wattage lookup determines the baseline wattage. While on-site, the evaluation team verified LED wattages and assessed the reasonableness of baseline assumptions but did not try to determine the exact specifications of removed equipment because it was no longer present and customer recall of such details is often inexact.
2) **Operating Characteristics** – the annual energy and peak demand savings for lighting projects rely on assumptions about hours of use, coincidence factors, waste heat factors, and savings factors from controls. The impact evaluation assessed the accuracy of these assumptions by trending actual lighting operations at the facilities in the evaluation sample. Comparing the measured factors with TRM assumptions provides insight into the variance between gross reported and evaluated savings and indications of where TRM updates may be warranted.

There were several noteworthy changes to SBI during FY2019 (July 1, 2018 to June 30, 2019). On December 1, 2018, the lighting measure taxonomy for SBI was updated to include assumptions about seasonal businesses. This change coincided with the deployment of the SLIC lighting calculator, which replaced a predecessor Excel lighting tool called EAT. Energy and peak demand savings are calculated in the SLIC tool and passed to the program tracking system (effRT) as values. To complicate matters:

- Factor schedules in EAT were not updated when the TRM was updated in January 2018.
- When the SLIC tool was rolled out in fall 2018, it was populated with old coincidence factors.
- Because the calculations happen in hundreds of individual MS Excel workbooks, there is limited capability to 'correct' enrollment savings that were computed with inconsistent factors from the TRM. The TRM change log for FY2019 addresses this issue noting that effRT implementation was corrected to accurately reflect TRM updates for SBI entries after 1/1/2019, while entries prior to 1/1/2019 remain unchanged.

Ultimately, the impact evaluation seeks to understand the accuracy of TRM assumptions about various factors. Realization rates are effectively a ratio with the evaluated savings as the numerator and the reported savings as the denominator. We calculate and report realization rates using the ex ante savings as recorded in effRT. This historic realization rate is used to adjust the claimed performance of SBI for FY2019. As discussed above, the TRM assumptions used to calculate SBI savings evolved over the course of FY2019. The denominator of this realization rate calculation relies on whatever savings assumptions were in effect when the transaction was recorded. This set of realization rates was shown in Table 3 and the basis of the evaluated gross and evaluated net savings for FY2019.

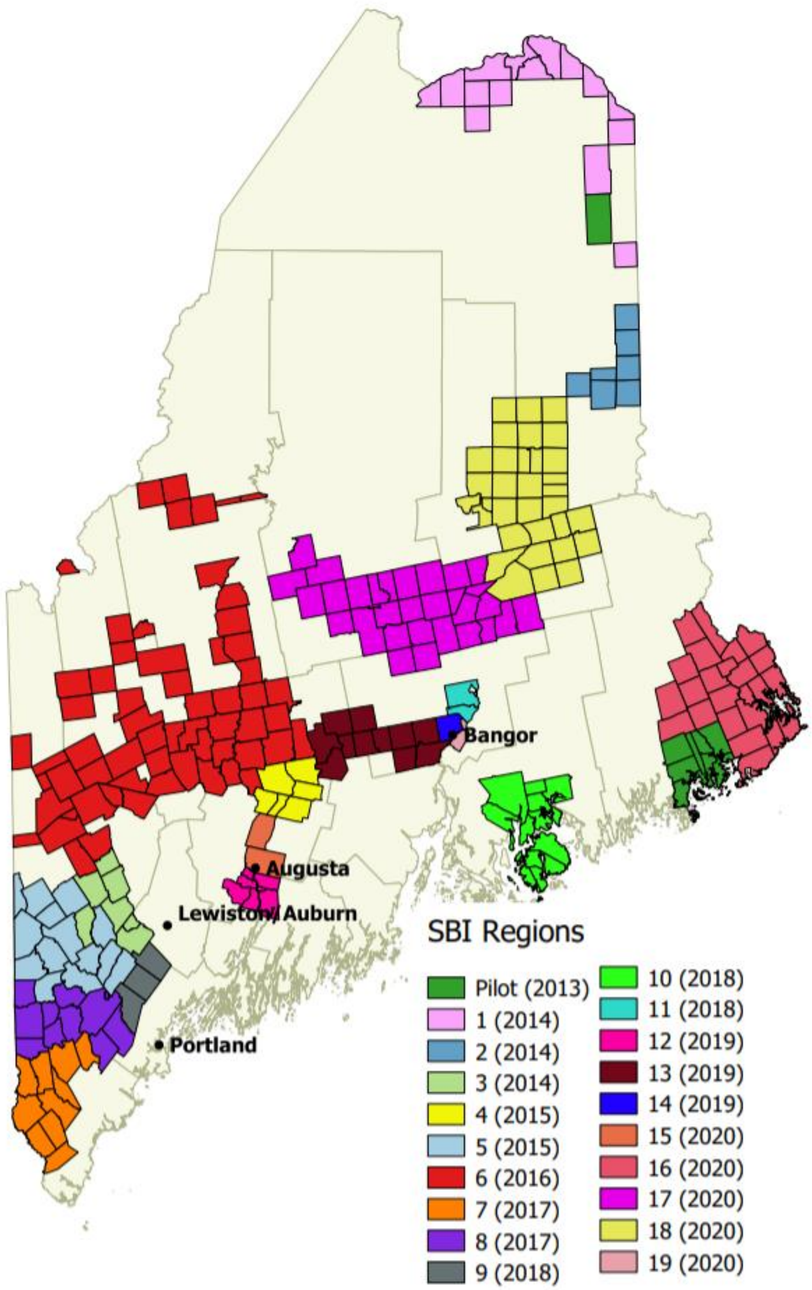
Prospectively applying the realization rates from this evaluation is not ideal because TRM assumptions evolved over the course of FY2019 and have been further updated since FY2019. Our recommended approach is to update the key drivers of the realization rates and apply a realization rate of 100% to new projects. Table 6 presented our recommended factors and Section 4 discusses the basis of those recommendations in detail. To support Efficiency Maine's implementation of this recommended approach, this report provides detailed information on each of the parameters in the verified gross savings calculation.

While any given product is only used in either SBI or Distributor Lighting, there is significant overlap in the lighting applications and types of businesses encountered in the two programs. In recognition of this synergy, the evaluation team drew samples from both programs to conduct a cross-cutting study of small business lighting operating characteristics in Maine. This report primarily focuses on the results of the SBI impact evaluation, which were calculated using data collected from FY2019 SBI participants. Certain methods and findings that cut across the commercial sector programs are presented in this report.

2.2 TRACKING DATA REVIEW

SBI recorded 528 enrollments during FY2019 across eight different Maine regions. Figure 3 shows all SBI regions since program inception in 2013 overlaid on a map of the state. The distribution of FY2019 activity across regions 7 through 14 is discussed in Section 2.3.

Figure 3: Map of SBI Regions



The average project size during FY2019 was approximately 8,000 kWh of energy savings and 2 kW of summer and winter peak demand savings. No individual enrollment recorded more than 50,000 kWh of energy savings or greater than 16 kW of summer or winter demand savings. Table 7 shows the breakdown of FY2019 energy savings by measure. Around 11% of the SBI energy savings came from outdoor lighting equipment. Controls and refrigerated case lights accounted for less than 1% of claimed savings and did not appear in the evaluation sample. Indoor linear and mogul lamps and fixtures accounted for the majority of savings in FY2019.

Table 7: FY2019 Energy Savings by Measure

Measure	FY2019 kWh	Share of FY2019 kWh
S52 Linear Retrofit Kit	1,207,917	28.4%
S81 Linear Ambient Fixtures	774,625	18.2%
S51 Recessed LED Fixture	524,730	12.4%
S61 High/Low Bay LED Fixture	386,910	9.1%
S13 Outdoor Wallpack	302,909	7.1%
S40 Screw-In Lamps	292,904	6.9%
S110 Linear and U-Bend Replacement Lamps	291,315	6.9%
S82 Ambient Retrofit Kit	97,611	2.3%
S23 Flood and Spot	94,258	2.2%
S11 Outdoor Parking Lot and Streetlight	88,791	2.1%
S06 Outdoor Replacement Lamp Type B/C	65,202	1.5%
S21 Recessed Cans and Downlights	63,444	1.5%
S64 Low Bay Mogul Type B/C	36,062	0.8%
S17 Outdoor Canopy/Parking Garage	12,030	0.3%
S08 Outdoor LED Retrofit Kit	6,734	0.2%
S30 Refrigerated Case Light	1,671	0.0%
L60 Fixture Mounted Occupancy Sensor	534	0.0%
L71 Vacancy Sensor	311	0.0%
Total	**4,247,958**	**100%**

2.3 SAMPLING

Sample design is the foundation for all data collection activities, and it also governs how the results from the sample get rolled up to develop estimates of program performance as whole. From a statistical standpoint, the parameter of interest is the relative precision of the demand realization rate at the 80% confidence interval. The evaluation team designed the commercial sample to be able to estimate summer and winter demand realization rates with ±10% precision at the 80% confidence level separately for Distributor Lighting and SBI. Equation 1 shows the sample size calculation formula from Section 7.2.3 of ISO New England Manual M-MVDR. Assuming a coefficient of variation of 0.5 and a desired relative precision of 0.1 returns a sample size of 41.

Equation 1: Sample Size Calculation Formula

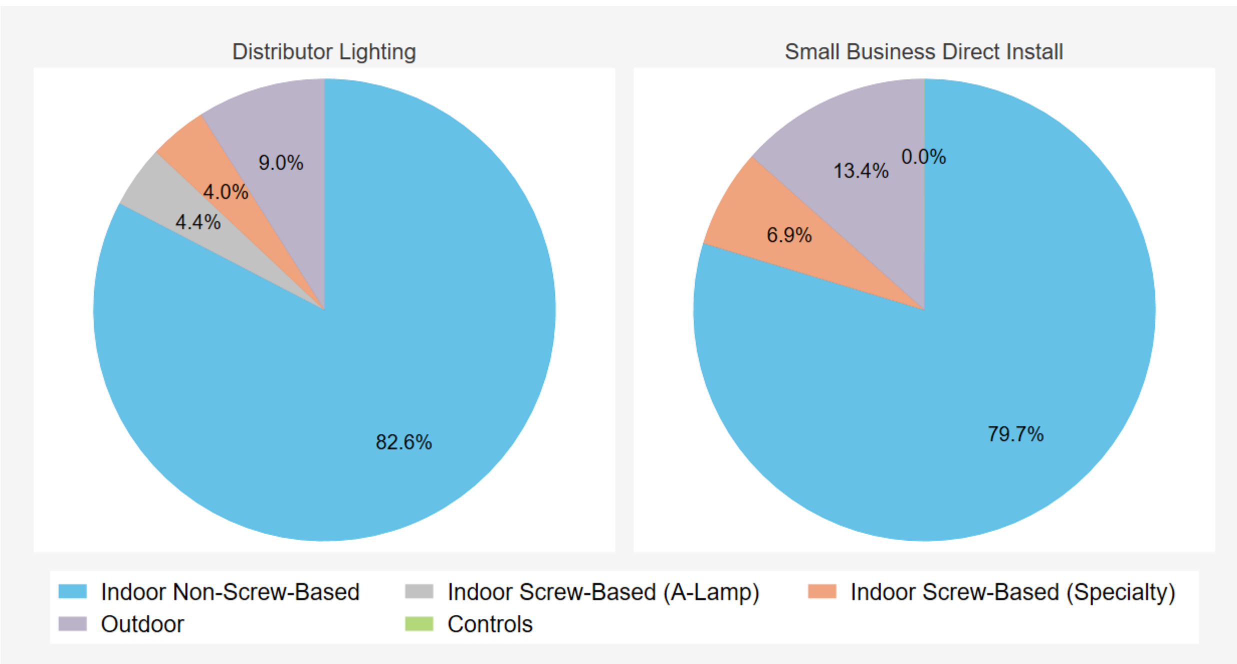
$$n = \left(\frac{1.282 * c.v.}{r.p.}\right)^2 = 41$$

There is significant overlap in lighting equipment and business types in the Distributor Lighting and SBDI programs, so some findings are able to leverage pooled sample sizes. Because the factor assumptions are so diverse across the lighting catalog, we did not attempt a design that would estimate *all new* summer and winter coincidence factors with ± 10% precision at the 80% confidence interval.

However, for the key CFs (e.g. 45.3% winter and 60.9% summer for interior lighting) we can calculate and report pooled coincidence factors and energy period factors at 80/10. Section 4 discusses our recommendations for incorporating evaluation results into the TRM.

The sampling plan for the SBI and DL impact evaluations called for 90 participants drawn evenly from the two programs. Ultimately, the evaluation team conducted a total of 49 SBI and 45 DL site visits. The 49 sampled sites for SBI corresponded to 51 enrollments in effRT as two participants in the sample had a lighting retrofit project that spanned two enrollments. Figure 4 shows shares of FY2019 unadjusted gross energy savings by measure category across the two programs. A map of measure names to measure categories is shown in Table 36. The majority of the resource savings came from indoor non-screw-based equipment (fixtures, retrofit kits, type A/C retrofit lamps, and high/low bay moguls). The "0.0%" component of SBI represents the "Controls" category. There are no A-lamps incented in SBI which is why the A-lamp category does not have a section in the SBI chart.

Figure 4: FY2019 Energy Savings Contribution by Program and Measure Category



2.3.1 Considerations for SBI

Figure 5 shows the unadjusted gross FY2019 energy savings by region for SBI. While we did not necessarily expect program delivery or performance to vary appreciably by region, the evaluation team sampled SBI participants following these general proportions to ensure geographic representativeness. Program delivery also moves geographically over time so representative sampling by region helped to ensure a representative cross-section of FY2019 enrollments across time.

Figure 5: FY2019 SBI Energy Savings by Region

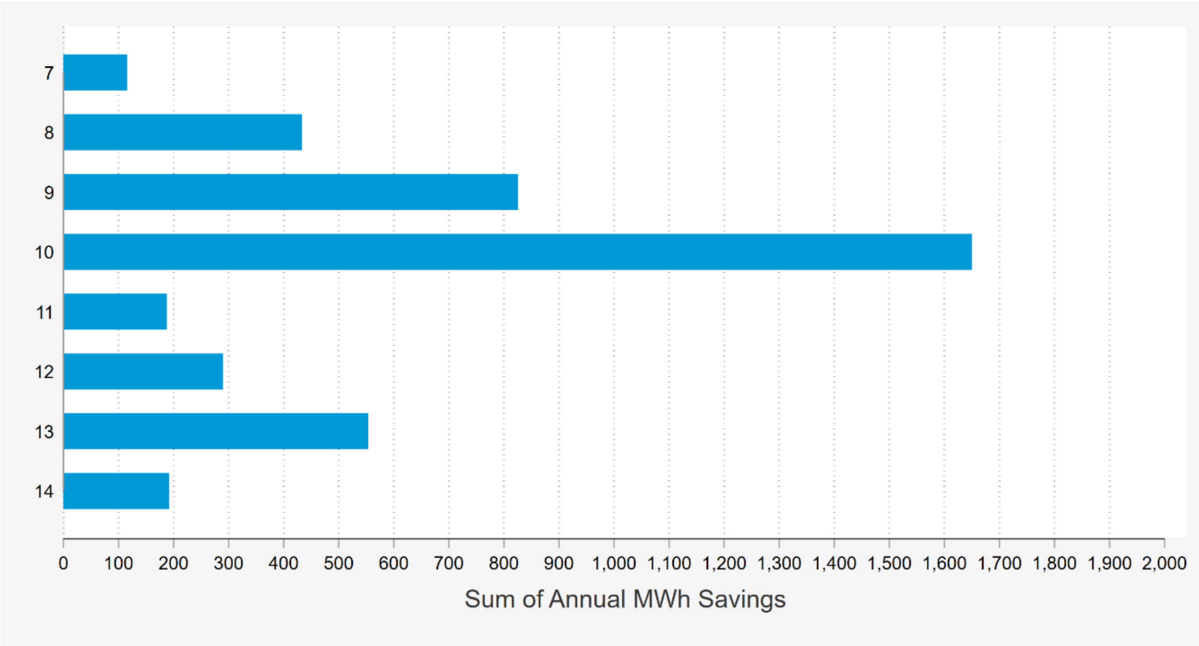


Table 8 shows the target sample size and achieved sample size by region along with the total number of FY2019 enrollments from each region. Region was used as the stratification variable when estimating realization rates via stratified ratio estimation[4] so Table 8 also shows the applicable case weight for each region. When using stratified ratio estimation, results from sampled projects in different strata are weighted differently in the weighted average realization rate and the case weight is the weighting variable. The case weight for a given stratum is equal to the number of projects in the population divided by the number of projects in the sample.

Table 8: Target and Achieved Sample by Region

SBI Region	Target Sample Size	Achieved (Enrollments)	Population (Enrollments)	Case Weight
7	1	1	10	10.00
8	5	6	41	6.83
9	9	10	128	12.80
10	17	21	207	9.86
11	2	2	29	14.50
12	3	3	44	14.67
13	6	5	54	10.80
14	2	3	15	5.00
Total	**45**	**51**	**528**	**Not Applicable**

[4] Section 8.3 of Uniform Methods Project Chapter 11 "Sample Design Cross-Cutting Protocol" provides a useful overview of ratio estimation and https://www.nrel.gov/docs/fy17osti/68567.pdf.

In FY2019, Efficiency Maine incorporated seasonal business assumptions into the TRM and SLIC tool based on findings from the 2017 Business Incentive program evaluation. Our team elected to not include quotas for seasonal businesses in our sample design for several reasons. First, we had no way to identify which Distributor Lighting measures were summer-only or winter-only. Second, approximately 60% of SBI projects in FY2019 were recorded prior to the shift to seasonal measure codes. Once the seasonal measure codes were in place, more than 97% of FY2019 measures were classified as year-round.

Each Maine business that participates in SBI is assigned to a facility type. The annual operating hours used to calculate energy savings in SLIC are either deemed based on a TRM lookup of facility and space type or "actual" based on the stated operating hours of the business. The EAT calculator did not include a deemed hours of use option so all EAT projects rely on the stated operating hours as input by the applicant. Of the final SBI sample of 49 sites, 32 relied on an EAT calculator and the other 17 used the successor SLIC tool. The sample design for the SBI evaluation focused on representativeness by region but also achieved a useful cross-section of facility types. Table 9 lists the 27 different facility types with SBI project counts and savings during FY2019 along with the quantity of unadjusted gross kWh savings in the population and achieved sample.

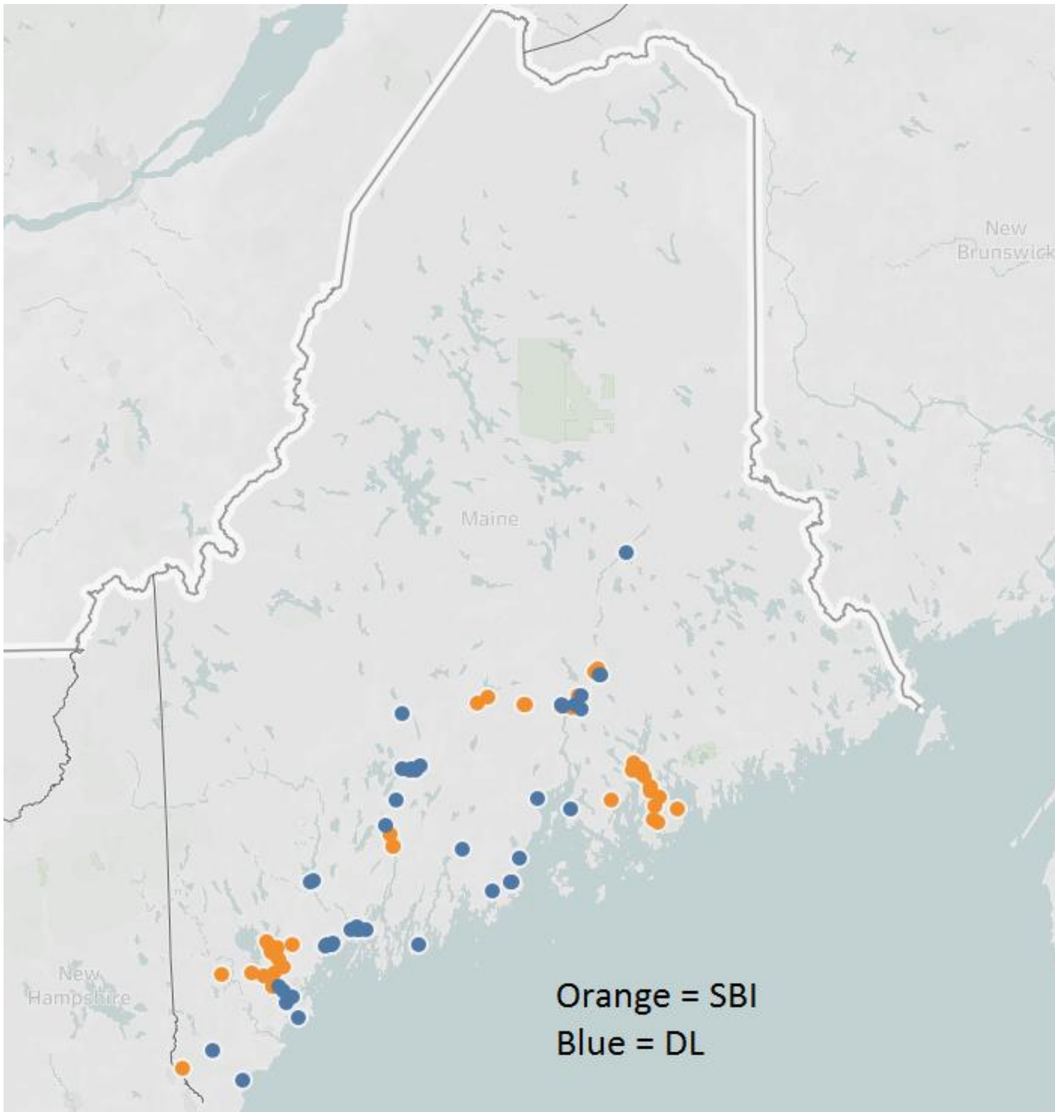
Table 9: SBI Sample and Population kWh Savings by Facility Type

Facility Type Name	FY2019 Projects	Sampled Projects	Total kWh	Sample kWh	% kWh in Sample
Agriculture	3	0	38,313	0	0.0%
Assembly	5	0	40,708	0	0.0%
Bar/Lounge	1	0	315	0	0.0%
Convenience Store	7	0	87,101	0	0.0%
Elementary/Secondary Schools	9	1	126,114	4,457	3.5%
Family Entertainment Centers	2	0	20,576	0	0.0%
Fire/Police/Public Safety	4	0	14,895	0	0.0%
Fitness Center	5	0	41,222	0	0.0%
Garage/Repair	116	12	803,156	79,711	9.9%
Grocery Store	4	0	44,630	0	0.0%
Health	24	1	173,425	5,421	3.1%
Health Care - Assisted/Nursing	1	0	27,277	0	0.0%
Health Care - Outpatient	7	0	38,340	0	0.0%
Hospital	2	0	22,296	0	0.0%
Lodging	4	0	19,589	0	0.0%
Manufacturing	27	5	297,627	68,552	23.0%
Manufacturing (1 Shift)	14	2	117,419	23,074	19.7%
Multi-family Building 5+ Units	7	0	34,497	0	0.0%
Municipal/Government	12	1	153,414	10,328	6.7%
Office	82	6	588,262	22,029	3.7%
Other	49	3	322,860	16,421	5.1%
Religious	4	0	17,529	0	0.0%
Restaurant	12	1	75,973	12,295	16.2%
Restaurant - Casual Dining	5	1	29,682	6,275	21.1%
Retail	90	18	835,223	156,628	18.8%
Retail - Chain Store	1	0	24,820	0	0.0%
Warehouse	31	0	252,694	0	0.0%
Total	**528**	**51**	**4,247,958**	**405,189**	**9.5%**

2.3.2 Summary of Sample

Figure 6 shows the locations of the completed sample, by program. Orange dots denote SBI sample points and blue dots denote DL sample points.

Figure 6: Sample Map



2.4 FIELD DATA COLLECTION

2.4.1 RECRUITMENT AND SCHEDULING

The recruitment task's objectives were to obtain participation agreements from the required number of sites; ensure customer safety and satisfaction; and time the technician visits to minimize disruption to the site's primary business activities. We offered a financial incentive via a tiered outreach approach where we first notified participants by letter from EMT that they had been selected in the evaluation sample, and then followed up by telephone or email. In general, DL recruiting was more complex than SBI. SBI sites were typically very aware of their participation, while recipients of Distributor Lighting equipment tended to be less aware, either because of the midstream nature of DL or because their contractor managed the equipment purchase and relationship with the distributor. The DL sample also included much larger organizations than SBI. The commercial recruitment approach followed these steps:

1. **Initial outreach.** An initial letter on EMT letterhead outlined the purpose of the effort, the benefits to the facility, and what study participation entailed. Letters were mailed in waves to allow time to call sites quickly, allow us to visit and cluster geographic regions for efficiency, and to allow for adjustments required by our sampling strategy.
2. **Recruitment.** Within three days of the site receiving the letter, a study recruiter called the site to attempt to schedule a site visit. Study participants were offered a total of $100 in incentives with $75 paid for the initial visit and another $25 offered for a meter removal visit.
3. **Scheduling.** Sites were scheduled taking into account the size of the site and time needed at the site. Efficiency Maine elected to have the evaluation team gather detailed HVAC information while on-site to inform a supplemental Additional HVAC Opportunity Assessment study, which increased the required time on site.
4. **Reminders and confirmation.** The recruiter or technician sent reminders to site contacts two days in advance of site visits to maximize participant follow-through and confirm critical information necessary to prepare for the site visit such as ladder requirements.
5. **Thank you email.** The evaluation team followed up with a thank you letter via email and notified the participant that they should have received their Amazon gift card via email.

The evaluation team completed the initial site visits between October 24, 2019 and December 13, 2019. For a small number of sites, we returned to site to install additional loggers or gather key equipment details flagged as missing via QA/QC procedures. For the most part, the loggers were left to collect data until fall 2020.

Once an SBI site agreed to participate in the evaluation, we downloaded the EAT or SLIC tool from effRT. Reviewing the detailed scope of work tabs in these calculators familiarized technicians with the types of LED equipment to be verified and the different spaces within the facility. The DL program does not utilize standalone lighting calculators or gather information on the installation location within a facility, so site visit preparation for DL visits largely consisted of technicians reviewing make/model information from effRT along with manufacturer cut sheets.

2.4.2 FIELD DATA COLLECTION

Field data collection must be linked to other elements of the impact analysis to deliver an integrated analysis. This means familiarizing technicians with the overall study objectives and how different data points will be used so that time on-site can be prioritized effectively. Four key elements we used to minimize disruption and ensure satisfaction were:

1) **Be on time**. By offering two-hour windows and keeping track of time we made sure to meet all of our appointments.

2) **Conduct work efficiently**. Prior to the site visit, our technicians reviewed project documentation so that they stepped on site knowing what they were looking for.

3) **Bring all the tools that we need and don't ask to borrow anything.** This mean having ladders tall enough to place loggers in high-bay fixtures and access rooftop HVAC equipment as well as basic hand tools.

4) **Treat their site well and take responsibility as needed.** Loggers were attached with non-damaging techniques including magnets and Command Strips.

Field visits included multiple data collection methods – including lighting loggers, photos, and maps – all organized in an online data collection tool. Verification of the counts and properties of program-supported equipment is a core evaluation task, but while on-site we completed a full lighting inventory for most sites. The claimed installed measure quantity, by measure, from effRT were stored in the online data collection system for reference as shown in Figure 7. Each item in the lighting inventory was either associated with one of the claimed program measures for the site or classified as "not program supported."

Figure 7: Program Measure Checklist – SBI Participant

Program Measure Summary

Measure Name	Installed Qty	kWh
S13R OUTDOOR WALL-MOUNTED & LED AREA FIXTURE (WALLPACK)	1	736
S52 LED RETROFIT KITS FOR INTERIOR LUMINAIRES	3	499
S61R HIGH/LOW BAY DESIGN WITH NEW FIXTURES	9	3193

DSA's online data collection tool is a straightforward and flexible online system hosted on our dedicated server and accessible online with a username and password. The system allows field technicians to create an unlimited number of buildings for a site, as many lighting spaces as necessary within each building, and record the lighting equipment in each space. Figure 8 shows the flow of information through screens. For this project, all nine of the S61 High Bay fixtures were installed in the "Shop Floor" space. The equipment record shown in the figure corresponds to two of the fixtures. The serial number of the lighting logger (10255309) is also entered at the equipment-level.

Figure 8: On-Site Data Collection Screens

Link(s)	Building/Space
Building Menu	Engine Shop

Add a Lighting Space	Lighting Space	Sqft
Menu	Shop floor	2450
Menu	Lobby	156
Menu	Office	84
Menu	Bathroom	90
Menu	Boiler	60
Menu	Outdoor	1

Lighting Spaces Menu

Lighting Space:	Shop floor
Interior/Exterior Lighting	Interior
Hours Table	147=Business hrs
Square Footage	2450

Edit Lighting Space Master

Add Lighting Inventory	Style	Tech	Length	Wattage	Qty	Control
Change	High Bay Linear	LED	48 Inches	160.0	2	Switch
Change	High Bay Linear	LED	48 Inches	160.0	5	Switch
Change	High Bay Linear	LED	48 Inches	160.0	2	Switch

Link(s)	Building/Space
Building Menu	Engine Shop

Link(s)	Lighting Space	Sqft
Light Space Menu	Shop floor	2450

Ignore this record?	N=No
Lamp Style	HBLI=High Bay Linear
Lamp Technical	LED=LED
Application	INGS=Indoor General Service
Length	48=48 Inches
Fixture Wattage	160.0
Fixture Quantity	2
Control	SW=Switch
Secondary Control	NF=Not Filled
Program Measure	115=S61R HIGH/LOW BAY DESIGN WITH NEW FIXTURES
Logged fixture?	Y=Yes
Logger Serial	10255309
Datetime Logger Installed	11/18/2019
Datetime Logger Retrieved	
Notes	1:1 replacement of 6 lamp T5HO

All spaces are associated with a schedule reported by the site contact. This self-reported schedule was used to sanity check logger data and calculate verified gross savings for outdoor measures, which were not logged for this evaluation. Figure 9 shows the self-reported operating schedule for a business that operates 8am to 5pm on weekdays, 9am to 2pm on Saturdays and is closed on Sundays.

Figure 9: Self-Reported Lighting Schedule

	Sun	Mon	Tue	Wed	Thu	Fri	Sat
Jan	ALL DAY	12:00AM to 07:59AM 08:00AM to 05:00PM 05:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 05:00PM 05:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 05:00PM 05:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 05:00PM 05:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 05:00PM 05:01PM to Midnight	12:00AM to 08:59AM 09:00AM to 02:00PM 02:01PM to Midnight
Feb	ALL DAY	12:00AM to 07:59AM 08:00AM to 05:00PM 05:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 05:00PM 05:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 05:00PM 05:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 05:00PM 05:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 05:00PM 05:01PM to Midnight	12:00AM to 08:59AM 09:00AM to 02:00PM 02:01PM to Midnight
Mar	ALL DAY	12:00AM to 07:59AM 08:00AM to 05:00PM 05:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 05:00PM 05:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 05:00PM 05:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 05:00PM 05:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 05:00PM 05:01PM to Midnight	12:00AM to 08:59AM 09:00AM to 02:00PM 02:01PM to Midnight
Apr	ALL DAY	12:00AM to 07:59AM 08:00AM to 05:00PM 05:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 05:00PM 05:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 05:00PM 05:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 05:00PM 05:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 05:00PM 05:01PM to Midnight	12:00AM to 08:59AM 09:00AM to 02:00PM 02:01PM to Midnight
May	ALL DAY	12:00AM to 07:59AM 08:00AM to 05:00PM 05:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 05:00PM 05:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 05:00PM 05:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 05:00PM 05:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 05:00PM 05:01PM to Midnight	12:00AM to 08:59AM 09:00AM to 02:00PM 02:01PM to Midnight
Jun	ALL DAY	12:00AM to 07:59AM 08:00AM to 05:00PM 05:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 05:00PM 05:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 05:00PM 05:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 05:00PM 05:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 05:00PM 05:01PM to Midnight	12:00AM to 08:59AM 09:00AM to 02:00PM 02:01PM to Midnight
Jul	ALL DAY	12:00AM to 07:59AM 08:00AM to 05:00PM 05:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 05:00PM 05:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 05:00PM 05:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 05:00PM 05:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 05:00PM 05:01PM to Midnight	12:00AM to 08:59AM 09:00AM to 02:00PM 02:01PM to Midnight
Aug	ALL DAY	12:00AM to 07:59AM 08:00AM to 05:00PM 05:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 05:00PM 05:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 05:00PM 05:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 05:00PM 05:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 05:00PM 05:01PM to Midnight	12:00AM to 08:59AM 09:00AM to 02:00PM 02:01PM to Midnight
Sep	ALL DAY	12:00AM to 07:59AM 08:00AM to 05:00PM 05:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 05:00PM 05:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 05:00PM 05:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 05:00PM 05:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 05:00PM 05:01PM to Midnight	12:00AM to 08:59AM 09:00AM to 02:00PM 02:01PM to Midnight
Oct	ALL DAY	12:00AM to 07:59AM 08:00AM to 05:00PM 05:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 05:00PM 05:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 05:00PM 05:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 05:00PM 05:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 05:00PM 05:01PM to Midnight	12:00AM to 08:59AM 09:00AM to 02:00PM 02:01PM to Midnight
Nov	ALL DAY	12:00AM to 07:59AM 08:00AM to 05:00PM 05:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 05:00PM 05:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 05:00PM 05:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 05:00PM 05:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 05:00PM 05:01PM to Midnight	12:00AM to 08:59AM 09:00AM to 02:00PM 02:01PM to Midnight
Dec	ALL DAY	12:00AM to 07:59AM 08:00AM to 05:00PM 05:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 05:00PM 05:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 05:00PM 05:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 05:00PM 05:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 05:00PM 05:01PM to Midnight	12:00AM to 08:59AM 09:00AM to 02:00PM 02:01PM to Midnight

Because our online data collection system requires a connection to the internet in order to operate, some data collection was done via pen and paper and photos and then entered into the online data collection system later. Baseline assessment was not a core objective of this evaluation, but technicians completed a lumen-based sanity check of the baseline equipment type stored in the program tracking data.

Technicians installed Hobo UX-90 light loggers on fixtures to assess operating time. Program-supported equipment was prioritized for metering, but loggers were also deployed on other lighting equipment within the facility, especially for sites with a limited number of program measures. Loggers were calibrated at placement using Hobo/ Onset's integrated calibration button. Fixtures were turned on and off (where practical) to check that the logger was functioning correctly.

Table 10 shows the number of lighting loggers deployed in the businesses sampled for the SBI impact evaluation by measure along with the percentage of kWh savings that measure represented in SBI during FY2019 (as shown in Table 7). Technicians installed an average of 7.3 lighting loggers per site. The distribution of installed lighting loggers was generally aligned with program uptake for interior lighting measures. The evaluation team did not deploy lighting loggers on outdoor lighting fixtures due to the challenges of discerning sunlight from light produced by the fixture in an outdoor setting.

Table 10: Logger Installation Summary by Measure - SBI

Measure	Loggers	Measure Share of FY2019 kWh Savings
S110 LED Replacement Lamps	51	6.9%
S40 Screw-In Lamps	20	6.9%
S51 Recessed LED Fixture	15	12.4%
S52 Linear Retrofit Kit	140	28.4%
S61 High/Low Bay LED Fixture	22	9.1%
S81 Linear Ambient Fixtures	44	18.2%
Not Program Supported	65	0.0%
Total	**357**	**81.9%**

The variance in the outdoor lighting was expected to be relatively low – with most fixtures operated either on a photocell, timer, or 24/7. During the site inspections, technicians worked with the site contact to create an operating schedule for each piece of outdoor lighting equipment (Figure 9). The annual hours of use and coincidence factors implied by these schedules were used to calculate verified gross savings for program-supported exterior lighting measures.

Technicians also examined HVAC systems at each site looking at the primary source of heating and cooling, the distribution system, nameplates, and service tags. This effort informed the calculation of interactive effects and was used to develop a separate "Additional Opportunity Assessment" deliverable for the Trust. During and after the visits we:

- Photographed the system and the nameplates where present and observable.
- Cataloged the HVAC capabilities, zoning (where practical), setpoints, and took nameplate photos.
- Cataloged roof-top units (RTUs) and related equipment such as make up air units (MAUs) when present.
- Used nameplate photos taken onsite to look up and catalog manufacturer specifications and efficiency levels.
- Summarized the HVAC configurations encountered by business size and type.

In all of the SBI sites, and nearly all of the smaller DL sites, we were able to gather data on most or all of the HVAC equipment. Cataloging RTUs and MAUs directly was limited to the sites where we were granted roof access. In many cases this was not possible or practical. In some cases, we needed to estimate system characteristics or use Google Maps to establish the number of units and their approximate capacity using size and number of condensing fans.

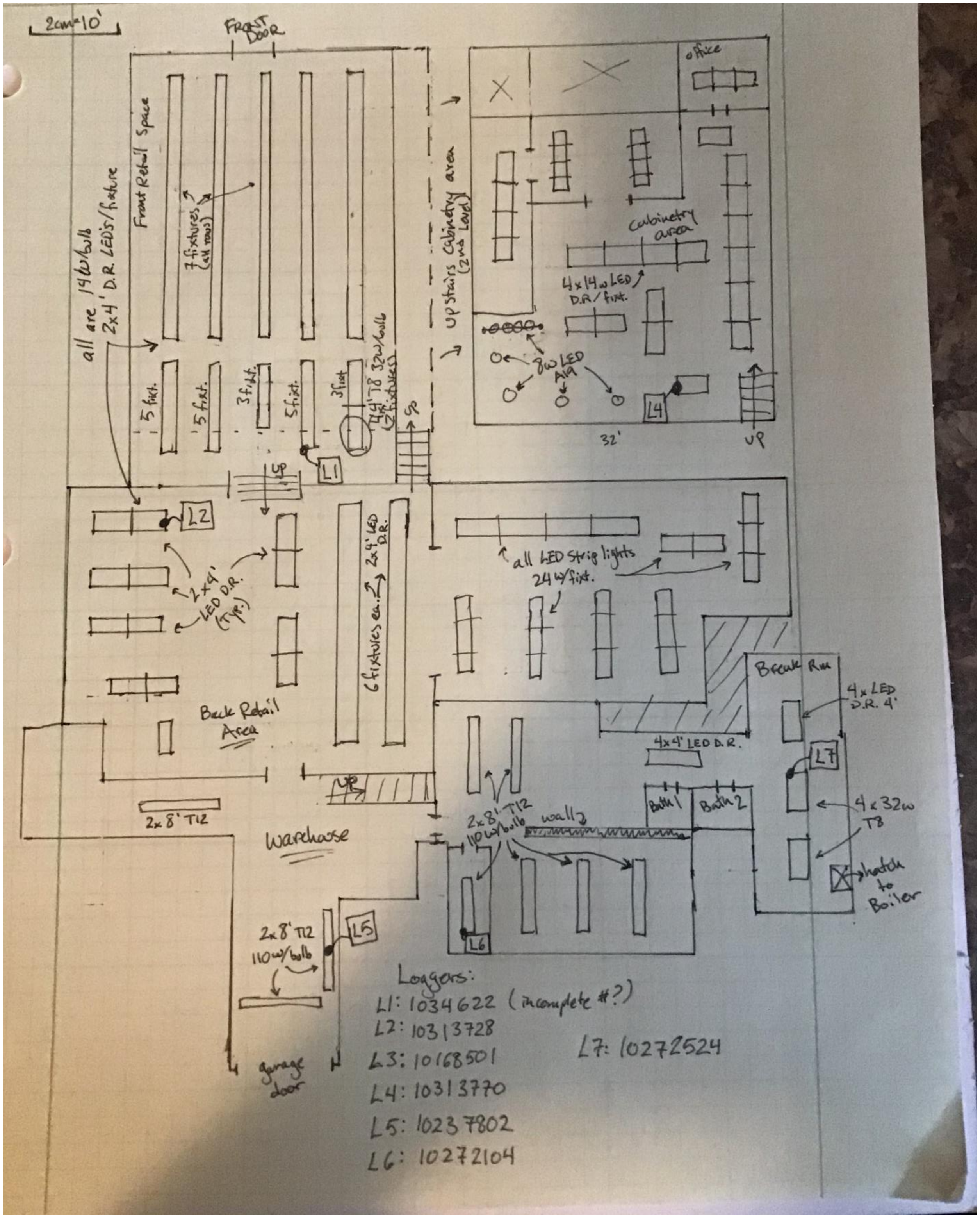
2.4.3 Logger Pickups

Installed lighting loggers were collected between September and November 2020. The evaluation team adjusted our planned logger retrieval process in several ways based on the COVID-19 pandemic.

- **Development of a COVID-19 safety protocol.** To ensure the safety of both staff and study participants, the evaluation team developed a cross-cutting safety protocol[5] which detailed the use of personal protective equipment and social distancing at all times while on site. Participants were also given the option to "self-remove" the loggers and return them via mail.
- **Modified outreach.** In August 2020, the evaluation team contacted study participants to remind them of the logger pickup and discuss a convenient time for the visit. In addition to these standard scheduling questions, we fielded a short battery of questions about how the pandemic had affected operations.
- **Leveraging the program delivery team.** The Center for Disease Control recommends limiting out-of-state travel to reduce virus exposure. Although there were no travel restrictions in place in Maine at the time of the logger removals, the evaluation team and Efficiency Maine wished to limit technician visits from out of state as much as possible. Local members of the SBI program delivery team completed the logger retrieval visit for approximately half of the commercial sites in the sample. The evaluation team provided site drawings like the one shown in Figure 10 along with photos of logged fixtures to facilitate the pickups.

[5] https://www.demandsideanalytics.com/wp-content/uploads/2020/12/COVID-Protocols-1-pager-FINAL.pdf

Figure 10: Site Drawing with Logger Locations



2.5 ANALYSIS OF LOGGER DATA

In our data collection system, each lighting logger is associated with a specific item from the lighting inventory collected onsite. In preparing the data for analysis, we merge the logger data with the equipment data collected on-site, as well as relevant fields from the program tracking data for program-supported equipment.

2.5.1 LOGGER DATA PROCESSING

In processing and analyzing the commercial lighting logger data, our team has two primary objectives.

- Loggers deployed on program-supported LED equipment in the SBI program are used to calculate the verified gross energy and demand savings via a realization rate developed using stratified ratio estimation.
- Estimate average HOU, summer and winter CFs, and energy period factors for commercial lighting equipment as a whole. This set of composite commercial lighting operating characteristics are used to estimate verified gross savings for the Distributor Lighting program and leverage all loggers deployed across both programs.

Regardless of how an individual logger is ultimately used in the evaluation, the upfront processing steps are the same. Due to the COVID-19 pandemic, study participants were given the option to "self-remove" loggers and return them via mail. However, most businesses elected to have a technician remove the loggers. Lighting logger removals occurred from September to November 2020. At the time of the removal, the evaluation team inspected the loggers themselves for heat (or any other) damage and flagged damaged loggers for data quality issues related to the damage. Technicians also performed a state test on each logger to confirm that the logger was correctly recording when the light was on and off. Figure 11 shows the state indication on the display screen of logger. The state test involves either turning the light on and off while looking at the screen, or covering and uncovering the sensor while the light is on.

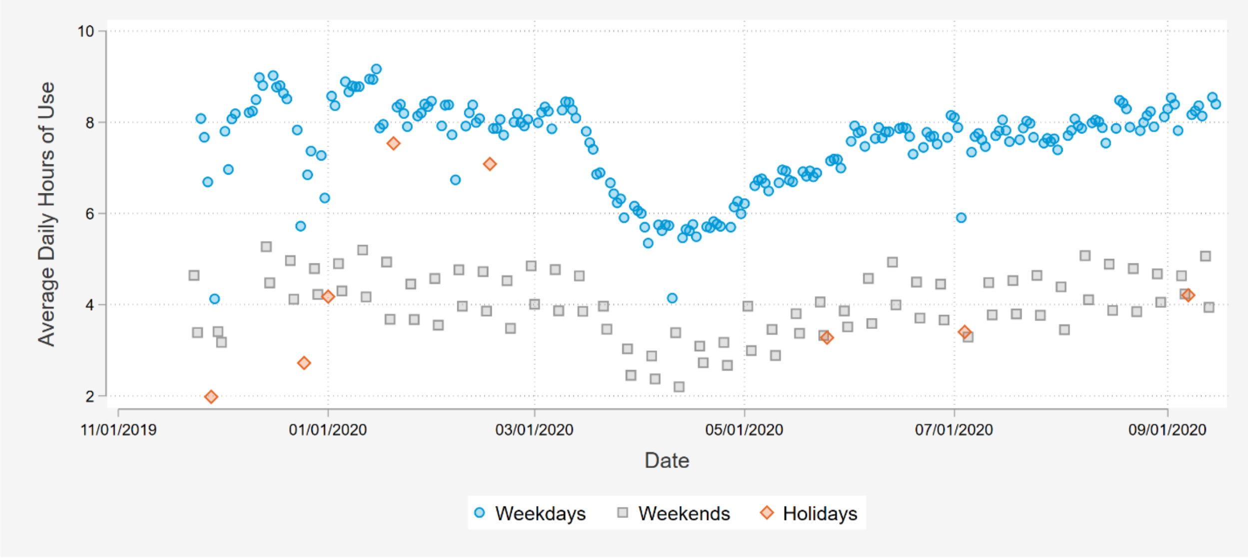
Figure 11: Successful Lighting Logger State Test

State test issues were recorded for approximately 25 loggers across the two programs. In a few cases the loggers never recorded an "on" state in ten months, indicating the lumen threshold was set too high given the placement. In other cases, ambient sunlight caused the logger to remain in the "on" state even when the fixture was turned off. After a manual review of the data we determined that some of the loggers with failed state tests worked correctly for a subset of the logging period and then abruptly started having issues due to a dead battery or falling out of position. In these cases, a portion of the data was kept for analysis and the questionable periods were excluded.

After completing some basic quality control checks, we reviewed the logger data for outliers in terms of hours of use (HOU) by comparing the logged operating hours to the self-reporting operating schedule recorded during the initial site visit. When scheduling the logger pickup appointment, we asked businesses how their operations changed as a result of the COVID-19 pandemic. The responses varied by industry but provided a useful data point for logger data validation.

The aggregate effect of the pandemic on Maine business lighting operation is apparent in Figure 12, which shows a simple daily average hours-of-use across all commercial loggers that passed the QA/QC filters. In mid-March, the average weekday hours-of-use begins to drop from approximately eight hours per day to less than six hours per day. In May, the average weekday hours begin to increase and by mid-summer are almost back to pre-pandemic averages.

Figure 12: Average Daily Hours of Use



On average, loggers were in place for slightly more than ten months. The evaluation team used a regression-based approach to annualize the data from each logger and account for the effects of the pandemic. After reading out the logger data, we converted it from a series of timestamps indicating when the light turned on and off into hourly data. All data is stored in EPT meaning that it reflects eastern daylight time (GMT-4) when daylight savings is in effect and eastern standard time (GMT-5) when daylight savings is not in effect. The percent of each hour of each day in the logging period that the light was on is stored as an observation. The "percent on" variable is inherently bounded – a light cannot be on less than 0% of an hour and it cannot be on for more than 100% of an hour. Given the bounded nature of the data, the evaluation team opted for a fractional regression technique.

Fractional regression is a model of the mean of the dependent variable y conditional on covariates x. Because y is in [0, 1], we must ensure that the conditional mean is also in [0, 1]. Essentially, we want a functional form that will not predict lighting operation less 0% or greater than 100% under any condition. We do this by using a maximum likelihood logit model for y. The fractional regression model specification used for each commercial lighting logger was.

$$y_{l,d,h} = DOW + Hour + Hour * (DOW + Summerpeak + Winterpeak) + Season + COVID$$

Where:

- **$Y_{l,d,h}$** = the percent on recorded by logger l on date d and hour h
- **DOW** = an indicator variable equal to zero on Sunday, one on Monday, two on Tuesday etc. Holidays are coded as seven regardless of which day of the week they fall on.
- **Hour** = an indicator variable for the hour of the day.
- **Summerpeak** = an indicator variable equal to one on non-holiday weekdays during June, July and August hours ending 14-17 (1pm to 5pm). Equal to zero otherwise.
- **Winterpeak** = an indicator variable equal to one on non-holiday weekdays during December and January hours ending 18-19 (5pm to 7pm). Equal to zero otherwise.
- **Season** = an indicator variable for season. Spring is defined as March-May, summer is June-August, fall is September-November, and winter is December-February.
- **COVID** = an indicator variable equal to one from March 15, 2020 to May 15, 2020. Equal to zero otherwise.

After estimating the regression for each logger, we use the coefficients to predict lighting usage across the 2021 calendar. This is referred to as an 8760 load shape because it contains predicted lighting usage for all 365*24 hours in 2021. Among the commercial logger regressions, 71% had a negative coefficient on the COVID indicator variable and 60% had a statistically significant negative coefficient at the 90% confidence level. A negative regression coefficient on the COVID indicator variable means that, holding other factors constant, lighting operating hours were lower from March 15, 2020 to May 15, 2020. This distribution of regression coefficients matches the visible trend in Figure 12 where average lighting operating hours dropped noticeably in spring 2020 with the onset of the COVID-19 pandemic. Importantly, the COVID indicator variable is set to zero in the 2021 calendar so we are predicting lighting operation absent the estimated change observed from March 15, 2020 to May 15, 2020.

2.5.2 LOGGER DATA ANALYSIS

The evaluation calculated energy and peak demand impacts for SBI at the measure-level for each sampled site. This required the logger-specific 8760 load shapes to be summarized across individual loggers and spaces within the business. Consider the following example for a business whose retrofit included quantity 63 of measure S52 (LED Retrofit Kits for Interior Luminaires). Table 11 lists the eight lighting loggers that were installed on program-supported fixtures. This example focuses on annual hours of operation for simplicity, but the calculations were performed on the full 8760 load shapes. The data collection system allows technicians to create an unlimited number of buildings and spaces within each building. A given lighting space can have an unlimited number of lighting equipment entries and an equipment entry can have multiple loggers.

Table 11: Logger Data Example – Step 1

Space Name	Equipment Key	Equipment Quantity	Logger	Annual HOU
Basement - storage on SLIC	758	5	10346069	1,824
Basement - storage on SLIC	759	4	10374189	1,919
Attic	789	11	10374186	786
Attic	789	11	10168519	1,279
Attic	789	11	10255371	1,291
Shop-Rt 3 side	790	12	10313751	1,626
Main Shop - Barn side	793	15	10261591	2,495
Office/ Repair Shop	796	15	10268304	1,944

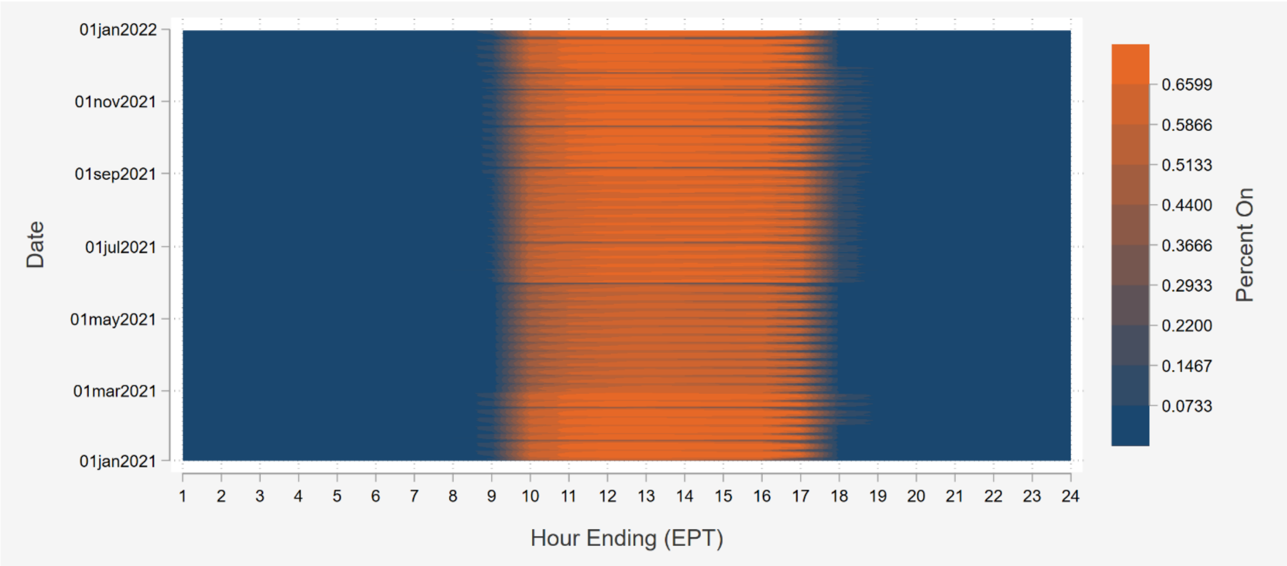
During the site visit, technicians observed 62 of the 63 claimed fixtures. However, the sum of the equipment quantity in Table 11 is greater than 62 because multiple loggers were associated with a single equipment entry. These "duplicates" are shaded green and correspond to the 11 program-supported fixtures in the attic. The evaluation team installed multiple meters in this space because the fixtures were controlled by different switches and operated independently of one another by facility staff. By installing multiple loggers in the space, we were able to capture the diversity in operating characteristics across the space. From an impact evaluation perspective, we want the savings calculation for the S52 measure at this site to correspond to the number of fixtures, not the number of loggers so the three loggers installed in the Attic are averaged to create the values shown in Table 12. The loggers in the "Basement" are not collapsed because they correspond to two separate equipment entries as evidenced by the different values of Equipment Key. Finally, a quantity-weighted average was calculated across all of the logged equipment in the site corresponding to the S52 measure code.

Table 12: Logger Data Example – Step 2

Space Name	Equipment Key	Equipment Quantity	Logger	Annual HOU
Basement - storage on SLIC	758	5	10346069	1,824
Basement - storage on SLIC	759	4	10374189	1,919
Attic	789	11	Multiple	1,119
Shop-Rt 3 side	790	12	10313751	1,626
Main Shop - Barn side	793	15	10261591	2,495
Office/ Repair Shop	796	15	10268304	1,944
Quantity-Weighted Average				**1,858**

The process above returns a composite 8760 load shape for the S52 measure in this facility. Figure 13 is a heat map showing the full annualized profile. The composite annual hours of use is 1,858, the summer coincidence factor is 0.66 and the winter coincidence factor is 0.025. For reference, the self-reported hours of use collected by the evaluation team during logger installation was 2,918. The EAT calculator used to calculate unadjusted gross savings used 2,912 hours per year for 44 fixtures and 2,392 hours per year for the other 19 fixtures.

Figure 13: Heat Map of S52 Retrofit Kit Operating Schedule at Example Site



The companion Retail and Distributor Lighting impact evaluation report describes how the evaluation team used all the commercial logger data collected across SBI and DL sites to estimate a composite commercial interior lighting load profile. In Section 4, we discuss prospective updates to the TRM and associated factor schedule for SBI based on the results of the logging activities for program-supported SBI equipment and the broader commercial logging effort.

2.5.3 COVID-19 Impacts

The effect of the COVID-19 pandemic and associated shelter-in-place order was clearly visible in the commercial light logger data. Figure 12 showed a simple daily average hours-of-use across all commercial loggers that passed the QA/QC filters. When scheduling logger pickups in the fall of 2020, the evaluation team fielded a short battery of questions about how the pandemic impacted operating hours for their business. Respondents were asked whether the COVID-19 pandemic affected their operating hours on a short-term basis and long-term. Long-term was defined as operating a reduced schedule in fall 2020 when the question was asked. The response patterns to this simple battery of questions, as well as ad hoc discussions with participants during the logger pickup visits informed the evaluation modeling decisions with respect to annualizing logger data collected during a global pandemic.

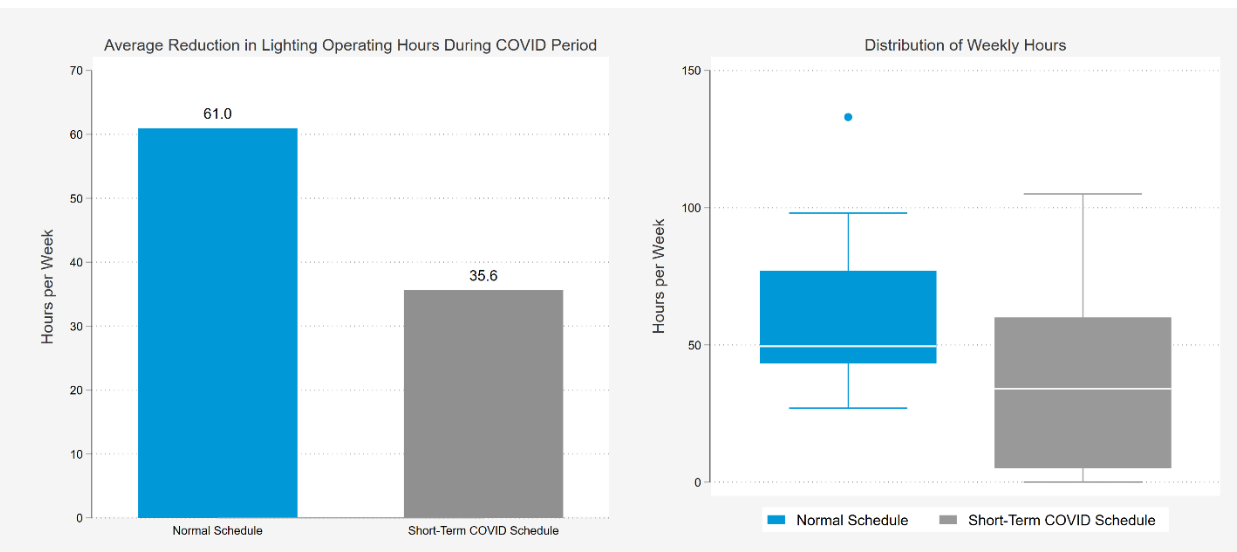
Table 13 shows the results across both the SBI and DL sample. Over half the commercial businesses surveyed reported a short-term reduction in operating hours during spring 2020. These respondents were asked to estimate the duration of the reduction in weeks. Responses ranged from two to twenty weeks with a mean of 7.5 weeks. Fewer respondents (8%) reported long-term reductions in operating hours.

Table 13: Distribution of Responses to COVID-19 Questions

COVID Reduced Operating Hours	Short-Term	Long-Term
Yes	53%	8%
No	47%	92%

A common theme among the responses was that the business itself may have been closed for a period of time in spring 2020, but the staff used that time to complete projects around the facility during business hours so lighting operation wasn't particularly atypical. Participants who indicated a short-term reduction in hours of use during the pandemic were asked to estimate their normal hours per week and the average hours per week of lighting operation during the temporary reduction. Figure 14 shows the average of the responses as well as the distribution. In the boxplot on the right side of Figure 14, the box stretches from the 25th percentile to the 75th percentile and the white line represents the median, or 50th percentile. On average, among participants who indicated a short-term reduction in hours, the average drop in self-reported hours per week was 42%. Beneath this average was a mix of respondents whose business closed completely (100% reduction) and respondents who reported modest reductions of 10-20%.

Figure 14: Changes in Lighting Operating Hours During COVID Period



2.6 INTERACTIVE EFFECTS

The evaluation team estimated the HVAC interactive effects values of LED lighting on heating demand, cooling demand, heating energy, and cooling energy. The approach used to estimate these values follows the methods laid out in the Efficiency Maine TRM, whereby four factors are combined to construct the effect value:

- **Internal Gain Contribution (%):** The percent of waste heat that remains inside the building, contributing to the increased or decreased need for heating or cooling from the HVAC system. The evaluation team found the current TRM values for this term to be reasonable and used a weighted average of the existing "High/Low Bay" and "Non-Bay" values to compute the 55% factor shown in Table 14.
- **Applicability (%):** The percentage of lighting that is installed in spaces that are heated or cooled by the HVAC system. This factor was calculated from the results of the lighting socket and building inventories. For SBI, whether a measure is installed indoors or outdoors is known, so applicability is calculated for interior lighting only. No interactive effects are applied to exterior lighting measures.
- **Concurrency (%):** The percent of time that both lighting and HVAC systems are operating concurrently. This factor was calculated by using the indoor, conditioned lighting profiles and an assumed distribution of weather-normalized heating and cooling periods. The weather-normalized data is a population-weighted average TMY3 dataset that includes information from Portland (weighted 71.2%), Bangor (23.4%), and Caribou (5.4%), Maine. To determine when heating or cooling was used, the evaluation team used the following logic:
  - **Commercial Heating:** Days where the temperature was below 50°F for at least 3 hours.
  - **Commercial Cooling:** Days where the temperature was above 60°F for at least 3 hours.
- **HVAC Efficiency (%):** The efficiency of the heating and cooling systems. This factor was calculated from the results of the commercial field data collection efforts.

These four factors are combined to generate the interactive effects for heating and cooling energy and demand according to the following formulae.

$$IE_{cool,energy} = 1 + \frac{IGC * \%A * C}{Eff_{HVAC}}$$

$$IE_{cool,demand} = 1 + \frac{IGC * \%A * C}{Eff_{HVAC}}$$

$$IE_{heat,energy} = \left(\frac{IGC * \%A * C}{Eff_{HVAC}}\right) * 0.003412 MMBtu/kWh$$

$$IE_{heat,demand} = 1 - \left(\frac{IGC * \%A * C}{Eff_{HVAC}} * \%_{electric\ heat}\right)$$

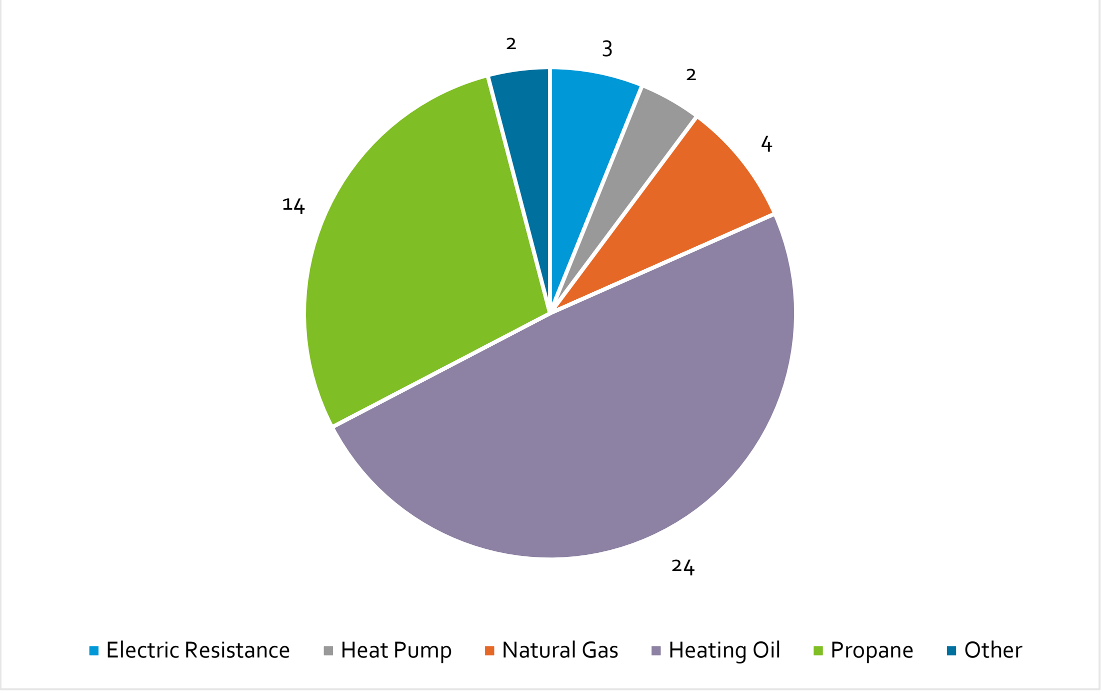
The inclusion of a heating demand interactive effect is a departure from the existing TRM characterization. With increased penetration of electric heat in Maine, the effects of lighting efficiency programs on winter peak demand are no longer negligible. A key distinction between the heating demand and cooling demand formulae is that the interactive effect for heating demand is adjusted by the percent of heating systems that are electric as opposed to fuel oil, wood, gas or other sources. This fraction is currently 2.48% for commercial customers but is expected to grow with increased adoption of heat pumps in Maine. Table 14 summarizes the factors calculated for each of the four interactive effect values.

Table 14: Interactive Effects Calculations

Sector	Mode	Resource	IGC	%Applicability	Concurrency	Eff_{HVAC}	IE Value
Commercial	Cool	Demand	55.0%	62.5%	95.1%	437.6%	1.0747
Commercial	Cool	Energy	55.0%	62.5%	28.3%	437.6%	1.0222
Commercial	Heat	Demand	55.0%	84.6%	100.0%	259.1%	0.9955
Commercial	Heat	Energy	55.0%	84.6%	54.5%	81.4%	0.0011

In SBI, the actual heating fuel type is collected for each facility and used to calculate the savings stored in effRT. Our site visits largely confirmed the heating fuel type recorded by the program delivery team. Figure 15 shows the distribution of heating fuel types across the SBI sample. This distribution is noticeably different from the commercial fuel shares used in the Distributor Lighting evaluation. Those shares were calculated across all SBI and DL sites and weighted by heating capacity. The difference is simple – large commercial businesses tend to be located where natural gas service is available and those businesses represent a large share of the commercial heating (and lighting) capacity. This evaluation includes projects from SBI Regions 7-14, which are located in areas of Maine more likely to have natural gas service than other regions of Maine away from the Interstate 95 corridor.

Figure 15: Distribution of Heating Fuel in the SBI Sample

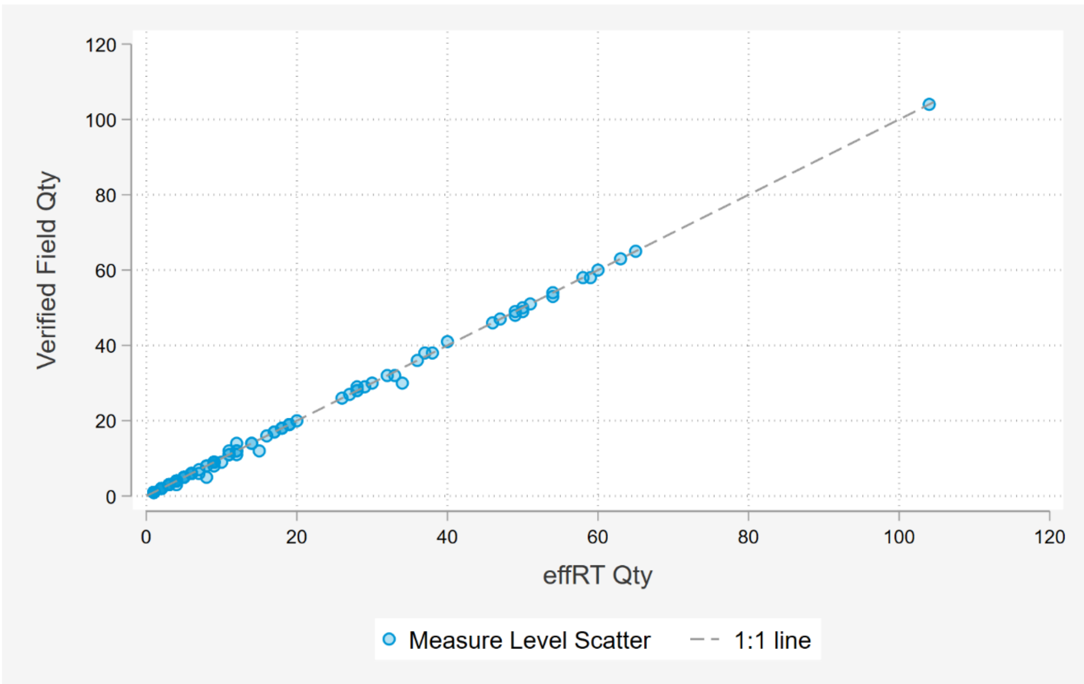


Ultimately, we calculated a single realization for all fuel and applied it to all unadjusted gross FY2019 fossil fuel impacts. As a result, the gross verified and net verified fossil fuel impacts shown in Table 3 follow the same distribution as the unadjusted gross fuel impacts.

2.7 ESTIMATED GROSS IMPACTS

Almost all of the variance between the unadjusted gross savings values and the verified gross impacts is attributable to lighting operating characteristics as opposed to equipment counts or properties. Figure 16 shows the correspondence of equipment counts as observed by the evaluation team during site visits and the installed measure quantity recorded in the EAT/SLIC tool and stored in effRT. Any differences in counts were well within the threshold for technician counting errors so the verified savings calculations rely on the installed measure quantity as recorded in effRT.

Figure 16: SBI Measure-Level Equipment Count Correspondence



LED wattages recorded by field staff were also highly aligned with the values stored in the program tracking data. This is not a surprising finding given the fact that SBI contractors scope projects from an approved product catalog and the wattage lookup tables in the EAT/SLIC tools are populated with manufacturer wattages for the specific products with negotiated program pricing. For example, one of the most common measures in the SBI sample was S52 Linear Retrofit Kits. Table 15 summarizes the occurrences of the 2x4 linear permutation in our sample. In this case the "2" refers to strips rather than tubes because retrofit kits just have strips of diodes rather than tubular lamps and the "4" is the length of the strips in feet.

Table 15: Example Baseline and Efficient Wattages

Installed Measure	Efficient Wattage	Measure Quantity	Removed Fixture	Baseline Wattage
S52 LED Retrofit Kit: Linear 2x4	23.9	72	T12 - 2-Lamp 4' T12	70.7
S52 LED Retrofit Kit: Linear 2x4	23.9	27	T12 - 4-Lamp 4' T12	141.2
S52 LED Retrofit Kit: Linear 2x4	23.9	16	T12 - 2-Lamp 8' T12	120.6
S52 LED Retrofit Kit: Linear 2x4	23.9	12	T8 - 3-Lamp 4' T8	89
S52 LED Retrofit Kit: Linear 2x4	23.9	6	T8 - 4-Lamp 4' T8	112
S52 LED Retrofit Kit: Linear 2x4	23.9	3	T12 - 2-Lamp 8' T12 HO	197.9

The efficient wattage of 23.9 was confirmed by the field staff who recorded 24W in the data collection tool. Table 15 also shows the frequency this measure was paired with removed fixtures in the SBI sample and the associated wattage, which was not observable during the site visits because they had been removed. The most common removed fixture pairing in Table 15 is exactly what we would expect, a two lamp, four-foot T12 fixture. None of the pairings in Table 15 are implausible from a physical or lumen output standpoint. Satisfied in the reasonableness of all equipment pairings and wattages, the evaluation team ultimately calculated gross verified savings using the baseline and efficient wattages stored in effRT for all sampled projects. In total, the power draw of the LED lamps and fixtures in the SBI sample was just 36.5% of replaced equipment. For comparison, Demand Side Analytics recently completed an impact evaluation of a Small Business Direct Install lighting program in New York where the comparable ratio was 36.7%.

While specific projects involved increased or decreased levels of lighting output, the overall improvement in lighting efficacy is consistent with our expectations for this type of program. Figure 17 shows the distribution of wattage ratios across measures in the SBI sample and Table 16 summarizes wattage reduction by measure. The measures showing the largest and smallest relative improvements make sense based on the efficacy of the common types of replaced equipment.

Figure 17: Distribution of Wattage Ratios in SBI Sample

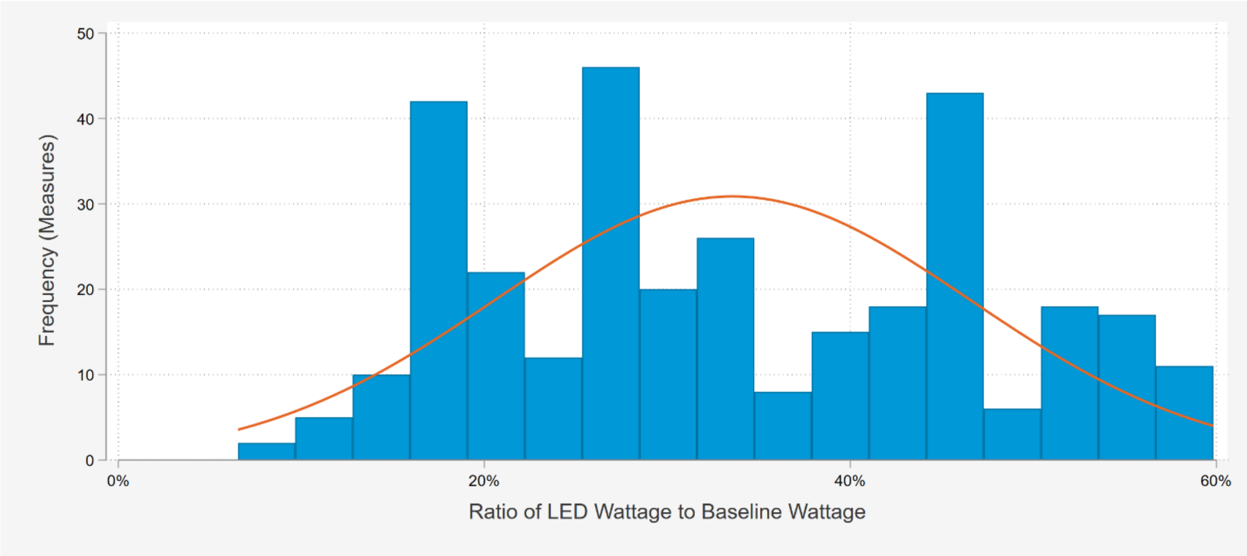


Table 16: Wattage Reduction by Measure in the SBI Sample

Measure	Baseline kW	LED kW	Ratio (LED/Baseline)
S06 Outdoor Replacement Lamp Type B/C	0.95	0.12	12.2%
S11 Outdoor Parking Lot and Streetlight	3.25	0.96	29.6%
S13 Outdoor Wallpack	5.85	1.54	26.4%
S21 Recessed Cans and Downlights	0.07	0.02	25.7%
S23 Flood and Spot	1.24	0.24	19.7%
S40 Screw-In Lamps	17.80	2.89	16.3%
S51 Recessed LED Fixture	8.23	2.79	33.9%
S52 Linear Retrofit Kit	92.43	31.05	33.6%
S61 High/Low Bay LED Fixture	39.32	18.64	47.4%
S81 Linear Ambient Fixtures	32.50	12.24	37.7%
S110 Linear and U-Bend Replacement Lamps	23.35	11.66	49.9%
Total	**224.98**	**82.16**	**36.5%**

As described in Section 2.5.2, the evaluation team developed a composite lighting load profile for each program measure code at each sampled site. Since outdoor fixtures were not logged, we used self-reported schedules to calculate savings for outdoor lighting measures. A single measure code for a given site can include multiple records, which correspond to entries in the EAT/SLIC tool. Table 17 illustrates the calculation of total baseline and efficient connected load at the measure code level for the S52 Linear Retrofit Kit measure at the same sample site discussed in Section 2.5.2.

Table 17: Sample Calculation of Baseline and Installed Connected Load

Baseline Equipment	Baseline Qty.	Baseline Wattage	Installed Equipment	Installed Qty.	Installed Wattage
T8 - 4-Lamp 4' T8	9	112.0	Linear 2x4>=50W	9	50.1
T8 - 4-Lamp 4' T8	3	112.0	Linear 2x4<50W	3	23.9
T8 - 2-Lamp 4' T8	2	59.0	Linear 1x4<40W	2	20.1
T8 - 4-Lamp 4' T8	9	112.0	Linear 2x4>=50W	9	50.1
T12 - 2-Lamp 4' T12	6	70.7	Linear 1x4<40W	6	20.1
T12 - 2-Lamp 4' T12	6	70.7	Linear 1x4<40W	6	20.1
T8 - 2-Lamp 4' T8	6	59.0	Linear 1x4<40W	6	20.1
T12 - 2-Lamp 4' T12	1	70.7	Linear 1x4<40W	1	20.1
T8 - 2-Lamp 4' T8	6	59.0	Linear 1x4<40W	6	20.1
T12 - 2-Lamp 4' T12	15	70.7	Linear 1x4<40W	15	20.1
Baseline kW		**5.1576**	**Installed kW**		**1.8177**

The baseline and efficient lighting wattage values are calculated by multiplying quantity and wattage, dividing by 1,000 to convert from Watts to kW, and summing. Recall from Section 2.5.2 that the composite annual hours of use from the logged program-supported S52 fixtures at this site was 1,858. Equation 2 shows the core energy savings calculations.

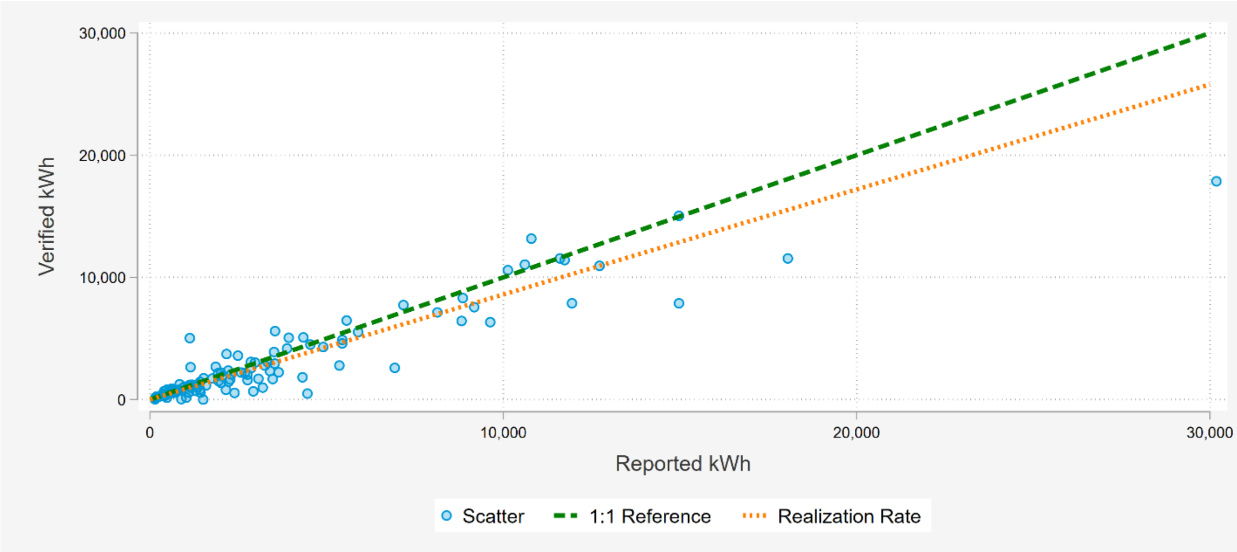
Equation 2: Annual Energy Savings Calculation

$$\Delta kWh/year = (5.1576 - 1.8177) * 1858 = 6{,}206$$

The other component of the energy savings calculation, and a minor source of variance between unadjusted gross and verified gross savings for SBI, is the updated HVAC interactive effect assumptions discussed in Section 2.6. This example site has fossil fuel heat so is only adjusted using the IE_Cool_E term to account for the reduced summer air conditioning load attributable to the less waste heat from LED fixtures. The verified gross energy savings for this measure was 6,336 kWh/year, which is equal to 65.8% of the unadjusted gross savings claim of 9,631 kWh/year. This calculation is performed for each measure in the sample and then summarized at the site level.

The evaluation team calculated realization rates using stratified ratio estimation. The case weights for each SBI region were shown in Table 8. The energy realization rate for SBI was 85.2%, which means in aggregate the verified gross kWh savings estimated by the evaluation team were approximately 15% lower than the unadjusted gross kWh values stored in effRT. Figure 18 provides a visual illustration of the realization rate at the measure level. Each blue point is a distinct measure from a site in the evaluation sample. The orange trend line is the realization rate (y=0.852*x). The green trend line is presented for reference to illustrate what a 100% realization rate would look like overlaid on the data.

Figure 18: SBI Energy Realization Rate Visualized



The program realization rates represent the average ratio of verified savings to unadjusted gross savings. As shown in the Figure 18, these ratios varied across projects and measures. Because the impact evaluation relied on a sample of projects rather than a census, there is uncertainty (or a margin of error) around the estimated realization rates. The amount of uncertainty is a function of the sample size and the amount of variance observed between individual project results and the average ratio in the sample. The margin of error for energy at the 80% confidence level is ± 4.68% so the confidence interval of the realization rate is (80.6%, 89.9%). The relative precision is equal to the margin of error divided by the realization rate, or ± 5.5% at the 80% confidence interval. Once the realization rates are calculated, they are applied to all FY2019 program activity to estimate the verified gross savings for the program as a whole.

2.7.1 Gross Verified FY2019 Energy and Demand Savings

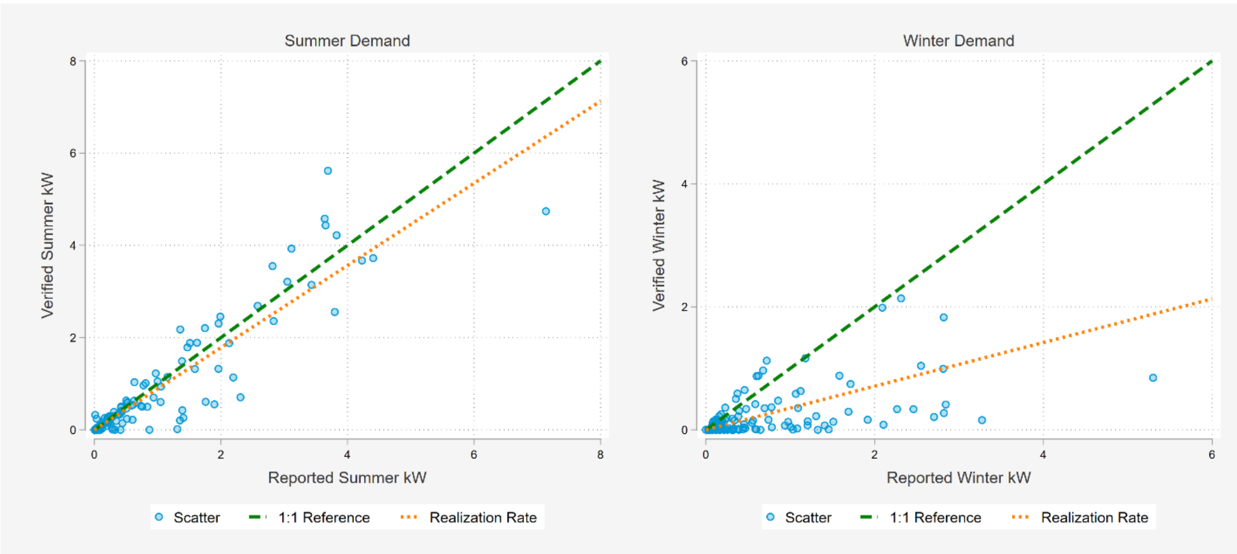
Table 18 presents the core results of the impact evaluation. For some Efficiency Maine programs, the distinction between unadjusted gross and adjusted gross is important. Adjusted gross savings are calculated by applying an in-service rate and prior realization rate to the unadjusted gross impacts. For SBI in FY2019, in-service rate was 1.0 and the realization rates were also 1.0 – meaning that the unadjusted gross and adjusted gross savings were identical.

Table 18: Verified Gross Impacts – SBI FY2019

Resource	Unadjusted Gross	Realization Rate	Gross Verified	RP at 80%	Lower Bound	Upper Bound
kWh	4,246,829	85.2%	3,620,336	5.5%	3,421,528	3,819,144
Winter kW	967.2	34.8%	336.7	13.9%	290.0	383.4
Summer kW	1,188.9	88.5%	1,052.0	6.4%	984.3	1,119.8
Fossil Fuel (MMBTU)	-4,146	78.5%	-3,253	7.9%	-2,997	-3,510

Verified savings for electric energy, summer demand, and fossil fuel were slightly lower than unadjusted gross savings leading to modest downward adjustments. The most notable difference between unadjusted gross and gross verified savings occurs for winter demand. The winter demand realization rate of 34.8% also leads to lower precision for the winter demand results. Figure 19 overlays the demand realization rates on a scatter plot of measure impacts.

Figure 19: SBI Demand Realization Rates Visualized



The factor schedule in place during FY2019 for year round interior lighting fixtures used a summer coincidence factor of 60.9% and a winter coincidence factor of 45.3%. These coincidence factors were derived from logging conducted during the 2017 Business Incentive Program Impact Evaluation.[6] The comparable values for program-supported SBI interior lighting in this evaluation are 56.9% and 17.7%. We offer the following observations regarding the notable difference in correspondence across seasons.

- **Business Type and Size:** SBI, by design, serves very small businesses. The average lighting project size in the Business Incentive program evaluation was approximately three times the size the average in our SBI sample (24 MWh vs. 8 MWh). Larger businesses that participate through a prescriptive rebate process may keep longer business hours and stay open during winter evenings. As discussed in Section 4, the observed winter coincidence factors in the Distributor Lighting sample were much larger, particularly in the large stratum.
- **Seasonality:** One of the major findings in the Business Incentive program evaluation dealt with the prevalence of seasonal businesses in Maine. Of the 66 prescriptive lighting projects in the Business Incentive program evaluation sample, 22 were classified as seasonal businesses. Of those 22 businesses, 9 were closed completely during the winter and 13 reported operating a reduced schedule during the winter months. The SBI sample did not include any businesses that were closed during the winter, but many did report reduced hours during certain seasons. It

[6] https://www.efficiencymaine.com/docs/EMT-BIP-Impact-Evaluation-Report-11_5_17.pdf

appears that seasonal businesses were excluded from the calculation of the average coincidence factors. It may be true that the type of businesses that receive program services are especially likely to operate a reduced schedule during winter months. The winter peak definition of 5pm-7pm non-holiday weekdays during December to February falls both after sunset and after classic "9 to 5" office hours.

2.7.2 SEGMENTED EVALUATION RESULTS

Comparing of the impact evaluation results across sub-groups can help to be a useful tool for understanding the key drivers of the overall results. Although these comparisons are useful, statistical significance is diminished for small sample sizes. The sample sizes in this evaluation are not adequate to develop separate impact factors by facility type or measure code beyond the separation of interior and exterior equipment. The segmented results presented in this section are calculated without the regional case weights used to develop the primary gross impact evaluation results.

As discussed in Section 2.3, each Maine business that participates in SBI is assigned to a facility type. The annual operating hours used to calculate energy savings in SLIC are either deemed based on a TRM lookup of facility and space type or "actual" based on the stated operating hours of the business. The EAT calculator did not include a deemed hours of use option so all EAT projects rely on the stated operating hours as input by the program delivery team. Of the final SBI sample of 49 sites, 32 relied on an EAT calculator and the other 17 used the successor SLIC tool. Table 19 compares the electric realization rates observed across the two program delivery tools.

Table 19: Realization Rates by Program Delivery Tool

Tool	Sites	RR kWh	RR Summer kW	RR Winter kW	RR MMBTU
EAT	32	86.3%	86.3%	32.4%	68.0%
SLIC	17	76.5%	96.0%	33.9%	102.3%

Table 20 provides a similar comparison for interior and exterior measures. None of the outdoor measures in the SBI sample were reported to operate during the summer peak period so the verified gross summer demand savings was zero. The unadjusted gross summer demand savings from the 22 outdoor measures in the sample was only 0.276 kW. The 92 interior measures in the sample claimed 110 kW of summer demand saving so outdoor lighting has little to no impact on summer demand at the program level. Outdoor lighting measures do contribute meaningfully to winter demand impacts because the ISO-NE winter peak falls after sunset in Maine. Table 20 shows that the low winter demand realization rate for winter demand was driven by the study results for interior lighting. Although less extreme than winter demand, indoor lighting measures were responsible for the energy realization rate being less than 100% at the program level.

Table 20: Realization Rates by Installation Location

Location	Measures	RR kWh	RR Summer kW	RR Winter kW	RR MMBTU
Outdoor	22	108.5%	0.0%	89.2%	Not Applicable
Indoor	92	81.0%	89.7%	29.2%	76.3%

As shown in Table 9, the FY2019 population included businesses from 27 different facility types and 11 of those facility types were represented in the evaluation sample. Table 21 compares electric realization rates across the sampled facility types. TRM assumptions for outdoor lighting do not vary by building type and the evaluation found limited realization rate volatility among outdoor measures, so Table 21 looks at the results for indoor lighting measures only.

Table 21: Indoor Lighting Realization Rates by Facility Type

Facility Type	Sites	RR kWh	RR Summer kW	RR Winter kW
Elementary/Secondary Schools	1	11%	1%	13%
Garage/Repair	12	97%	100%	25%
Health	1	44%	43%	1%
Manufacturing	5	84%	92%	22%
Manufacturing (1 Shift)	2	57%	60%	6%
Municipal/Government	1	99%	95%	43%
Office	6	77%	69%	21%
Other	3	70%	68%	16%
Restaurant	1	105%	90%	55%
Restaurant - Casual Dining	1	55%	71%	62%
Retail	18	84%	105%	39%

While the TRM assumptions for annual hours of use vary by facility type, and space type within a facility, the indoor lighting coincidence factors are shared. Table 22 shows the key impact factors for interior lighting, by facility type, observed in the SBI sample. Low winter coincidence values are observed across almost all facility types. Even the restaurant facility type, which we would expect to show heavy operation from 5pm to 7pm, showed limited winter CF values. Closer inspection of the sample reveals that one site is a bakery which closes before the beginning of the ISO-NE winter peak. The other restaurant site showed near 100% winter coincidence for certain fixtures in the core kitchen and dining area, but the project average was lowered by logged program measures in the office spaces. The lone sampled project from the 'Elementary/Secondary Schools' facility type was actually a small pre-school with fewer than ten enrolled children during the COVID-19 pandemic. When field staff retrieved the loggers, they noted that 90% of the lights in the building were off. The site contact noted that after retrofitting to brighter LED fixtures, they did not need to use as many lights during the day.

Table 22: Interior Lighting Impact Factors by Facility Type

Facility Type	Sites	Annual HOU	Summer CF	Winter CF
Elementary/Secondary Schools	1	309	0.01	0.08
Garage/Repair	12	2,155	0.72	0.18
Health	1	1,242	0.33	0.00
Manufacturing	5	2,575	0.75	0.17
Manufacturing (1 Shift)	2	899	0.23	0.03
Municipal/Government	1	2,160	0.75	0.27
Office	6	1,465	0.47	0.11
Other	3	1,935	0.53	0.19
Restaurant	1	4,162	0.72	0.35
Restaurant - Casual Dining	1	3,025	0.64	0.45
Retail	18	2,277	0.70	0.26

Table 23 summarizes the SBI results by measure. The "Sites" column indicates the number of sites in our sample that had received a given measure code. There are no clear trends across equipment type. The outdoor measures tend to show the highest hours of use, with high winter CF and low summer CF. The interior measures all show between 2,049 and 2,734 annual hours of use with high summer CF and low winter CF.

Table 23: Impact Factors and Realization Rates by Measure

Measure	Sites	HOU	Summer CF	Winter CF	RR kWh	RR Summer	RR Winter
S06 Outdoor Replacement Lamp Type B/C	1	4,374	0.00	0.50	172%	0%	71%
S11 Outdoor Parking Lot and Streetlight	9	4,495	0.00	0.76	105%	0%	108%
S13 Outdoor Wallpack	8	4,432	0.00	0.66	105%	0%	94%
S21 Recessed Cans and Downlights	1	2,214	0.88	0.00	72%	111%	0%
S23 Flood and Spot	4	3,636	0.00	0.61	95%	0%	44%
S40 Screw-In Lamps	16	2,734	0.64	0.34	86%	75%	45%
S51 Recessed LED Fixture	6	2,455	0.62	0.40	75%	66%	51%
S52 Linear Retrofit Kit	28	2,049	0.66	0.15	76%	89%	25%
S61 High/Low Bay LED Fixture	11	2,580	0.82	0.11	95%	106%	19%
S81 Linear Ambient Fixtures	14	2,324	0.78	0.10	84%	97%	16%
S110 Linear and U-Bend Replacement Lamps	16	2,451	0.68	0.44	75%	84%	63%

2.7.3 SEASONAL BUSINESSES

One project in the completed SBI sample utilized a seasonal measure code. This fishing business from Region 10 installed 14 linear ambient fixtures under measure code IS81S. Figure 20, Figure 21, and Figure 22 compare the lighting schedules for this site across the SLIC tool, the participant-reported schedule entered by our field technicians, and the composite lighting profile constructed from three lighting loggers deployed at the facility. For this facility, the seasonal coincidence factor assumptions worked well:

- The assumed summer coincidence factor was 60.9% and the metered summer coincidence factor was 71.1%.
- The assumed winter coincidence factor was 0.0% and the metered winter coincidence factor was 0.2%.

The custom occupancy schedule entered in the SLIC tool returned higher operating hours (3,780) than the schedule collected by our field technicians (2,005) or measured with lighting loggers (2,241). The variance in operating schedules comes from weekend operating hours and the start/end time of the business during the spring and fall.

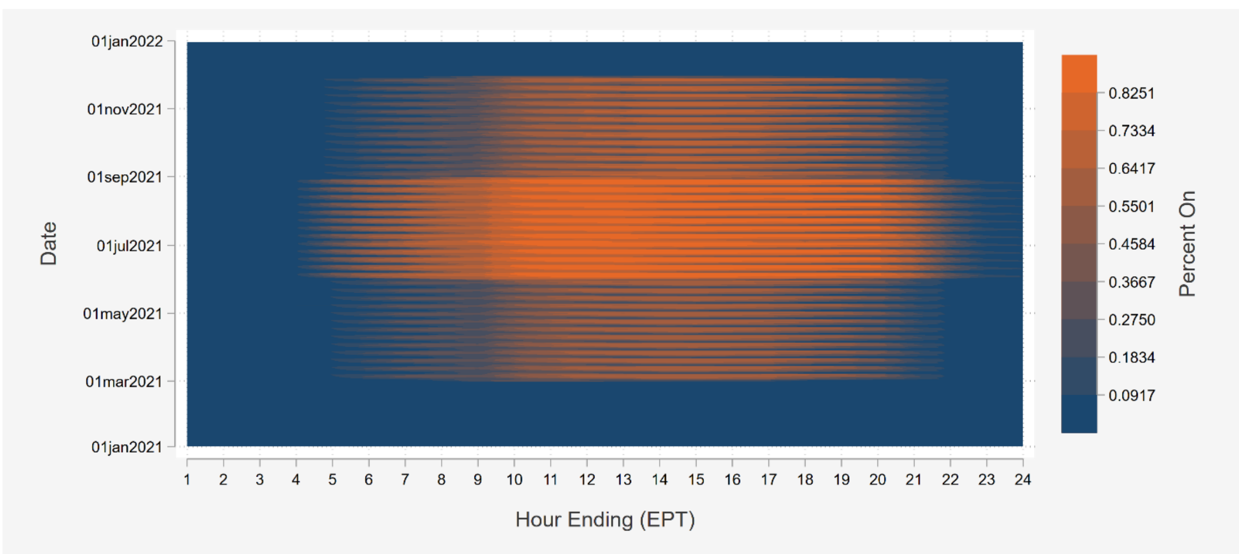
Figure 20: Custom Occupancy Schedule for Seasonal Business – SLIC Tool

	Location #1	Location #2	Location #3
Space Type:	Kitchen	Restroom	Retail_Space
Unique Location/Space Description	KITCHEN	BATHROOM	RETAIL SHOP
Facility Hours of Occupancy			
Default annual lighting runtime (hours):	N/A	N/A	N/A
Use custom occupancy schedule?	Yes	Yes	Yes
Use schedule from a different location?		KITCHEN	KITCHEN
Custom Hours of Occupancy			
Sunday start time:	4:00 AM		
Sunday end time:	10:00 PM		
Monday start time:	4:00 AM		
Monday end time:	10:00 PM		
Tuesday start time:	4:00 AM		
Tuesday end time:	10:00 PM		
Wednesday start time:	4:00 AM		
Wednesday end time:	10:00 PM		
Thursday start time:	4:00 AM		
Thursday end time:	10:00 PM		
Friday start time:	4:00 AM		
Friday end time:	10:00 PM		
Saturday start time	4:00 AM		
Saturday end time:	10:00 PM		
Average weeks of occupancy per year:	30.0		
Custom annual lighting runtime (hours):	3,780	3,780	3,780

Figure 21: Lighting Operating Schedule Collected by the Evaluation Team

	Sun	Mon	Tue	Wed	Thu	Fri	Sat
Jan	ALL DAY	ALL DAY	ALL DAY	ALL DAY	ALL DAY	ALL DAY	ALL DAY
Feb	ALL DAY	ALL DAY	ALL DAY	ALL DAY	ALL DAY	ALL DAY	ALL DAY
Mar	ALL DAY	ALL DAY	ALL DAY	ALL DAY	ALL DAY	ALL DAY	ALL DAY
Apr	ALL DAY	ALL DAY	ALL DAY	ALL DAY	ALL DAY	ALL DAY	ALL DAY
May	12:00AM to 07:59AM 08:00AM to 07:00PM 07:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 07:00PM 07:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 07:00PM 07:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 07:00PM 07:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 07:00PM 07:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 07:00PM 07:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 07:00PM 07:01PM to Midnight
Jun	12:00AM to 07:59AM 08:00AM to 07:00PM 07:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 07:00PM 07:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 07:00PM 07:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 07:00PM 07:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 07:00PM 07:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 07:00PM 07:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 07:00PM 07:01PM to Midnight
Jul	12:00AM to 07:59AM 08:00AM to 07:00PM 07:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 07:00PM 07:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 07:00PM 07:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 07:00PM 07:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 07:00PM 07:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 07:00PM 07:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 07:00PM 07:01PM to Midnight
Aug	12:00AM to 07:59AM 08:00AM to 07:00PM 07:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 07:00PM 07:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 07:00PM 07:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 07:00PM 07:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 07:00PM 07:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 07:00PM 07:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 07:00PM 07:01PM to Midnight
Sep	12:00AM to 07:59AM 08:00AM to 07:00PM 07:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 07:00PM 07:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 07:00PM 07:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 07:00PM 07:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 07:00PM 07:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 07:00PM 07:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 07:00PM 07:01PM to Midnight
Oct	12:00AM to 07:59AM 08:00AM to 07:00PM 07:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 07:00PM 07:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 07:00PM 07:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 07:00PM 07:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 07:00PM 07:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 07:00PM 07:01PM to Midnight	12:00AM to 07:59AM 08:00AM to 07:00PM 07:01PM to Midnight
Nov	ALL DAY	ALL DAY	ALL DAY	ALL DAY	ALL DAY	ALL DAY	ALL DAY
Dec	ALL DAY	ALL DAY	ALL DAY	ALL DAY	ALL DAY	ALL DAY	ALL DAY

Figure 22: Heat Map of Metered Annual Lighting Profile – Sample Seasonal Business



3 NET IMPACT ACTIVITIES AND FINDINGS

3.1 OVERVIEW

The SBI program includes an online participant survey where participants provide further context to their motives and decisions regarding LED lighting upgrades. Some of the survey questions were designed to target the specific inputs used to designate attribution to this program. These inputs include “intention”, if the user would have otherwise made the purchase of interest, and “influence”, if the program shifted a consumer behavior toward the purchase of interest. These inputs result in a net-to-gross ratio (NTGR) which numerically represents how much of the savings associated with a purchase should be attributed to the program and what portion should be designated as free ridership.

Two survey versions were included in this analysis. The initial in-house survey was completed by 26 respondents prior to modifications based on a review by the evaluation consulting firm DNV-GL. This survey is referred throughout as the “Pre Survey”. The updated version, deemed the “Post Survey” had 139 complete responses.

3.2 SCORING METHODOLOGY

Our scoring algorithm computed an intention score and an influence score (0% is not a free rider, 100% is a complete free rider) for each respondent that completed a survey. These input scores are averaged to calculate free ridership, which is then used to compute the NTGR.

3.2.1 INTENTION

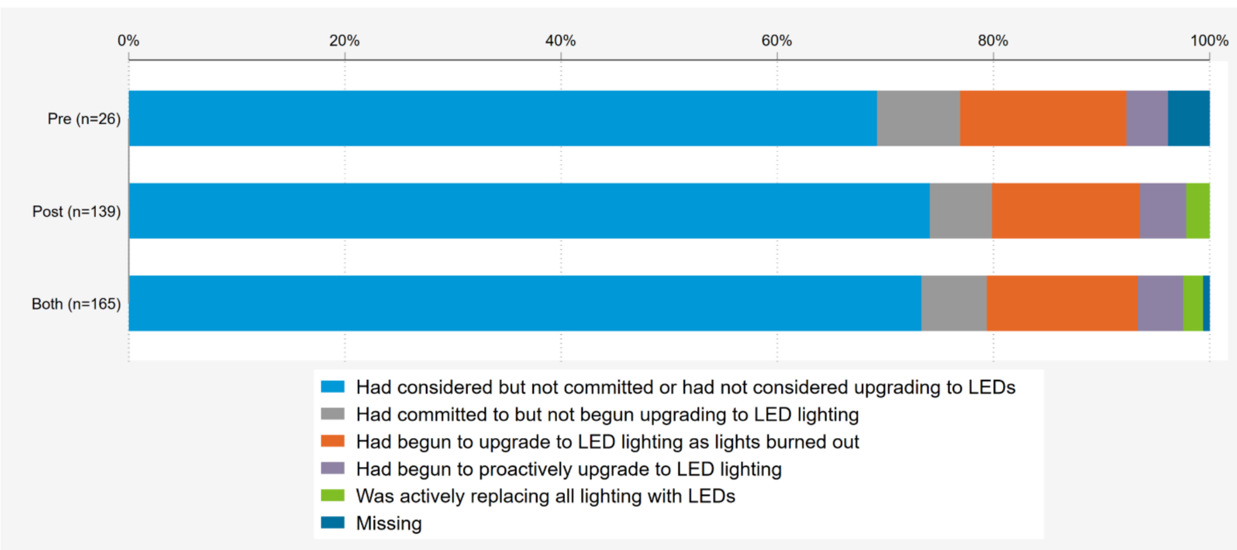
Intention defines what participants’ actions would have been absent the SBI program. The question, responses, and scoring are provided in Table 24. Scores ranging from 0% to 100% were assigned to each response to a single intention question. Lower scores indicate the responder had less intention of incorporating the LED upgrades, suggesting the program was more important for the responders’ participation. A few participants left this question unanswered, and these “Missings” were not included for aggregate calculations.

Table 24: Intention Response Scoring

Question	Response	Score
Which response best describes your situation prior to participating in the Efficiency Maine Small Business Initiative?	Had not considered upgrading to LED Lighting	0%
	Had considered but not committed to upgrading to LED lighting[7]	0%
	Had committed but not begun upgrading to LED lighting	25%
	Had begun to upgrade to LED lighting as lights burned out	50%
	Had begun to proactively upgrade to LED lighting	75%
	Was actively replacing all lighting with LEDs	100%
	Missing	N/A

Figure 23 separates the Pre and Post surveys and also shows the combined responses in the "Both" portion of the graph. For the intention component, 73% of responders selected the options indicating they had not considered or had not committed to upgrading LED lighting. These selections receive a 0% intention score, suggesting they would not have participated without the program, and benefits should fully be attributed to the program for 73% of the responders.

Figure 23: Intention Response Distribution



3.2.2 Influence

Influence captures how impactful the SBI program was in a participant's decision to move forward with the LED upgrade. This value was formed based on survey responses to three questions. The questions, responses, and scoring are provided in Table 25. The two versions of surveys offered different response formats. The Pre Survey allowed responders to rank the importance of each category on a scale of 0-10. The Post Survey used phrases defining level of importance. Both scales are shown in Table 25.

[7] A single respondent wrote in "Wanted to upgrade 'sometime', but was cost prohibitive for us." This entry has been reclassified to "Had considered but not committed to upgrading to LED lighting."

Scores ranging from 0% to 100% were assigned to each response for the three influence questions. Lower scores indicate the program was more important for the responders' participation. The minimum score across the three questions for each responder was used as that participant's influence score. All participants answered at least one of the three questions, so "Missings" were not included for aggregate calculations.

Table 25: Influence Response Scoring

Question	Response	Score
Please indicate how important each of the following was on your decision to upgrade lighting equipment in your business.		
Availability of Efficiency Maine Small Business Initiative	Extremely Important, 9, or 10	0%
	Strongly Important, 7, or 8	25%
	Moderately Important, 5, or 6	50%
	Slightly Important, 3, or 4	75%
	Not Important, 0, 1, or 2	100%
One-year payback on installed equipment	Extremely Important, 9, or 10	0%
	Strongly Important, 7, or 8	25%
	Moderately Important, 5, or 6	50%
	Slightly Important, 3, or 4	75%
	Not Important, 0, 1, or 2	100%
Connection to an SBI-partnering contractor	Extremely Important, 9, or 10	0%
	Strongly Important, 7, or 8	25%
	Moderately Important, 5, or 6	50%
	Slightly Important, 3, or 4	75%
	Not Important, 0, 1, or 2	100%

Figure 24 and Figure 25 show participant responses to each of the three influence questions. Figure 24 shows the responses to the "Pre Survey" which indicate the surveys completed prior to DNV-GL's review and Figure 25 shows the "Post Survey" responses which followed the review. For both surveys and all influence components, the majority (62%-79%) of responders stated the category was "Extremely Important" to their decision to upgrade lighting equipment in their business. These selections receive a 0% influence score, suggesting they would not have participated without the program, and benefits should fully be attributed to the program for the majority of responders.

Figure 24: Pre Survey Influence Response Distribution

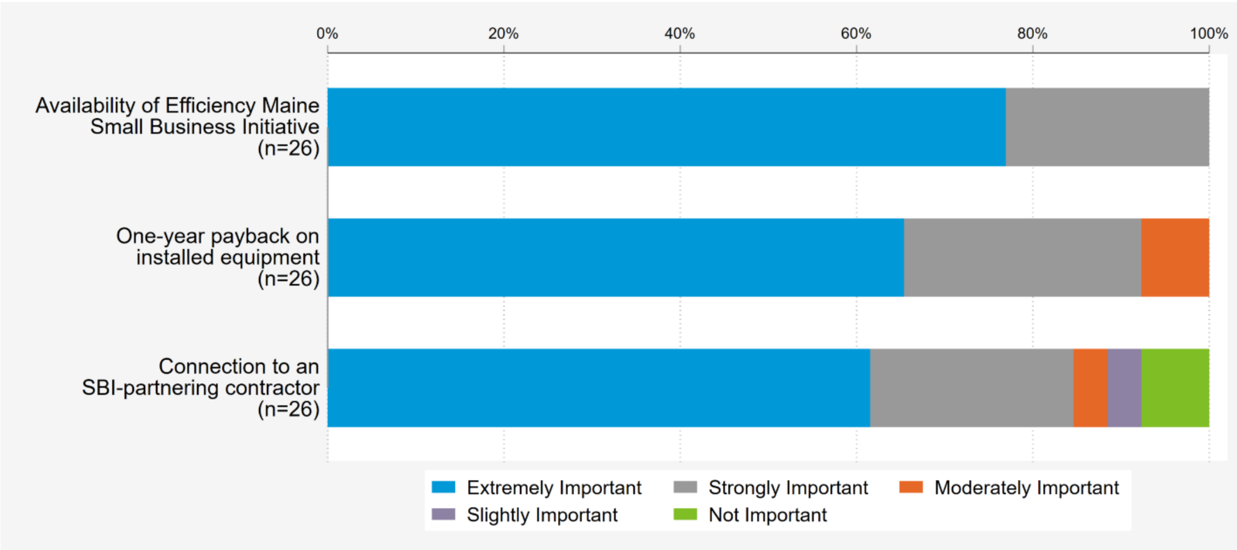
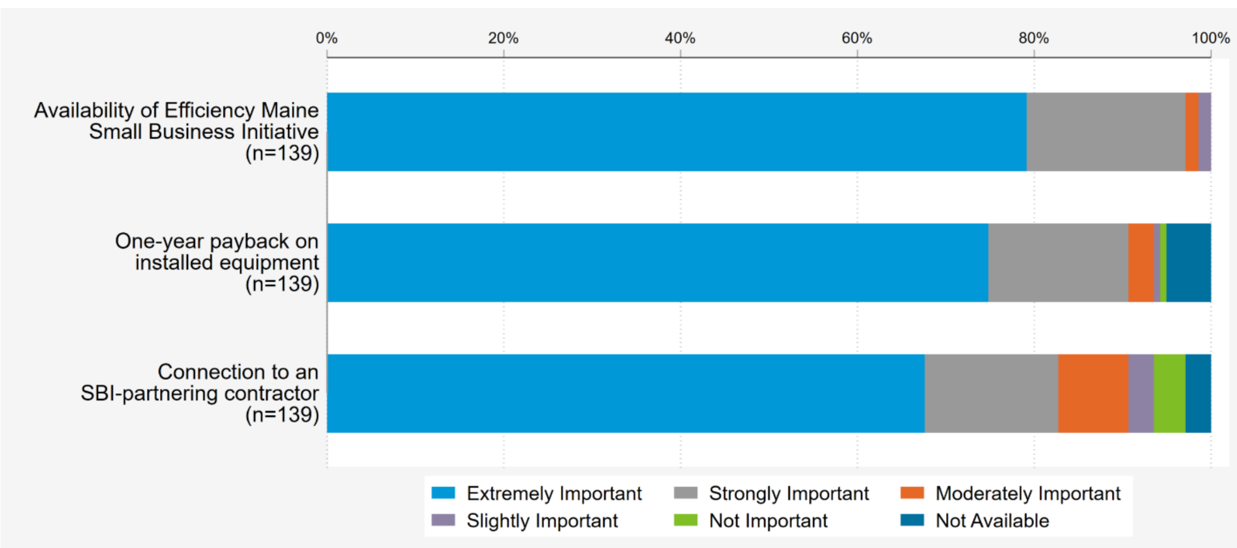


Figure 25: Post Survey Influence Response Distribution



3.3 NET-TO-GROSS RATIO CALCULATION

The influence and intention-based NTGR combines ratings of the program's influence on participants' decisions and responses about participants' likely actions absent the program to obtain a free ridership score and in turn the NTGR. NTGR can sometimes include a spillover component. This survey does not consider spillover, so the final NTGR calculation is 1 minus free ridership.

Table 26 displays the average intention and influence scores by survey and in aggregate. A single account is missing the intention score and this participant is therefore omitted from the free ridership and NTGR calculations. The average of these values provides the participant's free ridership value. We calculate an overall free ridership of 8.6%. The resulting NTGR is 91.4%. The relative precision is ±1.5% at the 80% confidence level and the 80% confidence interval around the NTGR is (90.0%,92.7%).

Table 26: Net to Gross Results

Survey	n	Intention	Influence	Free Ridership	NTGR (1-FR)
Post	139	13.7%	4.0%	8.8%	91.2%
Pre	25	13.0%	2.0%	7.5%	92.5%
Both	**164**	**13.6%**	**3.7%**	**8.6%**	**91.4%**

3.4 NET VERIFIED FY2019 ENERGY AND DEMAND SAVINGS

Table 27 shows the core results of the net impact evaluation for FY2019 along with the upper and lower bounds of the 80% confidence interval. A common net to gross ratio of 91.4% was applied to all resource impacts.

Table 27: Verified Net Impacts – SBI FY2019

Resource	Gross Verified	NTGR	Net Verified	RP at 80%	Lower Bound	Upper Bound
kWh	3,620,336	91.4%	3,308,987	1.5%	3,259,353	3,358,622
Winter kW	337		307.7		303.1	312.3
Summer kW	1,052		961.5		947.1	976.0
Fossil Fuel (MMBTU)	-3,253		-2,974		-2,929	-3,018

4 PROPOSED UPDATES TO TRM FACTOR SCHEDULES

At Efficiency Maine, evaluation results are used both retrospectively and prospectively. Section 2.7.1 presented the gross verified savings estimates for FY2019 and Section 3.4 presented the net verified results. Once an impact evaluation is complete, Efficiency Maine uses the findings from the most recent impact evaluation to increase the accuracy of the adjusted gross savings that are calculated for various reporting purposes between evaluations. Impact evaluation results can be applied prospectively in two general ways:

1. Adopt the realization rates from the impact evaluation in the TRM and effRT factor schedule.
2. Modify the parameter assumptions in the TRM and program delivery tools to match the findings of the evaluation. By updating the key parameter values, the realization rates in the TRM can be set to 100%.

The net impact evaluation results should be incorporated by updating the freeridership factor from 7.2% to 8.6% for all measures in the SBI catalog. The participant survey used to evaluate net impacts did not include a spillover battery so we recommend leaving the spillover factor set to 0% in the TRM and effRT.

Lighting savings are driven by a relatively limited combination of factors so it is not unwieldy to diagnose the factor(s) placing upward or downward pressure on the realization rate. As discussed in Section 2.7, the evaluation found nearly perfect correspondence regarding equipment counts and wattages so realization rate volatility came almost exclusively from operating characteristics. Where possible, the evaluation team believes option #2 is the better mechanism for reflecting impact evaluation results prospectively. However, the diversity of annual hours of use assumptions for commercial lighting makes it very challenging to propose a prospective update to the annual hours of use parameter. Consider the following possible pathways with SBI for characterizing annual hours of use.

- **Use of Actual Hours:** In the SLIC tool, the applicant has the option to enter up to ten custom occupancy schedules for a participating business and map the resulting annual hours of use to installed measures. The "user-defined" inputs do not come from a TRM factor schedule so cannot be adjusted prospectively from a TRM standpoint. Efficiency Maine could provide guidance to qualified partners regarding the use of custom schedules.
- **Default Annual Hours of Operation:** If users of the SLIC tool wish to rely on deemed hours of use, the values are determined by a two-way lookup of facility and space type shown in Figure 26. While this lookup table is very granular, there is some amount of user discretion in how a business is mapped to a facility type and how a given space within the facility is classified.

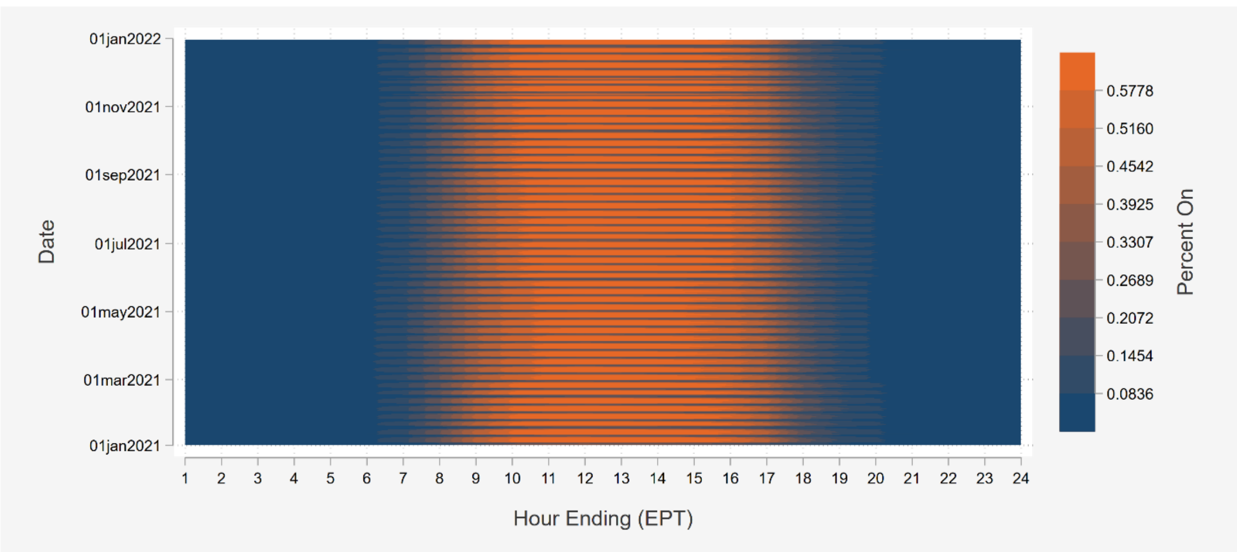
Figure 26: Default Lighting Hours of Use by Space and Facility Type

	Facility Type																														
	Health			Lodging/ Residences			Manufacturing/ Industrial				Dining/ Drinking			Retail				Schools		All Others											
Space Type	Health Care - Hospital	Health Care - Outpatient	Health Care - Assisted/Nursing	Apartments / Condos 5+ Units	Hotel/Motel	University - Dormitory	Manufacturing (1 Shift)	Manufacturing (2 shifts)	Manufacturing (3 shifts)	Other Industrial - USER DEFINED	Restaurant - Fast Food	Restaurant - Casual Dining	Bar/Lounge	Retail - General	Retail - Convenience Store	Retail - Chain Stores	Retail - Grocery Store	School(K-12)	University	Office Building	Assembly	Family Entertainment Centers	Movie Theaters	Fitness Center	Religious	Warehouse	Automotive Facility (Sales & Service)	Correctional	Fire/Police/Public Safety	Municipal/Government	Other Commercial - USER DEFINED
Assembly	2,080	N/A	2,912	N/A	N/A	600	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A	N/A	N/A	1,600	2,400	2,040	1,064	1,952	1,954	5,836	1,955	N/A	4,056	5,477	1,872	2,400	
Break_Room	5,096	2,550	3,640	N/A	2,912	1,600	1,257	2,514	3,771		2,496	2,496	2,496	1,802	1,802	2,514	2,514	1,303	1,303	1,829	884	1,562	1,456	2,514	391	2,918	1,257	2,912	7,655	2,400	
Cafeteria	3,640	2,550	3,640	N/A	3,640	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A	N/A	N/A	2,356	3,024	2,550	375	N/A	N/A	N/A	N/A	1,775	N/A	3,640	N/A	N/A	
Classroom	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A	4,842	4,842	N/A	N/A	1,429	1,800	NA	596	N/A	N/A	N/A	715	N/A	N/A	900	N/A	N/A	
Conference	675	2,040	2,600	N/A	2,550	480	1,671	3,342	5,013		N/A	N/A	N/A	1,018	1,018	3,342	3,342	1,221	1,800	971	488	1,456	1,456	624	600	1,277	1,671	2,184	1,456	1,680	
Dining	3,640	N/A	3,640	N/A	3,640	N/A	N/A	N/A	N/A		4,452	3,120	3,213	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1,952	N/A	N/A	416	N/A	N/A	3,640	2,912	960	
Equipment/Engineering Space	975	1,560	1,560	N/A	1,560	1,680	765	1,020	2,040		2,448	2,448	2,448	2,034	2,034	2,448	2,448	1,560	2,448	2,064	707	976	1,563	1,456	1,560	2,295	780	4,368	2,184	1,560	
Exterior	4,380	4,380	4,380	4,380	4,380	4,380	4,380	4,380	4,380		4,380	4,380	4,380	4,380	4,380	4,380	4,380	4,380	4,380	4,380	4,380	4,380	4,380	4,380	4,380	4,380	4,380	4,380	4,380	4,380	
Gym/Fitness	3,640	2,040	2,912	2,856	2,912	N/A	N/A	N/A	N/A		N/A	N/A	N/A	6,566	6,566	N/A	N/A	2,545	3,360	NA	101	N/A	N/A	5,712	N/A	N/A	N/A	3,640	2,184	N/A	
Hallway_or_Corridor	8,640	3,570	8,766	8,640	8,766	3,066	2,995	5,877	8,766		4,896	3,427	N/A	2,262	2,262	5,877	5,877	3,598	3,598	1,914	1,424	1,952	586	3,598	1,955	2,483	2,995	8,766	7,655	2,400	
Kitchen	4,368	3,120	4,368	2,912	4,368	2,240	1,936	3,872	5,808		5,081	3,557	3,213	1,737	1,737	3,872	3,872	1,626	1,626	3,000	1,308	1,562	1,759	N/A	978	1,925	1,936	5,081	3,640	N/A	
Library	N/A	N/A	3,640	1,820	N/A	3,920	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A	N/A	N/A	1,767	3,024	N/A	1,782	N/A	N/A	N/A	978	N/A	N/A	3,920	N/A	2,400	
Office_Closed	1,291	1,291	1,291	1,785	2,250	1,671	1,620	3,240	4,860		2,448	2,448	2,448	2,449	2,449	3,240	3,240	1,444	1,444	1,671	678	1,366	586	4,377	782	1,994	1,620	2,250	2,496	2,400	
Office_Open	2,455	2,455	2,455	1,785	2,250	2,240	2,334	4,668	7,002		2,448	2,448	2,448	3,417	3,417	4,668	4,668	2,338	2,338	2,378	2,734	1,562	1,563	1,459	782	2,758	2,334	2,250	3,640	2,400	
Other - User defined																															
Production	N/A	N/A	N/A	N/A	N/A	N/A	2,959	5,918	8,640		N/A	N/A	N/A	2,897	2,897	5,918	5,918	NA	NA	1,972	N/A	N/A	N/A	N/A	N/A	3,351	2,959	N/A	N/A	N/A	
Restroom	685	685	685	2912	267	685	431	862	1,293		3,212	3,212	3,212	587	587	862	862	1,515	1,515	1,212	873	1,171	1,563	5,712	1,955	1,140	431	3,640	3,276	1,680	
Retail	2,716	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A	4,284	4,284	4,284	4,284	N/A	N/A	3,558	3,184	N/A	N/A	N/A	N/A	N/A	3,120	N/A	N/A	N/A	
Storage	984	984	984	1,456	17	1,420	927	1,854	2,781		3,077	510	714	1,801	1,801	1,854	1,854	1,420	1,420	992	401	586	728	2,918	1,560	1,516	927	714	2,184	960	
Warehouse	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A	2,550	2,550	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2,918	N/A	2,295	4,056	N/A	N/A	1,920	
Lobby_or_Concierge	8,766	3,570	8,766	8,766	8,766	5,950	2,295	2,295	2,295		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	3,570	N/A	1,952	1,954	5,836	1,955	2,295	2,295	8,766	6,124	2,400	
Sleeping_or_Living_Spaces	N/A	N/A	5,096	5,460	2,600	3,066	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	5,477	3,828	N/A	
Nurses_Station	8,640	3,000	8,640	N/A	N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
Patient_Rooms	2,912	N/A	2,912	N/A	N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
Treatment_Rooms	3,640	2,600	2,600	N/A	N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	

The lookup table shown in Figure 26 includes several hundred distinct assumptions for annual hours of operation. Although the SBI and DL evaluations included over 600 lighting loggers at a variety of Maine businesses, the study does not have the statistical power to propose updated assumptions at this level of detail. Rather than propose a significantly simpler set of hours of use assumptions, the evaluation team's recommendation is to adopt an 81% energy realization rate for interior lighting measures delivered via SBI. This recommendation is based on the "indoor" row of the segmented results shown in Table 20. Our recommendations for exterior measures are discussed later in this section.

Currently the Efficiency Maine TRM and effRT have a single demand realization rate factor so the divergent summer and winter demand realization rates from this evaluation would be problematic to incorporate in the current framework. The 35% realization rate for winter peak demand is driven predominantly by limited operation of interior lighting equipment during winter evening hours. The heat map of program-supported interior SBI lighting equipment in Figure 27 shows that lighting operation wanes to approximately 20% during hour ending 18:00 and 19:00. For comparison, the TRM parameter assumption for winter coincidence factor in SBI is 45.3%.

Figure 27: SBI Interior 8760 Lighting Load Profile



The results of the impact evaluation clearly suggest a prospective change to the winter coincidence factor assumption for interior lighting measures. To a lesser extent, the 90% summer demand realization rate for interior also merits consideration. The evaluation team considered several questions before crafting our recommended updates:

- Should the composite lighting profile be based exclusively on logging of program-supported interior lighting measures?
- Or should it leverage logging results for lighting equipment in the SBI sample that was not upgraded via SBI? As shown in Table 10, this increases the number of loggers by approximately 20%.

- Should we leverage the logging activities completed as part of the Distributor Lighting evaluation in addition to the SBI sample?
- Does the data support separate coincidence factor assumptions by measure category?

Ultimately, we elected to include all logged equipment from SBI except for the seasonal business described in Section 2.7.3 as well as the logging data collected from the "Small" stratum of the Distributor Lighting evaluation. We chose to include the Small stratum of DL and not the Large stratum because the types of facilities encountered in the DL-Small stratum were similar to the customers served by SBI. Conversely, the DL-Large stratum was made up of large organizations that are fundamentally different from the types of businesses served by SBI. Table 28 shows the results. Only 42 of the 483 loggers which passed QAQC protocols measured the standard or specialty screw-in lamps so we would not recommend using the results to characterize the S40 measures separately from the remainder of the SBI catalog.

Table 28: Interior Lighting Parameter Assumptions for Small Businesses

Parameter	Indoor Non-Screw Based	Screw-Based	Composite Interior
Loggers Included	438	42	480
Annual HOU	2,543	2,193	2,517
Summer CF	60.9%	59.7%	60.8%
Winter CF	26.9%	24.2%	26.7%

Table 29 compares the composite interior values in Table 28 to the current TRM default values. The recommended parameter assumption for summer coincidence factor is almost identical to the current assumption of 60.9%. Although our recommendation for the interior lighting annual hours of use assumption is to multiply the operating hours in SLIC by 0.81, Table 29 presents a single default value that could be used as a benchmark.

Table 29: Comparison of Recommended SBI Interior Factors to Current TRM Defaults

Impact Factors	Annual Hours of Use	Summer CF	Winter CF
Evaluation	2,517 or 81% of SLIC Value	60.8%	26.7%
TRM Default	Varies by Facility Type	60.9%	45.3%

The decision to include logging data from the DL-Small sample is a tradeoff. It increases the sample size both in terms of number of businesses and lighting loggers. It also increases the magnitude of the composite factors because sites in the DL-Small stratum exhibit more frequent and coincident lighting operation than the SBI sample, on average. It is possible that including DL metering activity biases the factors upward because of some inherent difference between the types of businesses that participate in SBI and DL. It is also possible that the COVID-19 pandemic affected the businesses in the SBI sample more deeply and the inclusion of DL sample helps to provide a more stable view of typical lighting operation in the small business sector. Recall that our regression modeling approach only explicitly controls for atypical operation from March 15, 2020 to May 15, 2020.

Table 30 shows the energy period factors of the recommended 8760 interior lighting load profile for SBI interior measures and compares them to current TRM defaults. Lighting operation and savings are more concentrated in the "on-peak" periods for the evaluated EPF values.

Table 30: Energy Period Factors for Small Business Interior Lighting

Energy Period	SBI Interior (Evaluation)	SBI Interior (TRM)
Winter On	49.4%	43.6%
Winter Off	18.0%	23.8%
Summer On	24.6%	21.0%
Summer Off	8.0%	11.6%

Table 20 compared SBI realization rates for interior and exterior measures and showed that realization rates for energy and winter demand were reasonably close to 100%. Since the sample of SBI exterior measures was relatively small (n=22), we recommend basing any updates to exterior fixture operating assumption on the full non-residential evaluation sample, which includes both SBI and DL and observed equipment that was not program-supported. Table 31 compares the recommended outdoor lighting operating parameters to the current factor schedule.

Table 31: Outdoor Lighting Impact Factors

Impact Factors	Annual Hours of Use	Summer CF	Winter CF	Energy Period Factors			
				Winter On	Winter Off	Summer On	Summer Off
Evaluation	4,248	6.6%	82.4%	27.3%	45.0%	9.5%	18.2%
TRM Default	4,380	0.0%	78.0%	43.6%	23.8%	21.0%	11.6%

Table 32 presents a consolidated summary of our recommended updates to SBI impact factors. Currently the TRM and effRT utilize separate interactive effect assumptions for High/Low Bay lighting and Non-Bay lighting based on a difference in assumed Internal Gain Contribution. As discussed in Section 2.6, we recommend a single set of interactive effect factors using a blended Internal Gain Contribution assumption.

Table 32: Summary of Recommended SBI Factor Updates

Impact Factor	Interior High/Low Bay and Non-Bay	Exterior
Baseline and LED Wattage	No change	No change
Hours of Use ($HPD\backslash HPY_{comm}$)	Continue to allow custom schedules or selection of TRM defaults according to space and facility type in SLIC. Adjust via the RR_e term	Update the 'Exterior' row of TRM table 46 be updated from 4380 to 4248 for all facility types. Allow applicants to enter actual values in SLIC.
Energy Realization Rate (RR_e)	81%	100%
Demand Realization Rate (RR_d)	100%	100%
Summer CF	60.8%	6.6%
Winter CF	26.7%	82.4%
Energy Period Factors (EPF)	Winter On = 49.4%	Winter On = 27.3%
	Winter Off = 18.0%	Winter Off = 45.0%
	Summer On = 24.6%	Summer On = 9.5%
	Summer Off = 8.0%	Summer Off = 18.2%
Interactive Effects	IE_{COOL_D} = 1.0747	IE_{COOL_D} = 1.000
	IE_{COOL_E} = 1.0222	IE_{COOL_E} = 1.000
	IE_{HEAT_E} = 0.0011	IE_{HEAT_E} = 1.000
	IE_{HEAT_D} = 0.9955	IE_{HEAT_D} = 0.000
Measure Life	20 years	12 years
Avoided O&M (avoided future replacements)	Assumed labor and material cost to replace the lamp(s) in the baseline fixture in 3-5 years. Align baseline lamp and labor assumptions with the relevant Distributor Lighting measures	
Freeridership (FR)	8.6%	8.6%
Spillover (SO)	0.0%	0.0%

5 BENEFIT COST ANALYSIS

Efficiency Maine's primary benefit-cost test examines the cost effectiveness of program offerings from the perspective of all utility customers. This includes both participants of the program and non-participants. Table 33 lists and defines the relevant costs and benefits streams for the SBI impact evaluation. Some of the benefit streams listed in Table 31 are only applicable to certain scenarios and are not included in Efficiency Maine's primary benefit-cost test. Equipment and labor costs are captured for each project in the EAT/SLIC tools and loaded into effRT so there is minimal uncertainty in those cost components for SBI.

Table 33: Definitions of Cost and Benefit Elements

Cost or Benefit	Element	Description
Costs	Incremental Measure Cost	Incremental cost of the efficient measure relative to the baseline. Includes labor for retrofit or early replacement measure. If the incentive is greater than the incremental measure cost, the incentive is used instead.
	Program Delivery Costs	Direct costs to manage and market programs
	Increased Fuel Consumption	For fuel-switching measures and measures with secondary fuel impacts such as lighting interactive effects, the increased fuel cost is treated as a cost
	Evaluation, Measurement, & Verification	Analysis to inform design of programs or retrospective assessments
Benefits	Avoided Cost of Electric Energy	Avoided cost of marginal generation by costing period (summer on-peak, summer off-peak, winter on-peak, winter off-peak). Includes adders for wholesale risk factor and Demand Reduction Induced Pricing Effects (DRIPE).
	Decreased Fuel Consumption	Reduced usage of fuel as a result of program participation. Not applicable for SBI as the only fuel impacts are negative waste heat penalties, which are treated as a cost.
	Avoided Generating Capacity Costs	Value of avoided generation capacity during system peak. Calculated using a weighted average of the summer and winter demand impacts (2/3 winter demand and 1/3 summer).
	Avoided Transmission Capacity Costs	Deferred or eliminated investments in transmission capacity. Calculated using a weighted average of the summer and winter demand impacts (2/3 winter demand and 1/3 summer).
	Avoided Distribution Capacity Costs	Deferred or eliminated investments in distribution capacity. Calculated using a weighted average of the summer and winter demand impacts (2/3 winter demand and 1/3 summer). The avoided cost of distribution capacity was not quantified or included in either set of avoided costs used for this evaluation.
	Line Losses	Value of reduced losses of energy and demand from generation to customer
	Water Impacts	Marginal cost of avoided water consumption or related wastewater treatment. Not applicable for SBI because the program produces no water savings.
	O&M Impacts	Reduced operation and maintenance costs. Includes the avoided cost of future replacements if the efficient technology has a longer life than the baseline technology
	Reduced Environmental Impacts	Value of avoided CO_2 and other emissions not embedded in the cost of supplying electricity or fuel. This benefit stream is not part of the primary benefit-cost ratio and is only incorporated in the "More Carbon" scenario.

5.1 APPROACH

The evaluation team used two different sets of avoided costs and methodology and assumptions (M&As) in the analysis depending on the scenario.

- **Retrospective Scenarios:** Utilize the avoided costs and M&As in place during FY2019. FY2019 was the last year of the Trust's 2017-2019 Triennial Plan (Triennial Plan III, or TPIII). TPIII used the high case of avoided costs developed by Public Utilities Commission consultant London Economic Institute. We refer to these avoided costs as "LEI High". The real discount rate used to calculate the present value of costs and benefits was 6.5%. In scenarios that consider net-to-gross results, incentives to free riders are treated as a cost in accordance with the California Public Utilities Commission's 2007 Clarification Memo. The 2007 Clarification Memo posited that incentives paid to free riders should be treated as cost in a TRC test to avoid creation of a free rider cost advantage to rebate programs relative to direct install programs.
- **Prospective Scenarios:** Utilize the avoided costs and M&As in place for Efficiency Maine's 2020-2022 Triennial Plan[8] (Triennial Plan IV, or TPIV). TPIV uses avoided costs from the 2018 Avoided Energy Supply Component Study (AESC 2018).[9] The real discount rate for TPIV is 2.8% and the perspective on incentives paid to free riders is reversed to align with the 2017 National Standard Practice Manual for Energy Efficiency (NSPM).[10] The NSPM suggests program administrators exclude incentives paid to free riders from cost effectiveness screening that includes participant impacts: "the net cost of free riders is zero under any test that includes participant impacts."

The most notable difference between the LEI High and AESC 2018 avoided costs is that the LEI High avoided cost of capacity is larger than the AESC 2018 avoided costs and the avoided cost of electric energy is higher in AESC 2018. As a result, the ratio of energy benefits to capacity benefits is larger in the prospective scenarios. In the retrospective scenarios, capacity benefits are almost as large as energy benefits.

The evaluation team developed and calculated a total of eleven different benefit-cost scenarios for SBI. We conducted the modeling in an adapted version of Efficiency Maine's measure-screening tool. The first scenario, which is not reported, is a replica of the Cost Benefit Analysis Tool (CBAT) module in effRT. The intent of the replica model is to ensure all inputs and assumptions are loaded into the Excel tool and applied consistently with the CBAT module. Once we were satisfied with the consistency of our modified Excel calculator and effRT, we loaded the results of the impact evaluation and ran the scenarios laid out in Table 34.

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[8] https://www.efficiencymaine.com/triennial-plan-iv/
[9] Synapse Energy Economics, et. al., Avoided Energy Supply Components in New England: Costs Study Report, March 30, 2018.
https://www.efficiencymaine.com/docs/Appendix_E_2018_Avoided_Energy_Supply_Component_Study.pdf
[10] https://www.nationalenergyscreeningproject.org/the-national-standard-practice-manual-for-energy-efficiency/

Table 34: Benefit-Cost Scenarios and Descriptions

Scenario Number	Scenario Name	Perspective	Description
0	Replica	Retrospective	Uses adjusted gross impacts (FY2019 factor schedule). Does not reflect any findings from the impact evaluation
1	Verified Gross (retro)	Retrospective	Based on the verified gross FY2019 impacts determined by the impact evaluation
2	Verified Gross	Prospective	Based on the verified gross FY2019 impacts determined by the impact evaluation
3	Verified Gross: LB	Prospective	Benefits are calculated using the lower bound of 80% confidence interval of the realization rates
4	Verified Gross: UB	Prospective	Benefits are calculated using the upper bound of 80% confidence interval of the realization rates
5	Verified Net (retro)	Retrospective	Based on the verified net FY2019 impacts determined by the impact evaluation. Incentives to free riders treated as cost
6	Verified Net	Prospective	Based on the verified net FY2019 impacts determined by the impact evaluation
7	Verified Net: LB	Prospective	Benefits are calculated using the realization rates and the lower bound of 80% confidence interval of the NTGR
8	Verified Net: UB	Prospective	Benefits are calculated using the realization rates and the upper bound of 80% confidence interval of the NTGR
9	More carbon	Prospective	Same as Verified Gross with an additional $100 per short ton of CO_2[11] included for avoided and increased emissions
10	Adjusted EUL	Prospective	Same as Verified Gross with a 20-year EUL for interior fixtures and 12-year EUL for exterior fixtures per evaluation recommendations

We calculate the net present value of each cost and benefit component and compute a ratio with the benefits in the numerator and costs in the denominator. A ratio greater than 1.0 indicates that the program is cost-effective because the present value of the benefits exceeds the present value of the costs. A ratio of less than 1.0 indicates that the program is not cost-effective because the present value of the benefits is less than the present value of the costs.

5.2 RESULTS

Table 35 shows the benefit-cost ratio for each of the scenarios using Efficiency Maine primary test. SBI is cost-effective for all ten of the scenarios considered. The benefit-cost ratios range from 1.07 to 1.44. Following Table 35 we offer the following observations based on the results of the benefit-cost analysis.

[11] The $100 per short ton of CO_2 value is taken from the AESC 2018 report's estimate of the global marginal abatement cost of CO_2 emissions

Table 35: Benefit Cost Ratios by Scenario

Scenario Number	Name	Benefit Cost Ratio
1	Verified Gross (retro)	1.36
2	Verified Gross	1.13
3	Verified Gross: LB	1.07
4	Verified Gross: UB	1.18
5	Verified Net (retro)	1.27
6	Verified Net	1.11
7	Verified Net: LB	1.11
8	Verified Net: UB	1.12
9	More carbon	1.44
10	Adjusted EUL	1.35

- The retrospective scenarios show higher benefit-cost ratios using both verified gross and verified net savings despite the retrospective scenario having a higher discount rate. This result is largely a function of the different avoided cost arrays. The fuel costs per MMBTU in AESC 2018 are generally larger than in LEI High, so the interactive HVAC effects of installing LED lighting equipment generate more cost in the prospective scenarios. Capacity benefits are also notably smaller in the prospective scenarios.
- With a free ridership rate of just 8.6%, the SBI benefit-cost results are not sensitive to the handling of incentives to free riders. Despite the more conservative M&As with respect to free ridership, the retrospective verified net scenario has a higher benefit-cost ratio than the prospective verified net scenario.
- The confidence interval of the SBI NTGR is narrow with relative precision of ± 1.5% at the 80% confidence level. As a result, the benefit-cost ratios of scenarios #7 and #8 are no different from scenario #6. The Trust's TPIV perspective on incentives to free riders also makes benefit-cost ratios more resistant to NTGR fluctuations because the benefits and non-program delivery costs scale proportionately.
- Inclusion of an additional $100 per short ton of CO2 increases the benefit-cost ratio for SBI. Scenario #9 has the highest benefit-cost ratio in Table 35. The higher carbon valuation increases the benefit-cost ratio from 1.13 to 1.44. The effect is dampened somewhat because the additional carbon value is also associated with the additional fossil fuel usage in the costs.
- The evaluation team recommends modified EUL assumptions for LED fixtures that take into account annual hours of use from the composite indoor and outdoor profiles. This recommendation increases the EUL of interior fixtures from 13 years to 20 years and increases the verified gross benefit-cost ratio from 1.13 to 1.35.
- The Efficiency Maine TRM does not currently assign O&M benefits to any SBI measures. By contrast, some measures in the Distributor Lighting program are assigned O&M benefits as large, or even greater than the lifetime energy and capacity benefits they generate. Inclusion of even very conservative O&M benefits would improve the benefit-cost ratios for SBI.

APPENDIX A: MEASURE MAPPING

The map used to assign each measure to a measure category is shown in Table 36.

Table 36: Commercial Lighting Measure Category Map

Program	Measure Name	Category
Distributor	Bay_High_Type_BC<120 W - long life	Indoor Non-Screw-Based
Distributor	Bay_High_Type_BC>120 W - long life	Indoor Non-Screw-Based
Distributor	Bay_Low_Type_BC<80 W - long life	Indoor Non-Screw-Based
Distributor	Bay_Low_Type_BC>80 W - long life	Indoor Non-Screw-Based
Distributor	LED Specialty Bulb BR30/PAR16 Long Life	Indoor Screw-Based (Specialty)
Distributor	LED Specialty Bulb BR30/PAR16 Short Life	Indoor Screw-Based (Specialty)
Distributor	LED Specialty Bulb Candelabra Long Life	Indoor Screw-Based (Specialty)
Distributor	LED Specialty Bulb Candelabra Short Life	Indoor Screw-Based (Specialty)
Distributor	LED Specialty Bulb PAR20/PAR30 Long Life	Indoor Screw-Based (Specialty)
Distributor	LED Specialty Bulb PAR38/BR40 Long Life	Indoor Screw-Based (Specialty)
Distributor	LED Specialty Bulb R20/MR16/Globe Long Life	Indoor Screw-Based (Specialty)
Distributor	LED Specialty Bulb R20/MR16/Globe Short Life	Indoor Screw-Based (Specialty)
Distributor	LED Standard Bulb Long Life	Indoor Screw-Based (A-Lamp)
Distributor	LED Standard Bulb Short Life	Indoor Screw-Based (A-Lamp)
Distributor	Outdoor_Type_B <5000 lm - long life	Outdoor
Distributor	Outdoor_Type_B >10000 lm - long life	Outdoor
Distributor	Outdoor_Type_B 5k_10k lm - long life	Outdoor
Distributor	TLED_TYPE_A_2ft - long life	Indoor Non-Screw-Based
Distributor	TLED_TYPE_A_4ft - long life	Indoor Non-Screw-Based
Distributor	TLED_TYPE_C_4ft - long life	Indoor Non-Screw-Based
SBI	IS06Y Outdoor LED Mogul Screw-Base Replacement Lamps for HID Lamps	Outdoor
SBI	IS08Y LED Retrofit Kits for Streetlights/Parking Lot Lights/Fuel Pump Canopy Fixtures	Outdoor
SBI	IS110S LED Replacement Lamps	Indoor Non-Screw-Based
SBI	IS110W LED Replacement Lamps	Indoor Non-Screw-Based
SBI	IS110Y LED Replacement Lamps	Indoor Non-Screw-Based
SBI	IS11Y Outdoor Pole-Mounted LED Streetlight or Parking Fixture	Outdoor
SBI	IS13W Outdoor Wall-Mounted & LED Area Fixture (Wallpack)	Outdoor
SBI	IS13Y Outdoor Wall-Mounted & LED Area Fixture (Wallpack)	Outdoor
SBI	IS17Y LED Canopy or Parking Garage Fixtures	Outdoor
SBI	IS21Y Recessed/Surface/Pendant-Mounted LED Downlight	Indoor Non-Screw-Based

Program	Measure Name	Category
SBI	IS23S LED Flood and Spot Lights	Outdoor
SBI	IS23W LED Flood and Spot Lights	Outdoor
SBI	IS23Y LED Flood and Spot Lights	Outdoor
SBI	IS40S Screw-In LED Lamps	Indoor Screw-Based (Specialty)
SBI	IS40Y Screw-In LED Lamps	Indoor Screw-Based (Specialty)
SBI	IS51S Space Lighting Design with New Luminaires	Indoor Non-Screw-Based
SBI	IS51Y Space Lighting Design with New Luminaires	Indoor Non-Screw-Based
SBI	IS52W LED Retrofit Kits for Interior Luminaires	Indoor Non-Screw-Based
SBI	IS52Y LED Retrofit Kits for Interior Luminaires	Indoor Non-Screw-Based
SBI	IS61Y High/Low Bay Design with New Fixtures	Indoor Non-Screw-Based
SBI	IS64Y LED High/Low Bay Mogul Screw-Base Replacement Lamps for HID Lamps	Indoor Non-Screw-Based
SBI	IS81S Space Lighting Design with New Ambient Luminaires	Indoor Non-Screw-Based
SBI	IS81Y Space Lighting Design with New Ambient Luminaires	Indoor Non-Screw-Based
SBI	IS82Y Retrofit Kits for Direct Linear Ambient Luminaires	Indoor Non-Screw-Based
SBI	L60 Controls for LED Systems	Controls
SBI	L71 Vacancy Sensors for LED Systems	Controls
SBI	S110 LED Replacement Lamps SBI	Indoor Non-Screw-Based
SBI	S11R Outdoor Pole-Mounted LED Streetlight or Parking Fixture	Outdoor
SBI	S13R Outdoor Wall-Mounted & LED Area Fixture (Wallpack)	Outdoor
SBI	S17R LED Canopy or Parking Garage Fixtures	Outdoor
SBI	S21R Recessed/Surface/Pendant-Mounted LED Downlight	Indoor Non-Screw-Based
SBI	S23R LED Flood and Spot Lights	Outdoor
SBI	S30 Refrigerated Case LED Light Fixture	Indoor Non-Screw-Based
SBI	S40 Screw-In LED Lamps	Indoor Screw-Based (Specialty)
SBI	S51R Space Lighting Design with New Luminaires	Indoor Non-Screw-Based
SBI	S52 LED Retrofit Kits for Interior Luminaires	Indoor Non-Screw-Based
SBI	S6 Outdoor LED Mogul Screw-Base Replacement Lamps for HID Lamps	Outdoor
SBI	S61R High/Low Bay Design with New Fixtures	Indoor Non-Screw-Based
SBI	S64 LED High/Low Bay Mogul Screw-Base Replacement Lamps for HID Lamps	Indoor Non-Screw-Based
SBI	S8 LED Retrofit Kits for Streetlights/Parking Lot Lights/Fuel Pump Canopy Fixtures	Outdoor
SBI	S81R Space Lighting Design with New Ambient Luminaires	Indoor Non-Screw-Based