



FINAL REPORT

Rhode Island C&I Lighting Market Characterization and Adjusted Measure Life Study

Rhode Island Energy

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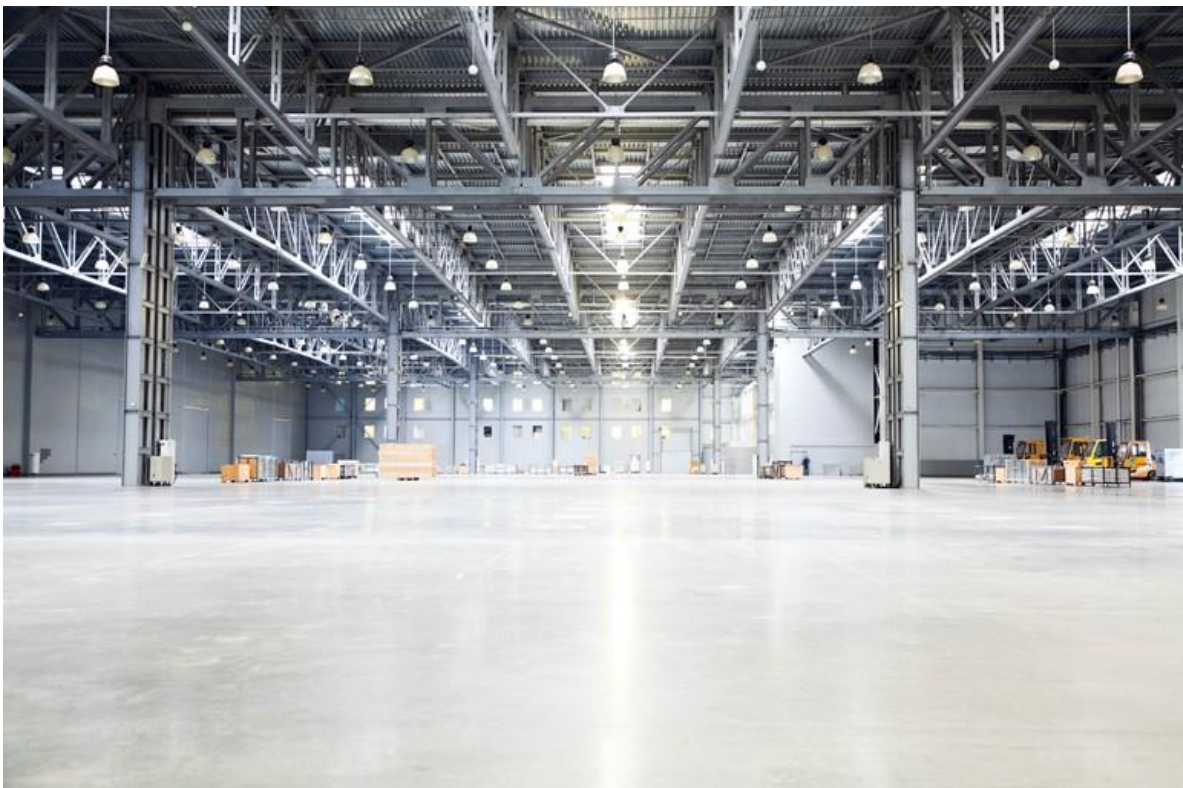




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1 INTRODUCTION

1.1 Study purpose, objectives, and research questions

On behalf of Rhode Island Energy, DNV carried out the Rhode Island Commercial and Industrial Lighting Market Characterization and Adjusted Measure Life Study from January to August 2022. The primary purpose of the study was to calculate the adjusted measure lives (AML) for non-residential custom and prescriptive lighting measures for the Rhode Island Technical Reference Manual (TRM) for prospective PY2023 application. In addition to producing future baselines for AMLs, the model results helped the study team:

- Understand the current and historical Rhode Island lighting saturation by technology
- Forecast the Rhode Island C&I lighting market trajectory
- Estimate the remaining opportunities to generate program savings

Energy savings from lighting programs have historically accounted for the majority of electric savings across energy efficiency portfolios. However, as the market moves rapidly towards LED technologies, there are fewer opportunities to continue to generate bountiful program savings from lighting. The transformation of the lighting market impacts the remaining savings potential in multiple ways. As the saturation of LEDs increases, the number of sockets available for LED upgrades is declining. This is exacerbated by the longer effective useful lives (EULs) of LEDs that burn out less frequently than their non-LED counterparts.

Additionally, as the baselines become more efficient, the claimable lifetime savings are also decreasing – this is reflected in the AML. The AMLs are the ratio of lifetime savings and first-year savings applied to program measures to calculate the lifetime savings in a dual-baseline framework – early replacement (ER) and replace-on-failure (ROF). The current program tracking systems calculate lifetime savings by multiplying first-year annual savings by the AML. While we expect lighting measures to be installed well past the recommended AMLs, the AML captures the magnitude of lifetime savings relative to the first-year savings.

The focus of the research was on the ambient linear submarket. Ambient linear fixtures consist of common recessed, suspended, or surface-mounted fixtures intended to provide ambient lighting in settings such as office spaces, schools, retail stores, and other commercial environments. Historically, this lighting application was dominated by fluorescent lighting (T12, T8, and T5), and while the trend had been to replace inefficient T12s with higher-efficiency T8s and T5s, the market is now trending, with help from program-induced acceleration, toward replacing all fluorescents with TLEDs and, most recently, LED integrated fixtures with and without controls.

1.2 Organization of report

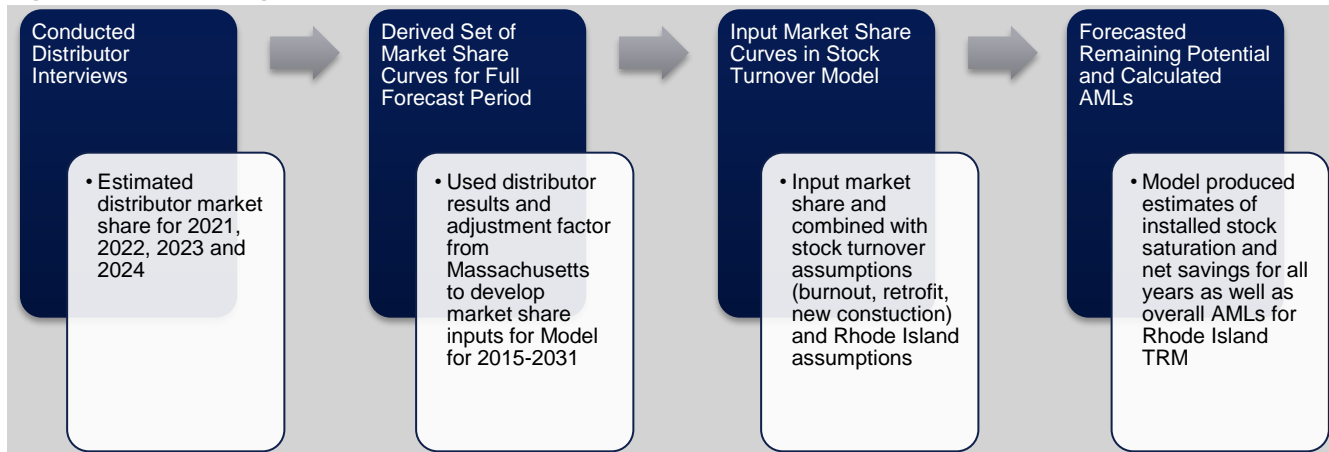
The rest of the report is organized as follows:

- Section 3: METHODOLOGY AND APPROACH
- Section 4: ANALYSIS AND RESULTS
- Section 5: CONCLUSIONS, RECOMMENDATIONS, CONSIDERATIONS, AND GUIDANCE FOR FUTURE RESEARCH
- Appendix A: STOCK TURNOVER MODEL ASSUMPTIONS
- Appendix B: DISTRIBUTOR SURVEY GUIDE

2 METHODOLOGY AND APPROACH

To estimate future baselines required for the AML calculations, DNV transformed a stock turnover model used in Massachusetts and Connecticut with Rhode Island-specific inputs. The key input to the model is market share, which was calibrated using primary data collected through in-depth interviews (IDIs) with lighting distributors. In addition to producing the AMLs, the stock turnover modeling process also yields forecasts of saturation and annual savings to help better understand the remaining potential for generating program savings. Figure 2-1 shows the steps in this approach.

Figure 2-1. Methodological approach.



2.1 Distributor interviews

The key objective of the distributor surveys was to determine recent and future market share by equipment technology. To capture recent market activity, we asked distributors to estimate their company's market share for 2021 and 2022. For each of these periods, the distributors were asked to estimate the percentage of their linear lighting sales by equipment category (LED luminaires, TLEDs, T5s, T8s and T12s). To understand where the market is headed, distributors were asked to estimate their company's market share projections for 2023 and 2024. The lighting distributors were asked to provide sales projections for two scenarios: a program scenario where the Rhode Island C&I lighting incentive program continued as-is and a program-ending scenario where the program did not exist in 2023 and 2024. In addition to the market share estimates/projections, the study also collected additional qualitative information about Rhode Island C&I lighting market characteristics, drivers, trends, and impacts of COVID-19. Appendix B includes the full survey instrument.

The sample frame for distributors included both participating distributors and non-participating distributors. The participating distributors were split between upstream participants, for which the DNV team had data about upstream data on 2021 sales and the second group of participants that were provided by National Grid but did not have 2021 upstream sales data. DNV labeled this second group as "Past Participants." The non-participant distributors were pulled from a ZoomInfo¹ search based on SIC codes 3646 (Commercial, Industrial, and Institutional Electric Lighting Fixtures) and NAICS code 423610 (Electrical Apparatus and Equipment, Wiring Supplies, and Related Equipment Merchant Wholesalers). DNV manually searched through each entry to ensure that only lighting distributors that operated in Rhode Island were included in the sample frame. DNV completed 17 interviews, including 13 upstream participants representing 59% of upstream savings from 2021, 2 past participants and 2 non-participants. Responses to the interviews were analyzed and weighted based on sample weights (N/n) multiplied by the response to a question asking respondents to estimate what percent of the C&I linear sales market in Rhode Island their company serves. Respondents that seemed to overrepresent their total market share were

¹ <https://www.zoominfo.com/>

down-weighted to reflect a more rational weight.² Table 2-1 breaks out the count of distributors in the population, the original sample target, and the total number of completes by the stratum.

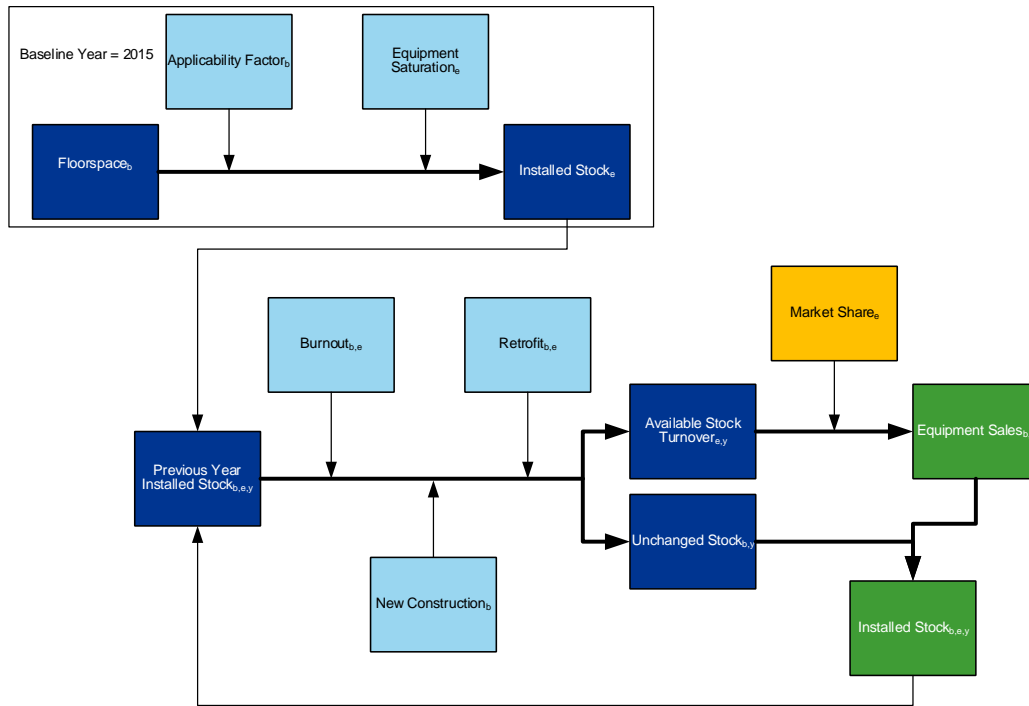
Table 2-1. Sample targets and number of completes

Strata	Population (N)	Target Sample	Completes (n)
Participant	32	10	13
Past Participant	19	4	2
Non-Participant	6	2	2

2.2 Stock turnover model

The following subsection describes the steps in the stock turnover model. Appendix A includes specific details on sources for the model assumptions. Figure 2-2 provides an overview of the model approach.

Figure 2-2. Stock turnover model diagram



Where:
 b = building type
 e = equipment type
 y = year

2.2.1 Step 1: Determine baseline stock

The starting year for the Model was 2015 since that was the point at which linear LED adoption was just beginning, and the saturation of LEDs was close to 0%. The total installed stock of lighting fixtures in 2015, by building type, was calculated by

² Weighted results were compared to unweighted results, and the differences were insignificant indicating that there was minimal variation between



multiplying the total lit floorspace by the number of linear fixtures per square foot (applicability factor) multiplied by the starting saturation rate by equipment type.

$$\text{Installed Stock} = \text{Lit Floorspace} \times \text{Applicability Factor} \times \text{Equipment Saturation}$$

To determine the lit floorspace, we used Commercial Buildings Energy Consumption Survey (CBECS)³ lit floorspace in 2012 by building type for New England and scaled it to Rhode Island based on the ratio of GDP by state. We utilized values in the U.S. Energy Information Administration's Annual Energy Outlook 2021 for growth rates. The applicability factor was based on on-site data from Rhode Island. The starting saturation rates were based on national estimates of installed stock in 2015.⁴

2.2.2 Step 2: Calculate annual stock available for turnover

There are three event types that create an opportunity for stock turnover or new installations. The sum of burn-out fixtures, retrofitted fixtures, and fixtures added due to new construction comprises the total stock available for turnover annually.

The number of lamps that burn out every year is equal to the total installed stock multiplied by the burn-out rate. The burn-out rate is 1 divided by the expected useful life of the equipment (EUL). In this model, the EUL is determined by the building-specific lighting hours of use divided by the market standard lifetime operating hours of the lighting equipment.

$$\text{Lamps Available Through Burnout} = \text{Installed Stock} \times \frac{1}{\left(\frac{\text{Lamp Rated Hours}}{\text{Building Annual Hours of Use}} \right)}$$

The retrofit rate is the percent of non-LED fixtures (after burn-out) that are retrofitted with an LED technology. This includes fixtures being installed to replace existing lamps and fixtures during renovation, retrofit/upgrade, or remodeling. The model assumes that this occurs at a rate of 10% each year in each sector, for a mean renovation cycle of 10 years.⁵ The retrofit rate is held constant through the forecast period, except in the program-ending scenario, where the retrofit rate is adjusted to 8% when the scenarios diverge in 2023 due to a lack of program influence.

$$\text{Lamps Available Through Retrofit} = (\text{Installed Stock} - \text{Lamps Available Through Burnout}) \times 10\%$$

In addition to burn-out and retrofit, the model assumes values in the U.S. Energy Information Administration's Annual Energy Outlook 2021 for growth rates. The number of fixtures added through new construction is based on the total lit floorspace added and the linear fixtures per square foot.

$$\text{New Lamps Through New Construction} = \text{Lit Floorspace} \times \text{Growth Rate} \times \text{Applicability Factor}$$

2.2.3 Step 3: Apply market share to stock turnover

To calculate the composition of the new stock each year, the model applies the derived market share curves to the total pool of available stock from burn-out, retrofit, and new construction to determine the total volume of new stock by equipment category. As discussed below, the market share inputs are derived based on the results of the distributor interviews and calibrated based on an adjustment factor from the Massachusetts distributor and calculated market share estimates. This is calculated at the building level; however, we don't have any data to support differences in market share by building type, so the market share is applied evenly across all building types. We apply two sets of market share to forecast the market in a program and program-ending scenarios, where the program incentives end after 2022.

³ <https://www.eia.gov/consumption/commercial/>

⁵ Based on same assumption used in DOE market model: https://www.energy.gov/sites/default/files/2020/02/f72/2019_ssl-energy-savings-forecast.pdf

2.2.4 Step 4: Calculate saturation and net savings

To estimate the installed stock of fixtures, the Model adds the stock turnover volume of sales to the unchanged stock each year. To estimate first-year net savings, we apply a delta watts savings assumption for all TLEDs and LED Luminaires installed each year. The difference between the total savings from the program scenario and the program-ending scenario yields the annual first-year net savings attributed to C&I linear program sales.

2.2.5 Calculate AML

Gross lifetime savings for the C&I lighting programs are assessed as a product of the first-year annualized savings and the measure life. To calculate the AML, we take the ratio of lifetime savings to first-year savings (delta watts). As lifetime savings and delta watts change, the AML changes. The inputs to the calculations are defined in Table 2-2, and the formulas for calculating AMLs are included below.

Table 2-2. Input definitions for AML calculations

Input	Definition
%ROF	% of lamps installed that replace-on-failure versus early-replacement ⁶
ER	Early replacement of a measure prior to the end of its useful life
Watts _F	Weighted average wattage of equipment sold without program-eligible technology
Watts _{PM}	Wattage of program measure (TLED or LED Luminaire)
Watts _A	Average wattage of all measures sold in year
Watts _I	Average wattage of all measures installed that are being retrofitted
EUL _F	Weighted average rated lifetime of non-program measure
EUL _{PM}	Weighted average rated lifetime of program measure
RUL _I	Remaining useful life of measures installed that are being retrofitted
Y	Year (future baseline)

2.2.5.1 Program Savings

$$\text{Adjusted Measure Life} = \frac{\text{Lifetime Savings}_{\text{Program}}}{\text{First Year Savings}_{\text{Program}}}$$

$$\text{Lifetime Savings}_{\text{Program}} = (\text{Lifetime Savings}_{\text{ROF}} * \% \text{ROF}) + (\text{Lifetime Savings}_{\text{ER}} * (1 - \% \text{ROF}))$$

$$\text{First Year Savings}_{\text{Program}} = (\text{First Year Savings}_{\text{ROF}} * \% \text{ROF}) + (\text{First Year Savings}_{\text{ER}} * (1 - \% \text{ROF}))$$

2.2.5.2 Replace on Failure

$$\text{First Year Savings}_{\text{ROF}} = (\text{Watts}_F - \text{Watts}_{\text{PM}})$$

$$\text{Lifetime Savings}_{\text{ROF}} = \text{First Period Savings}_{\text{ROF}} + \text{Second Period Savings}_{\text{ROF}}$$

⁶ https://ma-eeac.org/wp-content/uploads/MA19C14-E-LGHTMKT_2019-CI-Lighting-Inventory-and-Market-Model-Report_Final_2020.04.06.pdf



$$\text{First Period Savings}_{ROF} = (\text{Watts}_F - \text{Watts}_{PM}) * (\text{EUL}_F)$$

$$\text{Second Period Savings}_{ROF} = (\text{Watts}_{AY} - \text{Watts}_{PM}) * (\text{EUL}_{PM} - \text{EUL}_F)$$

2.2.5.3 Early Replacement

$$\text{First Year Savings}_{ER} = (\text{Watts}_I - \text{Watts}_{PM})$$

$$\text{Lifetime Savings}_{ER} = \text{First Period Savings}_{ER} + \text{Second Period Savings}_{ER}$$

$$\text{First Period Savings}_{Er} = (\text{Watts}_I - \text{Watts}_{PM}) * (\text{RUL}_I)$$

$$\text{Second Period Savings}_{ER} = (\text{Watts}_{AY} - \text{Watts}_{PM}) * (\text{EUL}_{PM} - \text{RUL}_I)$$



3 ANALYSIS AND RESULTS

The following section outlines the results from both the distributor interviews and the stock turnover modeling efforts.

3.1 Market share estimates

3.1.1 Distributor reported estimates

When asked about linear lighting sales in Rhode Island, distributors reported their sales of all LED technologies at 70% or higher starting in 2021. Assuming the program continues as-is, distributors estimated that share of LEDs would increase to 86% by 2024. The distributor reported composition of TLEDs vs. LED luminaires from 2021 through 2024 in the program scenario shows an unexpected change between 2022 and 2023, where TLEDs increase and LED luminaires decrease. DNV does not have any rationale for this unexpected change within the overall LED category, but we believe that the increasing trend in overall LEDs is an accurate market trajectory. Because of this discrepancy in results, DNV leveraged the trend in overall LED vs. non-LED equipment and minimized the use of differences within the subcategories for the modeling and forecasting tasks.

If the program ceased at the end of 2022, distributors reported that TLED sales in 2023 and 2024 would remain consistent with the mix from 2021 (approximately 23%). However, the percentage of LED luminaires sales would decrease, and non-LEDs would gain market share. This indicates that the programs have successfully pushed customers towards the higher efficiency LED technologies that still have higher equipment and installation costs. Fluorescent technologies accounted for less than 25% of total sales in 2021, with approximately half of that coming from T8s and the rest made up of T12s and T5s. The proportion of fluorescent T8s is expected to continue to decline with the existence of the program and is expected to increase if program incentives were to disappear. For the modeling tasks, we have limited data to inform future forecasts beyond 2024. However, the differences in market share for the lighting measures between 2023 and 2024 in the program-ending scenario are negligible, indicating that there is likely little improvement in LED market share into the future in the absence of the program. Figure 3-1 below shows the distributor estimates of market share, and Table 3-1 provides the estimates and associated descriptive statistics. These estimates do not include any estimate of changes in the volume of LED sales. It's likely that the total volume of LED sales in the program scenario is higher than the volume of LED sales in the program-ending scenario due to the increase in early replacement induced by the program.

Figure 3-1. Distributor reported estimates of market share (n=17)

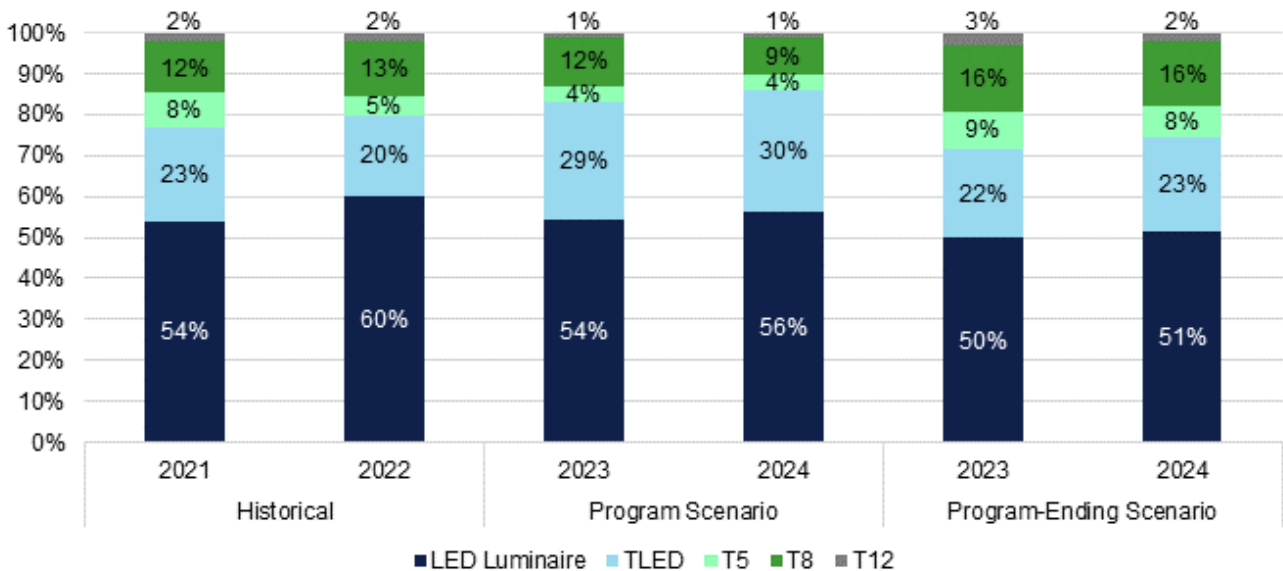


Table 3-1. Distributor reported estimates of LED market share and descriptive statistics

Scenario	Year	Equipment	Sample Size	Estimate	Standard Error	Lower CI	Upper CI	Absolute Precision	Relative Precision
Historical	2021	TLED	17	22.9%	0.06	12.3%	33.5%	10.6%	46.3%
		LED Luminaire	17	53.9%	0.13	31.1%	76.8%	22.9%	42.3%
	2022	TLED	17	19.7%	0.05	9.9%	29.5%	9.8%	49.9%
		LED Luminaire	17	60.2%	0.11	40.4%	79.9%	19.8%	32.8%
Program Scenario	2023	TLED	17	28.8%	0.04	21.5%	36.1%	7.3%	25.4%
		LED Luminaire	17	54.4%	0.05	46.2%	62.8%	8.3%	15.3%
	2024	TLED	17	29.7%	0.05	21.6%	37.7%	8.0%	27.1%
		LED Luminaire	17	56.2%	0.05	46.9%	65.5%	9.3%	16.5%
Program-Ending Scenario	2023	TLED	17	21.9%	0.05	12.9%	30.9%	8.9%	40.9%
		LED Luminaire	17	49.8%	0.11	30.4%	69.2%	19.4%	39.0%
	2024	TLED	17	22.9%	0.05	13.5%	32.4%	9.5%	41.3%
		LED Luminaire	17	51.4%	0.10	32.3%	70.5%	19.1%	37.1%

It is important to note that these distributors' estimates are not direct inputs into the model but rather are used, along with information from Massachusetts and distributor-reported differences between states, to inform the market share trajectory. There are several reasons why it's likely that distributors' results overstate the total market share of LEDs and the ratio of LED luminaires to TLEDs.

One reason that distributors may overstate the total LED market share across that market is that distributors tend to serve larger businesses and customers interested in lighting retrofits and new construction projects. While distributors also serve customers replacing burned-out or failed lighting systems, there are actors outside of the traditional sales that offer lamp replacement options. These actors include big box stores, home improvement stores, online retailers, and energy service companies (ESCOs). When asked to estimate 2022 overall market share rather than their own company sales, distributors reported that the overall share of LED technologies dropped from 80% to 76%. Similarly, the ratio of LED luminaires to TLEDs went from 60% and 20% and their company sales to 37% and 39% when asked about the overall market.

Another reason distributors may overstate LED market share is that distributors that responded to this survey were dominated by participating distributors that likely sell a higher proportion of LEDs than non-participating distributors. While we assume that most of the LEDs in the market are sold through participating distributors, we know that there are at least several non-participating distributors.

Despite these caveats, distributors still provide the best source of information on the direction of the sales market. Because of that, we used these results to inform the shape of the market share curves in the model and to estimate the differences in market share between the program and program-ending scenario.

3.1.2 Modeled market share

The key input that drives the stock turnover model is market share. Distributors provide key insights into the market share curves input to the model, but the distributor results are not direct inputs into the model. Rather, we use the market share estimates and qualitative information from distributors, along with information from research conducted in Massachusetts⁷, Connecticut, and the Pacific Northwest (PNW),⁸ to help derive the shape of these curves. Over the last several years, the

⁷ https://ma-eeac.org/wp-content/uploads/MA19C14-E-LGHTMKT_2019-CL-Lighting-Inventory-and-Market-Model-Report_Final_2020.04.06.pdf

⁸ <https://www.bpa.gov/EE/Utility/Momentum-Savings/Pages/Lighting.aspx>



Massachusetts Program Administrators have supported a multi-year research effort to fully understand the C&I lighting market and the rate of change. A 2019 study in Massachusetts included in-depth distributor interviews aimed at the understanding market share that resulted in estimates of at least 90% LED market share.⁹ Putting this together with results from on-site saturation surveys in Massachusetts and results from the Massachusetts stock turnover model, it was evident that the actual LED market share in Massachusetts was less than what distributors reported but that distributors could forecast the trajectory of market share. We applied this adjustment factor calculated in Massachusetts to the Rhode Island distributor results to develop full market share inputs.

In the early years (2016-2020), we don't have distributor results in Rhode Island, but we assume that the market share of LEDs followed a similar trend to Massachusetts and Connecticut in the earlier years since these years had low rates of LED market share and LED sales were driven by early adopters that were less influenced by program incentives. We assume that Rhode Island saw an increase in market share from 2017-2020 but at a slower pace than Massachusetts and Connecticut, based on findings from the distributor interviews. For the middle years (2021-2024), we applied the adjustment factor developed in Massachusetts directly to the distributor responses. The outcome from this adjustment aligns with qualitative responses from distributors that market share in Rhode Island historically lagged Massachusetts but has been catching up in recent years. For the later years (2025-2031), there is limited information to know what the future looks like, so we assumed a declining rate of increase as market share approaches 100%.

Figure 3-2 below shows the overall LED market share curves derived for the program scenario in the model compared to existing data sources. The red lines show Rhode Island-specific data, the dark blue lines show Massachusetts data, and the green lines show Connecticut. The graph also shows both distributors reported results as well as derived LED market share curves in Rhode Island, Massachusetts, and Connecticut, with the solid lines showing distributor reported estimates and the dashed lines showing the derived curves.

Figure 3-3 compares the program scenario overall LED market share to the program-ending scenario overall LED market share. It also breaks down the overall lead market share split between LED luminaires and TLED fixtures. Much of the growth in the program scenario is attributed to an increase in the LED luminaires while TLEDs decline. A similar trend can be observed in the program-ending scenario, though at a lower rate than the program scenario.

⁹ https://ma-eeac.org/wp-content/uploads/MA19C14-E-LGHTMKT_2019-CI-Lighting-Inventory-and-Market-Model-Report_Final_2020.04.06.pdf

Figure 3-2. Modeled Rhode Island (program scenario) overall LED market share compared to other jurisdictions

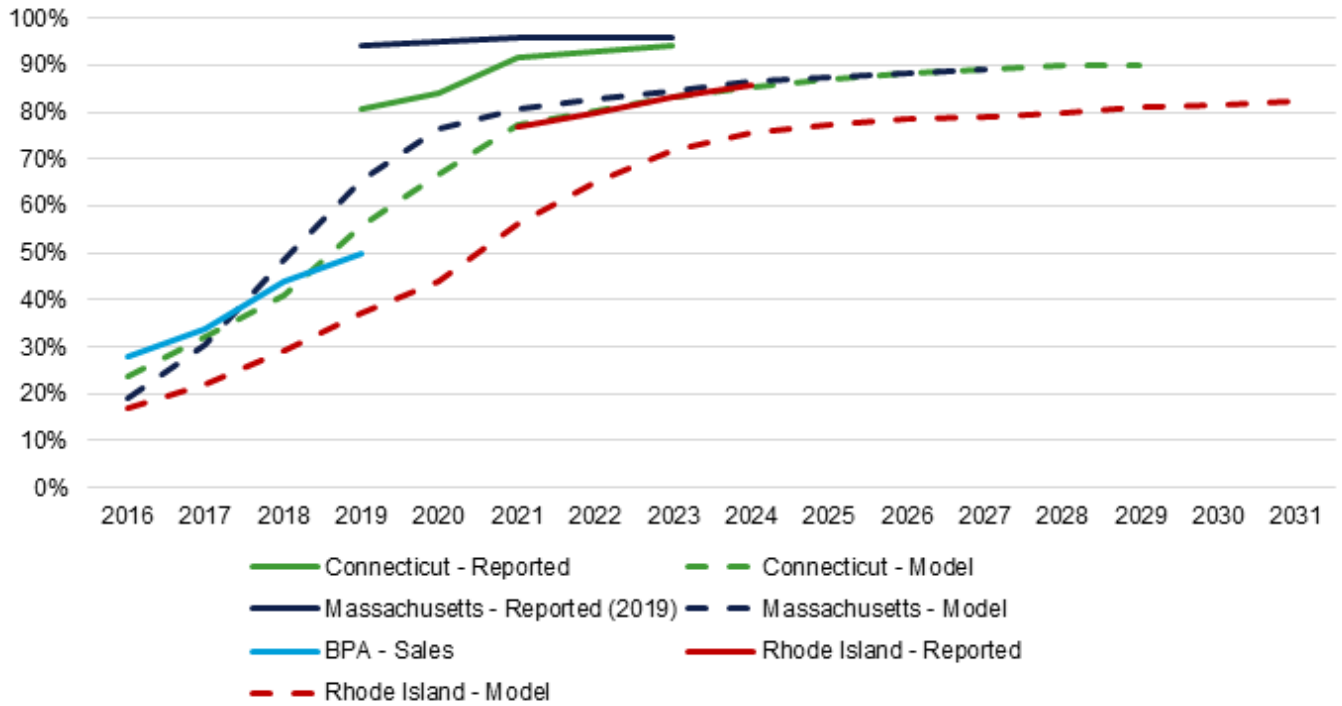
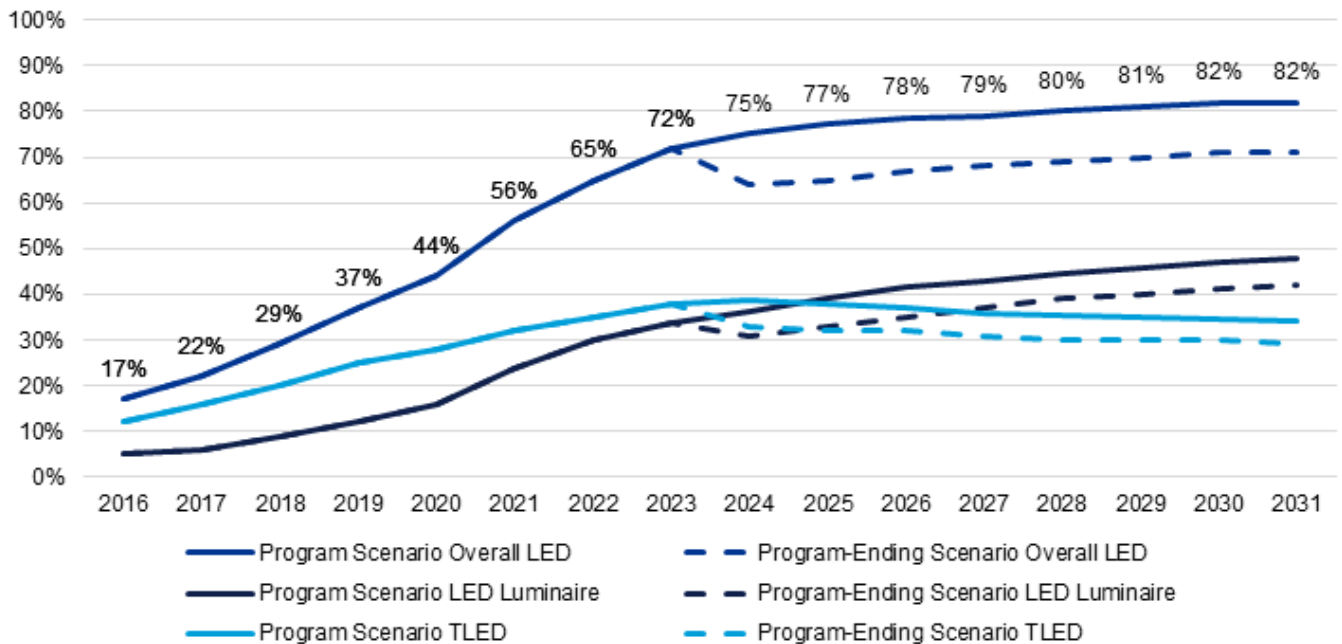


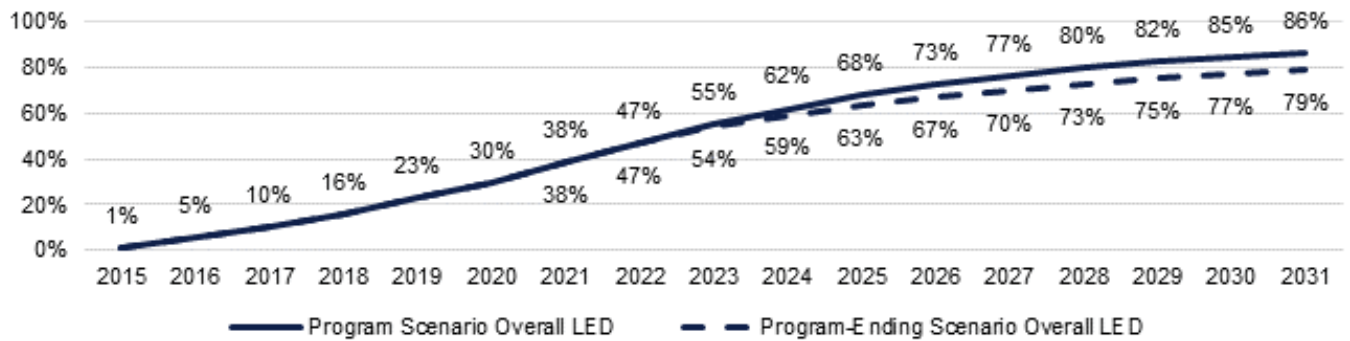
Figure 3-3. Modeled LED market share: program versus program-ending scenario



3.2 Installed stock saturation

After inputting the market share results explained above into the model, we estimate the annual change in installed stock over time. Starting at about 1% LED saturation in 2015, when LEDs were starting to be introduced into the linear market, we estimate that the saturation of LEDs has risen, accounting for approximately 38% of all installed linear stock in 2021. Assuming the program continues as-is, we forecast the saturation of LEDs will reach 62% by 2024 and 85% by 2030. If the program were to end in 2022, we forecast that LED saturation would continue to increase, albeit at a lower rate. We would still expect LED saturation to reach 59% by 2024 and 77% by 2030. Figure 3-4 shows the trajectory of the overall LED saturation over time in both the program and program-ending scenario.

Figure 3-4. Forecasted overall LED saturation - program versus program-ending scenario



Fluorescent T8s, which have historically accounted for most of the installed stock, has declined from about 75% in 2015 to about 48% in 2021. This is expected to continue to decline to about 24% in 2025. Fluorescent T12 and T5 fixtures are expected to continue a modest decline as they become fully phased out. Figure 3-5 and Figure 3-6 show the change in the installed stock for all equipment types through the forecast period in both the program and program-ending scenarios.

Figure 3-5. Forecasted installed stock saturation - program scenario

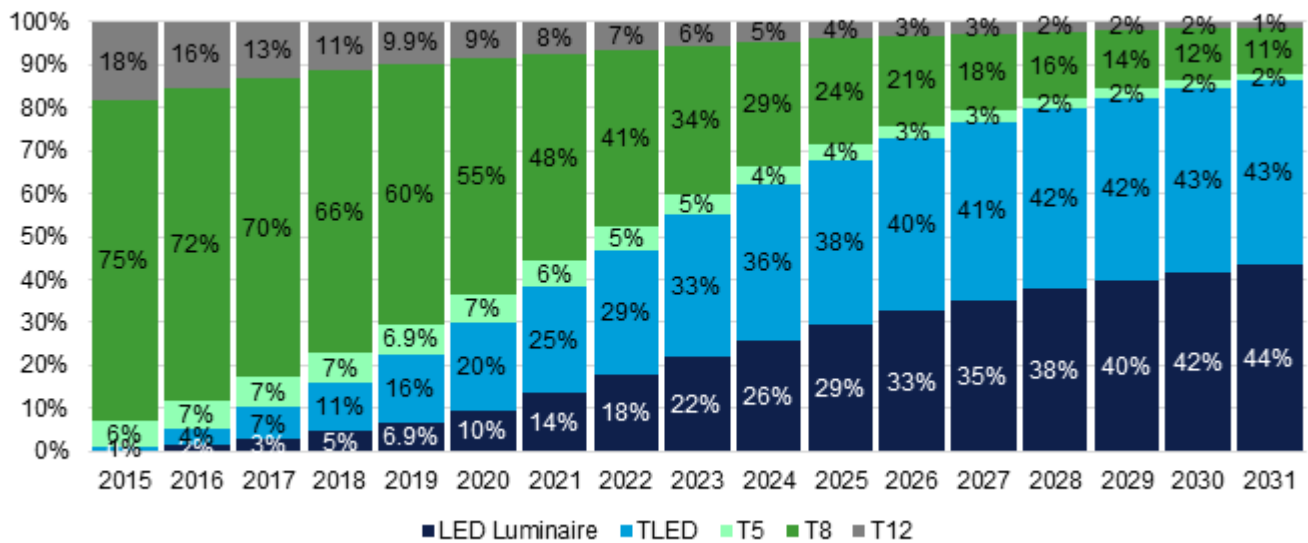
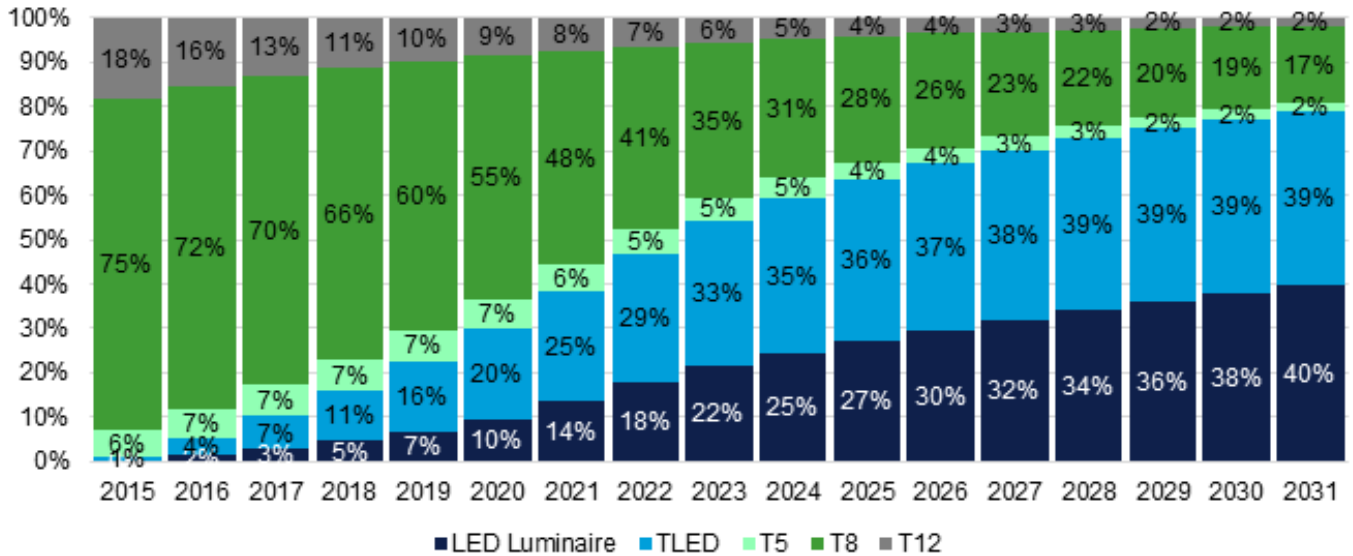


Figure 3-6. Forecasted installed stock saturation - program-ending scenario



The modeled saturation results align with the on-site saturation results calculated as part of the Rhode Island (RI) Commercial and Industrial (C&I) Market Characterization Data Collection Study conducted in 2019. As part of that effort, DNV inventoried lighting at 87 sites in Rhode Island and estimated that the saturation of LEDs in 2019 was 22%, which is in line with the 23% estimate from the modeling effort conducted as part of this effort. This also aligns with distributor-reported differences in market share across states, suggesting the Rhode Island market lags Massachusetts. Table 3-2 presents the LED saturation across Rhode Island efforts and across Massachusetts and Connecticut.

Table 3-2. Comparison of LED saturation rates across C&I jurisdictions

Jurisdiction	2019 LED Saturation Rate	2021 LED Saturation Rate	2025 LED Saturation Rate
Rhode Island Model (Program Scenario)	23%	38%	68%
Rhode Island 2019 Onsites ¹⁰	22%		
Massachusetts Model (Program Scenario) ¹¹	36%	62%	89%
Connecticut Model (Program Scenario) ¹²	31%	50%	77%

3.3 Net program first-year savings

With the longer lifetimes associated with LEDs and increasing rates of LED saturation, fewer sockets are available for upgrade leading to decreasing opportunities to generate first-year annual savings. Figure 3-7 shows that the first-year net annual savings have peaked and are expected to decline through the forecast period to 2031. These values are the difference in the sum of delta watts savings between LEDs installed in the program scenario versus the program-ending scenario. This assumes that the first-year savings remain constant for LEDs. Similar to our saturation forecasts, there are

¹⁰ http://rieermc.ri.gov/wp-content/uploads/2020/09/ri-market-characterization-data-collection-study_final-report.pdf

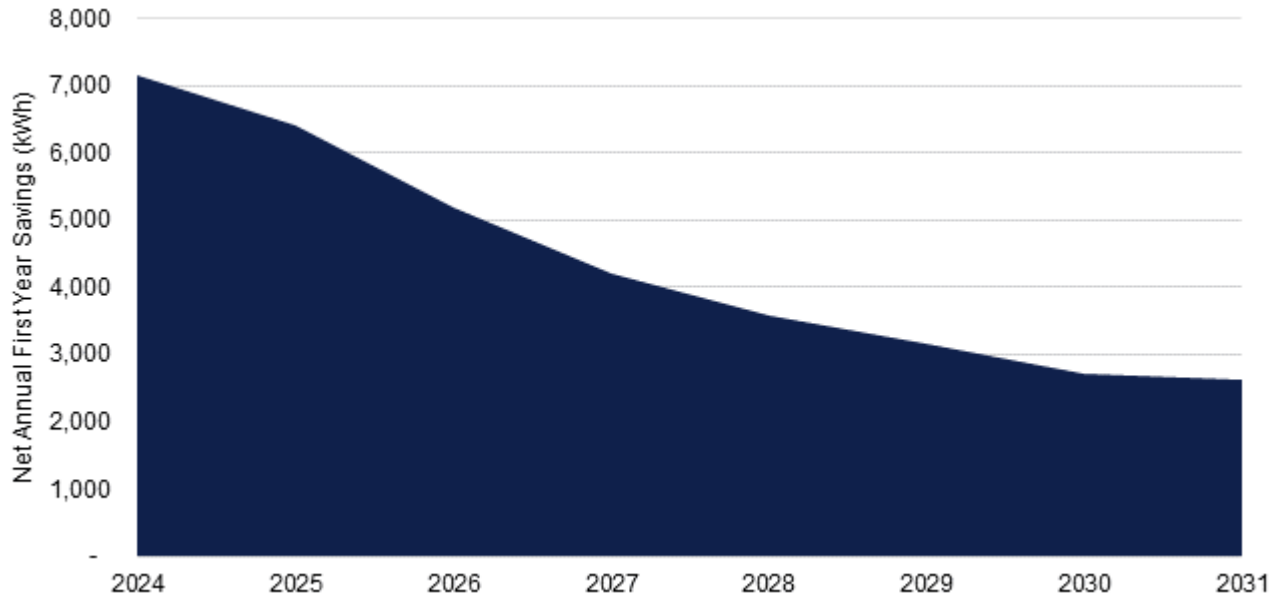
¹¹ https://ma-eeac.org/wp-content/uploads/MA20C09-E-LMC_LightingMarketCharacterization_FinalReport.pdf

¹² https://energizect.com/sites/default/files/2022-07/CT%202014_CI%20Lighting%20Saturation%20and%20Remaining%20Potential_Phase%201%20Memo_FINAL_20210628.docx



many assumptions that go into these forecasts, which compounds the uncertainty around exact estimates of savings; however, the overall takeaway is that savings are expected to decline and that lighting cannot be relied upon to generate the same historical levels of savings going forward.

Figure 3-7. First-year net annual savings (2024-2031)



3.4 Adjusted measure life

Using the future baselines forecasted in the model, DNV calculated the AMLs for ambient linear TLEDs, LED luminaires, and LED luminaires with controls. Table 3-3 shows the annual AML values from 2023-2025. Because baselines shift over time, the AML values also change over time. DNV recommends using the average value shown in the last column. While the focus of this effort was on the ambient linear submarket, DNV has also included recommendations for measures in the high/low bay and exterior/outdoor submarkets as well. For high/low bay measures, we recommend one additional year on top of the AML calculated for ambient linear measures based on qualitative results from distributors indicating the impact of the program is likely slightly higher. For exterior/outdoor measures, we recommend one less year based on distributors that indicated there would be a minimal drop in market share in the absence of the program. Distributor results for these other submarkets are summarized in subsection 3.5. Since screw-based lighting was not within the scope of this work, we recommend keeping the screw-based AMLs from the most recent Massachusetts research.¹³

¹³ https://ma-eeac.org/wp-content/uploads/MA-CIEC-Lighting-AML-PY21-PY22_FINAL_20210706.pdf



Table 3-3. Updated measure lives for Rhode Island TRM

Application	Measure	PY2023	PY2024	PY2025	Average	Rounded Recommendation
Ambient Linear	TLED	5.9	6.1	6.2	6.1	6
	LED luminaire	6.4	6.4	6.6	6.4	6
	LED luminaire w/controls	7.3	7.3	7.5	7.4	7
High/Low Bay	TLED				7.1	7
	LED luminaire				7.4	7
	LED luminaire w/controls				8.2	8
Exterior/Outdoor	TLED				5.1	5
	LED luminaire				5.4	5
	LED luminaire w/controls				6.2	6
Screw-Based	A-lamp				2.2	2
	Downlight				2.2	2
	Decorative				1.7	2

The AML for LED luminaire w/controls includes a longer AML due the stream of savings associated with controls functionality of the fixture. For calculating this, we adjust both the numerator (lifetime savings) and the denominator (first-year savings) in the AML calculations. For the first-year savings, we use the lighting control savings factor. In this case, we assumed a 33% savings factor, which is associated with a combination of high-end trim and occupancy sensors and represents a moderate control type.¹⁴ This factor is included in the AML calculator and can easily be adjusted to calculate the AML for different control types. For lifetime savings, we assume that the stream of savings is consistent with the first-year savings for the EUL of the lighting measure. This is based on evidence that shows there is no significant market transformation in the controls market like there is in the lighting market. Table 3-4 provides the AML for ambient linear LED luminaires w/controls using all possible lighting controls savings factors from recent research in Massachusetts.¹⁵ This shows that advanced controls, which are networked or luminaire-level lighting controls would have an 8-year measure life. All non-advanced controls have a 7-year measure life when rounded.

¹⁴ Lighting controls savings factor range from 24% to 49%. For advanced controls with a 49% savings factor, the AML would round to approximately one additional year. When rounded, the recommended AML is the same for all control types that range from 24% through 38%.

¹⁵ https://ma-eeac.org/wp-content/uploads/MA19C06_E_UPLGHT_Ctrls_Memo_FINAL_2021.09.21.pdf



Table 3-4. Sensitivity analysis for LED luminaires with controls

Controls Technology	Savings Factor	2023	2024	2025	Average	Rounded Recommended
Networked Lighting Controls (NLC)	49%	7.6	7.7	7.8	7.70	8
Luminaire-Level Lighting Controls (LLLLC)	49%	7.6	7.7	7.8	7.70	8
Dual Occupancy and Daylight Sensors	38%	7.4	7.4	7.6	7.47	7
Combination of High-End Trim and Daylight Dimming	35%	7.3	7.4	7.5	7.41	7
Combination of High-End Trim and Occupancy Sensors	33%	7.3	7.3	7.5	7.36	7
High-End Trim	27%	7.1	7.2	7.4	7.22	7
Daylight Dimming	28%	7.2	7.2	7.4	7.25	7
Occupancy Sensors	24%	7.1	7.1	7.3	7.15	7

Table 3-5 compares the Rhode Island recommended values against the current Massachusetts values. Since research clearly showed that the Rhode Island market is clearly lagging in Massachusetts, one would expect the AMLs to be greater in Rhode Island. However, there are several reasons why we see shorter AMLs in Rhode Island.

Table 3-5. Rhode Island versus Massachusetts ambient linear AMLs

Measure	PY 2020	PY 2021	PY 2022	PY 2023	PY 2024	PY2025
RI TLED	6.1	5.5	6.0	5.9	6.1	6.2
MA TLED	7.3	6.7	6.6			
RI LED luminaire	6.5	6.0	6.4	6.4	6.4	6.6
MA LED luminaire	7.5	6.9	6.8			

The primary driver of the differences between the states is due to differences in forecasts in the program-ending scenario between the two states. The last time Massachusetts calibrated the model, which was in 2021, research indicated that there would be a more significant decline in the program-ending scenario. The modeling effort in Rhode Island relied on a more streamlined approach to calculating market share. In Rhode Island, the program-ending scenario was forecasted using the magnitude of differences in distributor estimates between the program and program-ending scenario. So, while distributors indicated that Rhode Island lags Massachusetts, the modeled drop in LED market share in the program-ending scenario is

less severe, leading to more efficient baselines in future years in Rhode Island. This is also a result of the timing of the research. Massachusetts research was conducted in 2020 and Rhode Island research was conducted in 2022 at which point it's likely the naturally occurring commercialization of LEDs has advanced. Table 3-6 shows an example of the market share of all technologies, which is the baseline, in 2023. Rhode Island has a more efficient baseline in the program-ending scenario driven both by the increased LEDs as well as the lower T12 and higher T5 mix.

Table 3-6. Example baseline conditions in PY 2023

	T12	T8	T5	TLED	LED Luminaire	Baseline
Fixture Wattage	101	77	58	36	32	
Massachusetts	10.6%	24.9%	1.1%	40.5%	22.9%	<i>52.4 watts</i>
Rhode Island	6%	18%	4%	38%	34%	<i>46.8 watts</i>

In response to questions about what comprises the baseline, we have included some additional clarification. In this example baseline in 2023, we note that program-eligible technologies (LED) are included in the baseline. For ROF measures, we exclude LEDs from the first-period baseline to avoid any double counting that is occurring in the net-to-gross calculations. However, LEDs are included in all other baselines, including the ER first and second-period baseline and the ROF second period. For the first period baseline in ER, the baseline is the installed stock of technologies that are being replaced. In PY 2023, we make the assumption that the equipment that is being replaced that year was the original equipment that was installed in 2016 (equipment that has 1/3 of its EUL remaining). LEDs are included in this because we know that certain ER events, like tenant turnover and remodeling, occur that include replacing some LED technologies. This has been standard practice as agreed to across stakeholders in Massachusetts and Connecticut.

3.5 Additional market insights

The rest of this section includes additional market insights derived from the IDIs with lighting distributors.

3.5.1 COVID-19 impacts on the Rhode Island Market

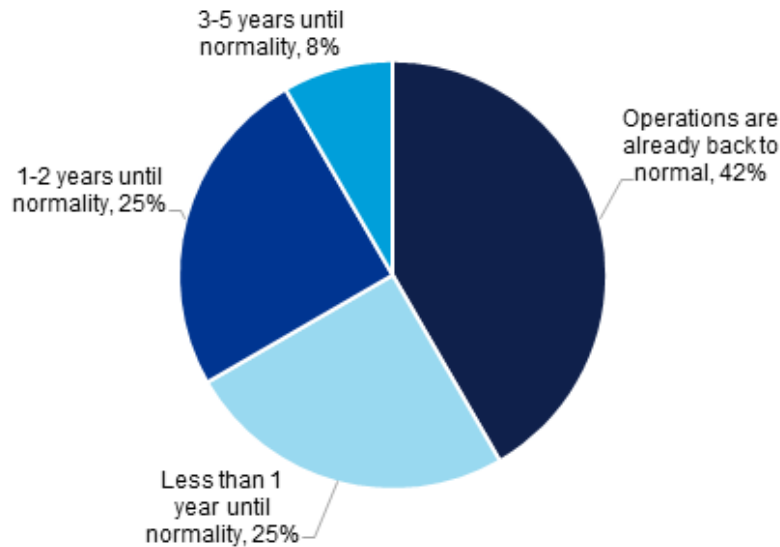
The COVID-19 pandemic disrupted lives and businesses, and Rhode Island distributors indicated that the lighting market did not escape these impacts in 2020. However, these distributors report a mix of impacts on business in 2021.

Some distributors reported a positive bounce-back in 2021 Rhode Island sales. For example, one distributor observed a record year in sales in 2021, stating that “commercial customers started to pursue projects that were stalled in 2020 due to COVID”. Another distributor said, “there were shipping delays in 2020, and customers were excited to get a lot of projects completed in 2021. There were inflation and price increases; however, activity and revenue were way higher in 2021 compared to 2020.”

The distributors were also asked whether the pandemic impacted the mix of linear lighting products they sold in 2021. Only one distributor said that their linear product mix did change due to the pandemic, saying that they sold a slightly higher percentage of LEDs.

The distributors were asked how long they expected the impacts of the pandemic to impact their company's operations. Figure 3-8 shows that 42% of the distributors said that their operations were back to normal, 8% said that it would take 3-5 years, and the remaining 50% were split evenly between less than one year and 1-2 years before their operations normalize.

Figure 3-8. When distributors expect their operations to return to normal (n =12)



3.5.2 High/low bay lighting

While this study did not collect quantitative market share estimates for non-linear submarkets, distributors were asked to characterize the Rhode Island market for lighting in the high bay/low bay and building exterior/outdoor applications. High and low bay lighting consists of pendant, recessed, or surface-mounted fixtures designed to provide light in spaces with indoor high ceilings. High bay lighting is used in spaces greater than 25 feet, and low bay lighting is used in spaces less than 25 feet. Nationally, this submarket combined account for approximately 21% of the total installed stock of fixtures, but they are also higher output systems making them candidates for large savings. The high/low bay market across the country was estimated to be at about 29% LED saturation in 2020.¹⁶

In general, the distributors agreed that absent the program, the market share of LEDs in the high and low bay submarket would be impacted. On average, respondents estimated that the market share of LEDs would decrease by 10-20% in the absence of the program. Reasons given include:

- “High/low bay probably makes up a specific chunk since the high/low bay fixtures typically take up a large amount of energy, and the program offers attractive rebates. It makes a simple decision for the end user; they get a great price right out the gate and lasts longer. Without the program, we can expect the market share to go down, but probably not a large amount. Energy savings most of the time are still enough to drive people to the LEDs.”
- “In the market, basic LED linear is still greater than high/low bays. There is more focus on high bays with integrated controls - adjusting lighting is a big benefit. Ending the program would definitely impact the market. More people would leave the lights alone and wouldn't make the change, they wouldn't be motivated to install new lighting in the warehouse, the investment wouldn't be worth it.”
- “Without the incentive it would not be attractive for customers. The disruption of a retrofit weighs heavily on the customer, it's great to have a sales pitch where we can state an ROI less than 2 years.”

3.5.3 Building exterior/outdoor lighting

The building exterior and outdoor application consist of lamps or fixtures for use outdoors or in locations exposed to weather conditions, including building exteriors, parking garages, parking lots, or open spaces. As we defined for this study, this

¹⁶ https://www.energy.gov/sites/default/files/2020/02/f72/2019_ssl-energy-savings-forecast.pdf



application does not include roadway or stadium lighting. Nationally, the exterior and outdoor submarkets were over 60% LED saturation in 2020.¹⁷ Several distributors pointed out that many of the exterior fixtures have already been upgraded to LED technology, but there is still some non-LED stock out there that can be converted. One distributor said that the “outdoor market was done heavily 7-10 years ago, it’s probably more saturated at this point. LEDs were more popular for exterior applications due to run hours and payback, and now interior projects are catching on.”

Distributors believe that the outdoor LED market would be slightly impacted without the program. On average, distributors estimated that exterior LED sales would drop at most 10% if the program were unavailable. One distributor pointed out that “people would still move to LEDs for the savings, and they’ve become familiar with LEDs over the years.” However, another distributor said, “Exterior LEDs are expensive fixtures, so without incentives, people would overlook changing them and choose the cheapest alternative.”

¹⁷ https://www.energy.gov/sites/default/files/2020/02/f72/2019_ssl-energy-savings-forecast.pdf

4 CONCLUSIONS, RECOMMENDATIONS, CONSIDERATIONS, AND GUIDANCE FOR FUTURE RESEARCH

4.1 Conclusions

- Rhode Island has proven to be a different market than Massachusetts and Connecticut's LED market share in the C&I space. Rhode Island has been less aggressive in transforming the market than the other jurisdictions, illustrated through distributor interviews and on-site data collection efforts in past studies. In 2021, we estimated the market share of LED fixtures across the Rhode Island C&I market to be 56%. In Massachusetts, we estimated the LED share to be 81% and Connecticut close behind at 77% in 2021.
- Starting at about 1% LED saturation in 2015, when LEDs were starting to be introduced into the linear market, we estimate that the saturation of LEDs has risen, accounting for approximately 38% of all instead linear stock in 2021. As a comparison to other jurisdictions, in 2021, Massachusetts was at 62%, and Connecticut was at 50%. Based on the Model forecasts, in Rhode Island, LED saturation is expected to increase to 68% by 2025, assuming the program continues as-is versus 63% if the programs were to end.
- With the longer lifetimes associated with LEDs and increasing rates of LED saturation, fewer sockets are available for upgrade leading to decreasing opportunities to generate program savings. With the declining savings, lighting cannot be relied upon to generate massive savings moving forward.
- COVID-19 slowed the uptake of LED technologies in this submarket in 2020. However, distributors experienced a bounce-back in 2021, and those whose business is not quite back to normalcy do not expect the effects to last much longer.
- There are still opportunities for savings in the high/low bay submarket. Distributors said that absent the program, C&I customers would not pursue projects given the disruption and lower ROI. In the exterior submarket, there are not as many non-LED products available in the marketplace, so customers will likely be forced to replace non-LEDs with LEDs as equipment burns out or fails.

4.2 Recommendations

- We recommend RI Energy adopt the updated AMLs reflected in Table 3-3 for TLEDs, LED luminaires, and LED luminaires with controls.



APPENDIX A STOCK TURNOVER MODEL ASSUMPTIONS

Input	Definitions	Source
Lit Floorspace	Total lit square footage by building type	CBECS 2012 ; New England states adjusted with GDP ratio by state
Floorspace Growth Rate	Total annual growth rate by building type	AEO 2021 Buildings (eia.gov)
Applicability Factor	Linear fixtures per lit square foot	RI C&I Market Characterization Data Collection Study
Hours of Use	Lighting hours of use by building type	RI Upstream Lighting Impact Evaluation
Delta Watts	Watt savings are used to estimate program savings applied to sales results	RI Upstream Lighting Impact Evaluation
Baseline saturation (2015)	Starting saturation in the baseline year (2015)	DOE SSL Forecast
Lamp Rated Lifetime Hours	Typical rated lifetimes by technology type	Massachusetts assumptions
System Wattage	Typical fixture wattage by technology type	Massachusetts assumptions
Retrofit Rate	% of fixtures retrofitted annually (LEDs excluded)	DOE SSL Forecast
%ROF	% of fixtures that are ROF instead of ER used to determine AML ratios	Massachusetts assumptions



APPENDIX B DISTRIBUTOR SURVEY GUIDE

SURVEY OVERVIEW

Objective: To understand the past, present, and future market share of equipment technologies in the commercial and industrial (C&I) linear submarket in Rhode Island (RI). The focus will be on quantitatively assessing the linear submarket (T8, T5, T12, TLED, and LED Luminaire) since those will be used to create a diffusion curve that will be a direct input into the RI market model.

Anticipated timing (survey length): approximately 30-45 minutes

Anticipated timing (in/out of the field): 3 weeks (2/14/2022 to 3/04/2022)

Method of data collection: in-depth interview (IDI)

Sample Design: we are targeting 16 completed surveys stratified by participation and size

Question	Instrument Goal
Screening: DS1 - DS6	Verify the respondent is a lighting distributor and familiar with the Rhode Island C&I Market. Responses to DS6 will be used to verify sample weights.
Market Share Estimates DS7; DS14 - DS22	Respondent to report historic company-specific market share in 2021 and predict company-specific and RI forecasts of market share and volume in 2022 and 2023 for linear products.
COVID Impacts: DS10 - DS13	Understand how COVID impacted the 2021 market, including market share.
RI and MA Comparison DS21 - DS23	Understand how RI is different from Massachusetts (MA). It will be used to benchmark other RI and MA research.
Fluorescent Investigation DS24 - DS27	Distributors may overestimate LED market share, so these questions will be used to verify previous estimates are correct and better understand the source of fluorescent equipment that we expect exists in the market.
High/Low Bay Potential DS28 - DS29	Qualitative responses to compare against linear submarket to inform Phase 2
Conclusion DS32 - DS34	Thank, verify email, and conclude



The table below shows the years for which distributors were asked to estimate market share by state for previous studies. For purpose of market share estimate comparison across states, we are going to use the known relationship between distributor-reported market share and overall market share developed in Massachusetts to calibrate market share estimates in Rhode Island that will eventually be used as annual inputs in the Market Model.

	2019	2020	2021	2022	2023	2024
Rhode Island			X	X	X	X
Massachusetts	X	X		X		X
Connecticut	X	X	X		X	

LIGHTING DISTRIBUTOR IN-DEPTH INTERVIEW GUIDE

Interview Information

Interviewer		Survey Length (min)	
Completion Date			

Contact Information

Phone	
Email	

Call Tracking

Date/Time	Notes

Introduction and Screening

[INTERVIEWER NOTE: THE QUESTIONS IN THIS INTERVIEW GUIDE SHOULD NOT NECESSARILY BE READ VERBATIM BUT MAY BE MODIFIED TO SUIT THE INTERVIEW]

DS1. Hi, my name is _____, and I am calling from DNV on behalf of Rhode Island National Grid regarding their energy efficiency programs that support the sale and adoption of efficient lighting products in Commercial and Industrial facilities across the State. I would like to ask you some questions about [if PARTICIPANT = YES] your participation in the Rhode Island programs and [ALL] trends in the C&I lighting market. In recognition of your time, a \$100 Amazon e-gift card will be emailed to you upon completing this survey.

[IF ASKED] We anticipate this interview will last about 30 minutes. Any information you provide will be treated as confidential.



[IF ASKED] DNV is an independent contractor hired to do this research. You can verify the legitimacy of this research by calling Erin Crafts from National Grid at 781-907-1423.

DS2. I would like to confirm – does your company engage in the wholesale distribution of C&I lighting equipment in Rhode Island? [INTERVIEWER NOTE: WE WANT TO MAKE SURE THE COMPANY IS A LIGHTING DISTRIBUTOR THAT OPERATES IN RHODE ISLAND]

Response ID	Response	Action
01	Yes	DS4
02	No	DS3

DS3. [IF DS2 = 02] What is the primary function of your company?

Response	Response	Action
A	[OPEN RESPONSE]	Terminate

* Response to be reviewed with possible follow up email to respondent

DS4. [IF DS2 = 01] Are you the right person to talk to about your company’s C&I lighting sales in Rhode Island and generally about trends in C&I lighting? [INTERVIEWER NOTE: MAKE SURE THE CONTACT IS FAMILIAR WITH THE RHODE ISLAND MARKET]

Response ID	Response	Action
01	Yes	DS6
02	No	DS5

DS5. [IF DS4 = 02] Can you please provide the contact information for who is the right person to speak to at your company?

Response	Response	Action
A	[NAME]	Thank and terminate
B	[POSITION]	
C	[EMAIL]	
D	[PHONE]	

Respondent Market Share

We are interested in better understanding the overall market for linear lighting technologies installed in commercial and industrial settings in Rhode Island. Linear lighting includes fluorescent tubes like T8s, T5s, and T12s, as well as LED tubes (like TLEDs). Linear lighting also includes fluorescent and LED luminaires like troffers, panels, and retrofit kits. When responding to the following questions, please think about your C&I linear sales in Rhode Island, specifically the total number of lamps and luminaires. We will not be asking about your sales of traditionally screw-based products like A-lines, decoratives, and downlights. Some of the questions are very specific, so we ask you to use your best estimate when responding to questions.

DS6. To get an idea of how much of the market your company represents, **approximately what percent of the C&I linear sales market in Rhode Island does your company serve?** [INTERVIEWER NOTE: IF RESPONDENT DOESN'T KNOW, USE PROBING QUESTIONS LIKE "IS IT MORE OR LESS THAN 10%."]

Response ID	Response	Action
01	___%	DS7
02	Don't Know	DS7



DS7. We would like to understand the overall trend in the share of sales that are LED over time. To compare the past, present and future, let's start with your 2021 linear sales. What was the breakdown of your linear lighting sales (in percent of total number of units) in Rhode Island in 2021? [INTERVIEWER NOTE: GOAL IS TO COMPLETE TABLE BELOW. USE GUIDING QUESTIONS TO BREAK OFF SMALLER QUESTIONS TO GET FULL RESULTS. RESULTS MUST SUM TO 100%.]

Guiding Questions:

- a. In 2021, what percent of your unit sales were LED versus Fluorescent?
- b. Within the LEDs, what percent of your unit sales were LED tubes (TLEDs) versus LED luminaires?
- c. What percent of your overall sales were fluorescent T8, T5, and T12?

Response	Technology Type	Equipment Type	% 2021 Sales
A	LED	LED Tubes (TLED)	
B		LED Luminaires (LED Fixtures/Systems)	
C	Fluorescent	T8	
D		T5	
E		T12	
Total			100%

DS8. [IF LED Luminaires > 0%] Approximately what portion of your LED luminaire sales were standard LED fixtures versus LED fixtures with integrated controls? By integrated controls, we mean any advanced controls capabilities as well as fixtures with built-in controls like daylight, network lighting controls or luminaire level lighting controls.

Response	Response	% of LED Sales
A	Standard LED fixtures	
B	LED fixture with integrated controls	
Total		100%

DS9. [IF LED Luminaires > 0%] Do you expect this mix between standard LED fixtures and LED fixtures with integrated controls to change in the future? If so, how?

Response ID	Response	Action
01	__%	DS10

DS10. Thinking back to the last year, 2021 was another unusual and challenging year for many businesses. Was your business impacted by COVID-19? If so, how was it impacted (overall sales, customer demand, supply chain delays, closures, furloughs...)?

Response ID	Response	Action
01	Yes [Explain]	DS11
02	No	DS14



DS11. **[IF DS10 = 01]** How much did COVID-19 impact the volume of C&I linear equipment your company sold in Rhode Island in 2021? By what percent? [INTERVIEWER NOTE: NEGATIVE MEANS DECREASE, CAPTURE PERCENT CHANGE IN SALES OF PRODUCT]

Response ID	Response	Action
01	__%	DS12

DS12. **[IF DS10 = 01]** Did the impacts from COVID-19 change the share of equipment that your company would have sold in Rhode Island in 2021? For example, did your company sell a higher percentage of fluorescent technology than you were expecting because of the impacts of COVID-19?

Response ID	Response	Action
01	Yes [Explain]	DS13
02	No	DS13

DS13. **[IF DS10 = 01]** How long do you expect the impacts of COVID-19 will affect your company's operations? [INTERVIEWER NOTE: PROBE USING RESPONSES TO DS10]

Response ID	Response	Action
01	Operations are already back to normal	DS14
02	Less than 1 year	
03	1-2 years	
04	3-5 years	
05	More than 5 years	
98	Don't know	

DS14. Now let's move ahead to this year, 2022. What percent of your company's linear sales in Rhode Island this year do you expect to be the following categories? [INTERVIEWER NOTE: THIS IS AN ESTIMATE SINCE 2022 IS ONGOING. USE GUIDING QUESTIONS TO FILL IN THE TABLE BELOW]

Response	Technology Type	Equipment Type	% 2022 Sales – Program
A	LED	LED Tubes (TLED)	
B		LED Luminaires (LED Fixtures/Systems)	
C	Fluorescent	T8	
D		T5	
E		T12	
Total			100%

DS15. **[IF DS14 C%+D%+E% = 0%]** You indicated that you don't expect to sell any fluorescent technologies this year [IF WEBSITE = AVAILABLE], and I see that you have some fluorescent technologies listed on your website. Can you confirm that you don't plan to sell any this year? [INTERVIEWER NOTE: YOU SHOULD BE FAMILIAR WITH PRODUCTS LISTED ON THE WEBSITE IN ADVANCE OF THIS CALL TO BE ABLE TO REACT TO THIS QUESTION.]

Response ID	Response	Action
01	Confirm [EXPLAIN]	DS16
02	Reject [Re-do DS14]	DS14



DS16. Based on your responses to estimates of your company sales in 2022, you said that your company's C&I sales in Rhode Island would be approximately [DS14A% + B%] LED. Do you think this is higher or lower than the market average for C&I linear sales across Rhode Island?

Response ID	Response	Action
01	Higher	DS17
02	Lower	DS17
03	Same	DS17

DS17. What do you think the share of C&I linear sales will look like across Rhode Island's entire market in 2022? This includes all distributor sales as well as sales that happen outside of the traditional distribution channels. [INTERVIEWER NOTES: THIS IS DIFFERENT THAN DS14, WHICH IS AIMED AT COMPANY SALES. WE WANT TO KNOW ABOUT THE ENTIRE MARKET.]

Response	Technology Type	Equipment Type	% 2022 Sales – Market
A	LED	LED Tubes (TLED)	
B		LED Luminaires (LED Fixtures/Systems)	
C	Fluorescent	T8	
D		T5	
E		T12	
Total			100%

DS18. [IF DS17 does not equal DS14] Why do you think the market looks different than your company's sales?

Response ID	Response	Action
01	[OPEN RESPONSE]	DS19

DS19. Going back to your company's sales and thinking ahead to 2023 and 2024, what do you think the share of your linear sales will be in Rhode Island assuming National Grid's program continues as-is?

Response	Technology Type	Equipment Type	% 2023 Sales – Program	%2024 Sales - Program
A	LED	LED Tubes (TLED)		
B		LED Luminaires (LED Fixtures/Systems)		
C	Fluorescent	T8		
D		T5		
E		T12		
Total			100%	100%

DS20. [IF PARTICIPANT = YES] According to our records, your company recently sold lighting products for use in Commercial and Industrial facilities through National Grid's energy efficiency program. As a reminder, this program offers financial incentives directly to contractors and commercial customers or through distributors when they purchase lighting equipment. If National Grid's program did not exist in 2023 and 2024, what do you think the share of your linear sales would be in Rhode Island?

[IF PARTICIPANT = NO] Currently, contractors and commercial customers are eligible for incentives through National Grid's energy efficiency programs that lowers the cost of LED technologies for those that participate. If National Grid's program did not exist in 2023 and 2024, what do you think the share of your linear sales would be in Rhode Island?



Response	Technology Type	Equipment Type	% 2023 Sales – NO Program	%2024 Sales – NO Program
A	LED	LED Tubes (TLED)		
B		LED Luminaires (LED Fixtures/Systems)		
C	Fluorescent	T8		
D		T5		
E		T12		
Total			100%	

Market Trends

DS21. As part of the research effort, we would like to understand how different the Rhode Island market is from the Massachusetts market. How familiar are you with the market for C&I linear lighting in Massachusetts?

Response ID	Response	Action
01	Very familiar	DS22
02	Somewhat familiar	DS22
03	Not familiar	DS24

DS22. In Massachusetts, we have witnessed high levels of LED market share and adoption – much of which is due to energy efficiency programs offered by the Sponsors of Mass Save. How does the current Rhode Island market compare to Massachusetts – both presently and moving forward?

Response ID	Response	Action
01	[OPEN RESPONSE]	DS23

DS23. Thinking back over the last five years, since LEDs first started to gain a toehold in the market, how would you say the total percent of linear sales across the market that were LED compares to the percent in Massachusetts? [INTERVIEWER NOTE: TRY TO CAPTURE A QUANTITATIVE COMPARISON. PROBE ON PERCENT DIFFERENCES OR CAPTURE VERBATIMS.]

Response ID	Response	Action
01	[OPEN RESPONSE]	DS24

DS24. Going back to Rhode Island now, do you consider anyone outside of the traditional distributor sales channel to be your competitors in the C&I sector in Rhode Island? [INTERVIEWER NOTE: THE GOAL IS TO FIND OUT IF CUSTOMERS PURCHASE LAMPS FROM PEOPLE WE ARE NOT CAPTURING. IF NO, PROBE ON ONLINE BULK WHOLESALERS, BIG BOX RETAIL, AND HOME IMPROVEMENT STORES.]

Response ID	Response	Action
01	Yes [WHO/EXPLAIN]	DS26
02	No	DS25

DS25. **[IF DS24 = 02]** Is there a typical C&I buyer who purchases lamps or fixtures outside the distribution channel? Why do they go that route? What are they purchasing?



Response ID	Response	Action
01	[OPEN RESPONSE]	DS27

DS26. [IF DS24 = 01] Why do some buyers prefer these alternatives to the traditional distribution chain? Are there products available there that traditional distributors do not offer?

Response ID	Response	Action
01	[OPEN RESPONSE]	DS27

DS27. [IF DS14 C% + D% + E% > 0%] Does your company plan to stop selling linear fluorescent technologies in Rhode Island? If so, when do you plan to stop offering them in Rhode Island?

Response ID	Response	Action
01	Yes [EXPLAIN]	DS28
02	No	DS28

High and Low Bay Potential

DS28. So far, we have been talking about linear lighting. Switching gears to talk a little about high and low bay lighting, how does the market share for LED equipment in the high and low bay submarket in Rhode Island in 2022 compare to the market share for LED equipment in the linear submarket in Rhode Island that we have been discussing? [INTERVIEWER NOTE: TRY TO GET A PERCENTAGE ESTIMATE OF HOW LED MARKET SHARE IS DIFFERENT.]

[IF ASKED] High bay/low bay lighting includes pendant, recessed, or surface-mounted fixtures specific for indoor high ceiling spaces with the high bays for installations higher than 25 feet and the low bays for installations 25 feet or lower.

Response ID	Response	Action
01	[OPEN RESPONSE]	DS29

DS29. If National Grid's energy efficiency program was not available to customers, how would this impact the market share of LEDs in the high and low bay submarket?

Response ID	Response	Action
01	[OPEN RESPONSE]	DS30

Outdoor/Exterior Lighting Potential

DS30. Now I'd like to talk a little about exterior lighting, how does the market share for LED equipment in the outdoor/exterior submarket in Rhode Island in 2022 compare to the market share for LED equipment in the linear submarket in Rhode Island that we have been discussing? [INTERVIEWER NOTE: TRY TO GET A PERCENTAGE ESTIMATE OF HOW LED MARKET SHARE IS DIFFERENT.]

[IF ASKED] Outdoor/exterior lighting includes lights or fixtures for use outdoors or in locations open to elements like building exteriors, parking garages, or open spaces.



Response ID	Response	Action
01	[OPEN RESPONSE]	DS31

DS31. If National Grid's energy efficiency program was not available to customers, how would this impact the market share of LEDs in the outdoor/exterior submarket?

Response ID	Response	Action
01		DS32

Conclusion

DS32. That concludes our survey effort for today. To ensure that you received the \$100 Amazon e-gift card, I would like to make sure that I have the correct email address for you. Is [EMAIL] the correct email address for you?

Response ID	Response	Action
01	VERIFY EMAIL	DS33

DS33. Do you have any additional thoughts or input on the LED market in Rhode Island that you would like to offer?

Response ID	Response	Action
01	[OPEN RESPONSE]	DS34

DS34. Pending the outcome of our research, we may conduct a follow-up effort that could include additional opportunities to provide feedback on the results. Are you interested in participating in any follow-up efforts in six months or so for an additional incentive?

Response ID	Response	Action
01	Yes	Thank and terminate
02	No	



EMAIL INTRO TEMPLATE

Hello _____,

My firm DNV is conducting research on behalf of National Grid to understand the current status of the Rhode Island commercial and industrial (C&I) lighting market.

Our initial research has identified you as a lighting distributor in Rhode Island, and we are hoping to set up a short phone interview with you to learn more about the lighting market in Rhode Island, with the hope that you can share some general information that will assist with our effort to better understand and characterize the current lighting market. In recognition of your time, a **\$100 Amazon e-gift card** will be emailed to you upon completion of this interview.

I've listed my availability below; please let me know which of these times work best for your schedule:

- [INSERT AVAILABLE TIME SLOTS HERE]

This interview will be over the phone and should last approximately 30-45 minutes. Once we hear about your availability and the best number to reach you, I will send a calendar invite.

Regards,

[DNV Staff Name]



About DNV

DNV is a global quality assurance and risk management company. Driven by our purpose of safeguarding life, property and the environment, we enable our customers to advance the safety and sustainability of their business. We provide classification, technical assurance, software and independent expert advisory services to the maritime, oil & gas, power and renewables industries. We also provide certification, supply chain and data management services to customers across a wide range of industries. Operating in more than 100 countries, our experts are dedicated to helping customers make the world safer, smarter and greener.