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2019 Reduced Wattage Lamp Replacement Program Long-Term Monitoring and Tracking Report

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1 Executive Summary

1.1 Background

NEEA's Reduced Wattage Lamp Replacement program sought to transform the Northwest linear fluorescent lamp replacement market

NEEA's Reduced Wattage Lamp Replacement (RWLR) program sought to transform lighting distributors' sales practices within the linear fluorescent lamp (LFL) replacement market in the Northwest by encouraging sales of higher efficiency, reduced wattage (25 and 28-watt) linear fluorescent lamps (RW LFLs) instead of 32-watt LFLs. To transform the LFL replacement market, NEEA engaged regional lighting distributors with the goal of shifting their sales and stocking practices toward RW LFL options by offering them tailored bonuses for selling higher proportions of RW LFLs and helping them arrange special pricing agreements with manufacturers. As part of the program, participating distributors also provided full-category sales data to NEEA, which enabled NEEA to provide bonuses based on changes in sales share.

Program success and market factors led the program to be transitioned to long term monitoring and tracking

Between 2014, when the RWLR program started, and the end of 2018, participating distributors' RW LFL sales as a percentage of their total LFL sales had increased dramatically from 12 percent to about 48 percent. Distributor participation in the RWLR program also increased to 14 regional distributors from five when the program began in 2014. Over the same period, sales of LED alternatives to fluorescent T8s (i.e., TLEDs) expanded dramatically. The increase in participating distributors' RW LFL sales share, coupled with rapid expansion of TLED sales, reduced the opportunity for conversion of 32W LFLs to RW LFLs. Given these market conditions and based on the 2019 RWLR Transition Market Progress Evaluation Report (TMPER),[1] NEEA decided to transition the RWLR program to long term monitoring and tracking (LTMT) in 2019.

Diffusion indicators track the continuing effects of the RWLR program on the LFL market after NEEA's exit

Having transitioned the RWLR program to LTMT, NEEA is seeking to determine if the program is continuing to influence the Northwest LFL market after NEEA's exit. The 2019 RWLR TMPER

[1] Cadeo Group. 2019. *2019 Reduced Wattage Lamp Replacement Transition Progress Market Evaluation Report*. https://neea.org/img/documents/2019-Reduced-Wattage-Lamp-Replacement-Transition-Progress-Market-Evaluation-Report.pdf

recommends assessing ongoing program influence using the following five diffusion indicators (DIs):

- DI 1 – RW LFL sales as a percentage of total regional LFL sales remain constant or increase.
- DI 2 – RW LFL sales as a percentage of total national LFL sales remain constant or increase.
- DI 3 – The price differences between RW LFLs and 32-watt LFLs, and between RW LFLs and TLEDs, remain constant or decrease.
- DI 4 – RW LFLs stocked by former RWLR participants as a percentage of all linear fluorescents they stock remains constant or increases.
- DI 5 – former RWLR participants' encouragement of their customers to purchase RW LFLs when technically feasible remains constant or increases.

Evergreen tracked diffusion indicators using sales data and market actor interviews

Evergreen Economics tracked the DIs for 2019 by building on sales datasets already available to NEEA with in-depth interviews conducted with former RWLR program participants, non-participants, and national manufacturers.

Sales datasets used for this study included:

- 2018 and 2019 linear lamp sales data for all 14 former RWLR program participants; and
- 2015 through 2018 linear lamp sales data for 16 non-participants representing 10 percent of the NEEA-modeled LFL sales of all non-participants in the region (non-participant sales data for 2019 was not yet available at the time of the analysis).

Non-participant sales data came from the Non-Residential Lighting Data Collection (NLDC) study. Since 2013, the NLDC study has collected full-category data for analysis of the non-residential lighting market and for savings estimation through the Bonneville Power Administration's (BPA's) "Momentum Savings Model". Table 1 summarizes the sales data sources that Evergreen Economics used in this study and the DIs these sources addressed.

Table 1: Sales Data Sources and Associated DIs

Sales Data Source	Distributor Group	Years Analyzed	DIs Covered
RWLR Participant Sales Data	Former RWLR participants	2018 – 2019	DI 1, DI 2
Non-Residential Lighting Data Collection (NLDC) Study	Non-participants	2015 – 2018	DI 1, DI 2

We conducted interviews with former participants, non-participants, and national manufacturers to address various aspects of the market not represented by sales data. Table 2 summarizes the

number of companies in each group for which NEEA had contact information, the number of interviews completed, and the DIs the interviews helped track.

Table 2: Interview Data Sources and Associated DIs

Interviewee Group	NEEA-Provided Contacts	Interviews Completed	DIs Covered
Former Participants	11	8	All DIs
Non-participants	21	6	DI 3
National Manufacturers	6	2[2]	DI 2, DI 3

1.2 Key Findings

The sales share of reduced wattage linear fluorescent lamps (RW LFLs) in the Northwest held steady within a shrinking LFL market (DI 1)

DI 1 tracks whether "RW LFL sales as a percentage of total regional LFL sales remain constant or increase." Sales data from former participants indicated that their sales of RW LFLs as a percentage of their LFL sales increased slightly by 1.2 percent from 47.4 percent to over 48.6 percent between 2018 and 2019. Review of non-participant sales data for 2015 through 2018 shows that their sales of RW LFLs as a percentage of their LFL sales has remained constant at about 10 percent. This trend together with interviews with non-participants indicated their sales share was likely to remain at that level in 2019. Overall, this indicated that the effects of the program on the region's RW LFL market share persisted in 2019 even after NEEA's exit from the market. At the same time, distributor sales of LFLs are giving way to TLEDs, resulting in a decline of the overall numbers of full wattage LFLs and reduced wattage LFLs being sold.

At a national level, the sales share of reduced wattage linear fluorescents appears to have held steady within a shrinking LFL market (DI 2)

DI 2 tracks whether "RW LFL sales as a percentage of total national LFL sales remain constant or increase." An interview with a national manufacturer of both LFLs and TLEDs suggests that national RW LFL sales as a percentage of total national LFL sales showed no change between 2018 and 2019. This finding is substantiated by the regional sales data results for DI 1, which also showed little change. At the same time, our interview with the national manufacturer of both LFLs and TLEDs and findings from the National Electrical Manufacturers Association (NEMA) see all linear fluorescents giving way to TLEDs, suggesting that total sales of full wattage and reduced

[2] One national manufacturer we interviewed produces both LFLs and TLEDs, while the other produces only TLEDs.

wattage LFLs are both falling. Overall, these findings indicate that national trends mirror those seen in the region served by NEEA.

Prices for RW LFLs are falling, but so are prices for TLEDs (DI 3)

All regional distributors interviewed (former participants and non-participants) indicated that their RW LFL prices either remained the same or decreased in 2019, leading to an overall price decline for RW LFLs. Our interview with the national manufacturer of both LFLs and TLEDs indicated that their RW LFL prices remained the same between 2018 and 2019. However, the price difference between RW LFLs and TLEDs also decreased. All interviewees, including former participants, non-participants, and the manufacturers, indicated that TLED prices remained the same or decreased in 2019, but that the decrease in price of TLEDs was greater than that of RW LFLs. While the cost difference between RW LFL and 32W LFLs decreased, so too did the cost difference between RW LFLs and TLEDs, making TLEDs more price competitive with RW LFLs.

Some former RWLR participants stocked fewer RW LFLs as a result of TLEDs' increasing market share (DI 4)

DI 4 tracks whether "RW LFLs stocked by former RWLR participants as a percentage of all linear fluorescents they stock remains constant or increases." Two of the eight former participants interviewed indicated that they would move away from stocking RW LFLs, while none indicated that they would increase their stock of RW LFLs. These two interviewees indicated that their primary motivation for decreased RW LFL stocking was to increase stocking of TLEDs, not a shift in preference toward 32W LFLs. Overall, while stocking of RW LFLs appears to have decreased across former participants as a whole, this is only true for a minority of former participants, and this trend appears to be the result of increased interest in TLEDs, not a shift in preference toward 32W LFLs.

Encouragement of RW LFLs is down, but encouragement is high for lower-wattage options generally (DI 5)

DI 5 tracks whether "former RWLR participants' encouragement of their customers to purchase RW LFLs when technically feasible remains constant or increases." Four of eight former participants we interviewed indicated that they encourage RW LFLs less frequently now than they did during the program. However, encouragement of lower-wattage alternatives to 32W LFLs (both RW LFLs and TLEDs) is still very high among former participants; all but one former participant interviewed indicated that they "often" or "always" encourage lower-wattage alternatives. That said, interviewees said the most commonly recommended lower wattage alternative is TLEDs, not RW LFLs. Ultimately, while encouragement of RW LFLs has decreased since the end of the program, encouragement of lower-wattage alternatives to 32W LFLs (both RW LFLs and TLEDs) is still high among former RWLR participants.

Overall, many program effects have persisted as TLEDs take a larger market share

Overall, our findings suggest that some of the effects of the RWLR program have persisted after NEEA's exit from the market. The regional market share for RW LFLs (within the shrinking LFL market) has been maintained and, among former participants, the sales share for RW LFLs relative to 32W LFLs has increased slightly. Similarly, most former participants are not changing their stocking practices of LFLs. In addition, prices of RW LFLs relative to 32W LFLs continue to fall. While encouragement of RW LFLs decreased, encouragement of lower-wattage alternatives to 32W LFLs, including both RW LFLs and TLEDs, has remained high.

Our research also shows that TLEDs continue to command more share of the linear lamp market. This is reflected at both the regional and national levels and is the primary motivation for some former participants to move their stock of linear lamps away from RW LFLs.

2 2019 RWLR Long Term Monitoring and Tracking Study

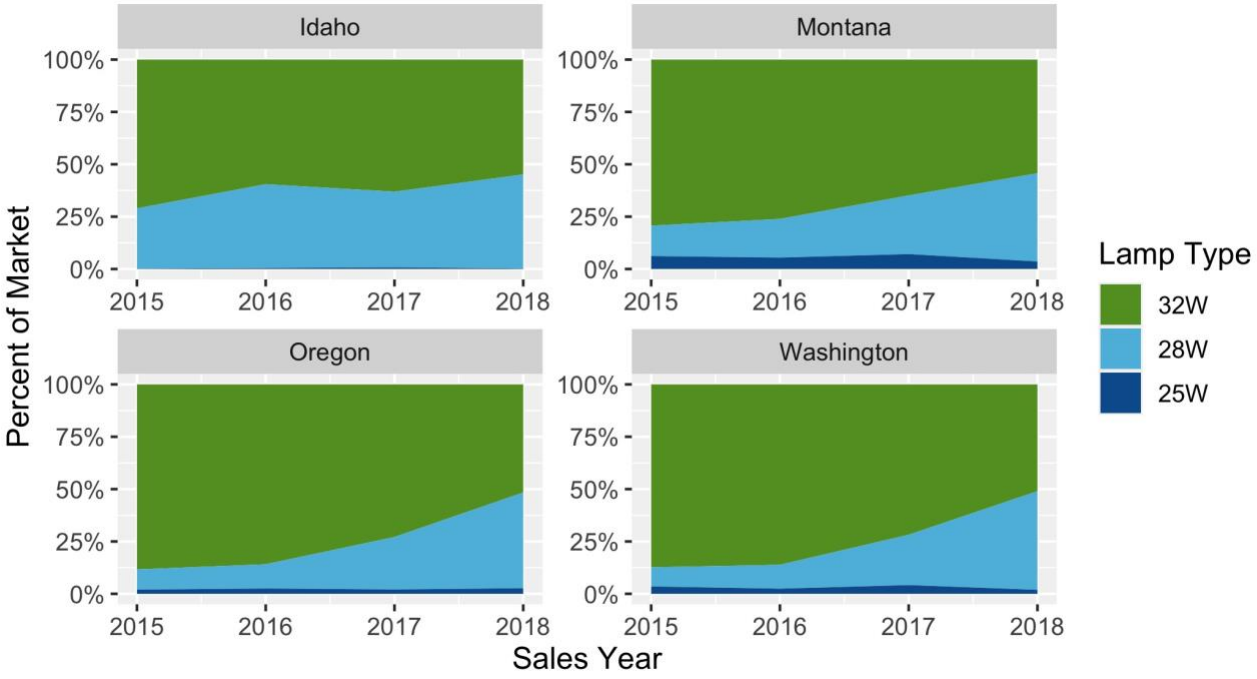
2.1 Background

Beginning with a market test phase in 2014, NEEA's Reduced Wattage Lamp Replacement (RWLR) program sought to transform distributors' sales practices within the linear fluorescent lamp (LFL) replacement market. NEEA identified 4-foot T8 LFLs as being a potential driver of savings because of their large share of the LFL market and because, at the time, the standard market choice was 32-watt (32W) LFLs, while reduced wattage (RW) 28W and 25W LFL options had little market share. At the time, LED alternatives to fluorescent T8s, also known as tubular LEDs (TLEDs), were virtually non-existent.

To transform the LFL market, NEEA engaged regional lighting distributors with the goal of shifting their sales and stocking practices toward RW options. To do this, NEEA offered distributor-specific bonuses to motivate them to increase their sales share of RW LFLs relative to 32W LFLs. NEEA also facilitated special pricing agreements between distributors and LFL manufacturers with the goal of reducing the price difference between 32W and RW LFLs. According to NEEA, as TLEDs became increasingly available during the program, the RWLR program focused on changing the sales and stocking practices of distributors that would not have otherwise transitioned to RW LFLs or TLEDs.

Between 2014 (when the RWLR program started) and the end of 2018, participating distributors' RW LFL sales as a percentage of their overall LFL sales increased dramatically from 12 percent to about 48 percent. Distributor participation in the RWLR program also increased to 14 regional distributors from five when the program began. Based on NEEA's publicly available data, Figure 1 shows that as a percentage of participants' total LFL sales, their RW LFL sales increased in every state that NEEA serves between 2015 (the first year of full program implementation) and the end of 2018 (when the program was transitioned to LTMT).

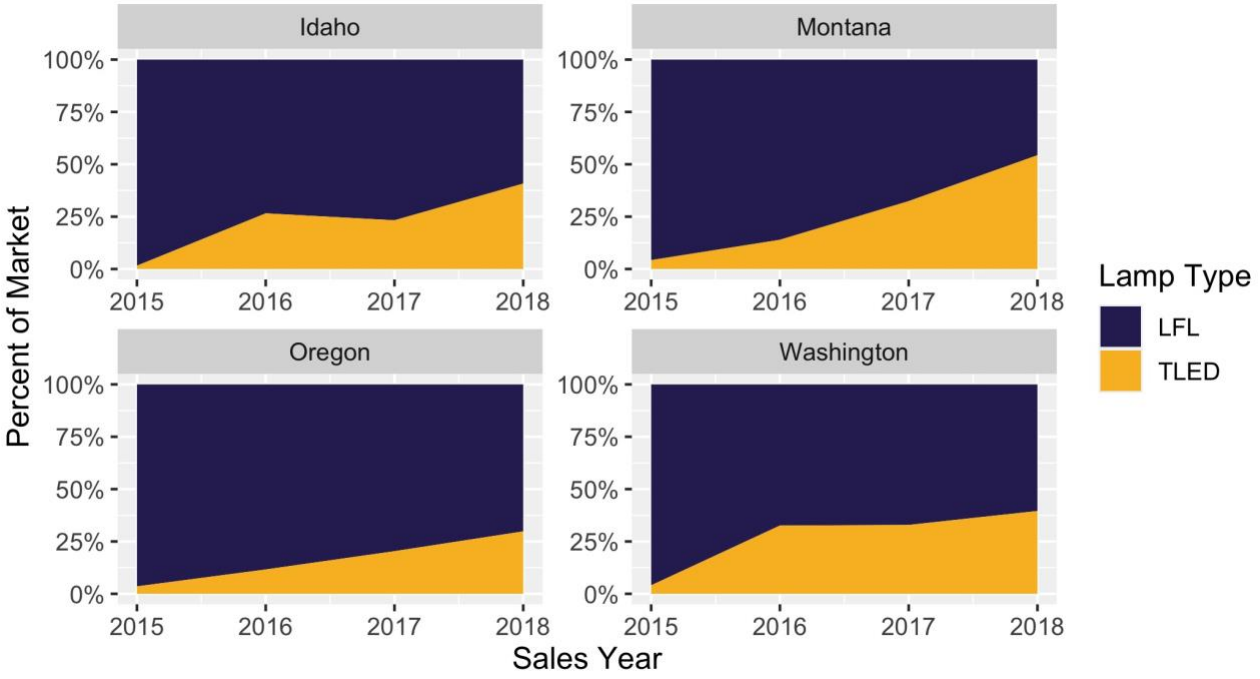
Figure 1: Change in Participant LFL Sales Share by LFL Type 2015 - 2018



At the same time, the market share of TLEDs among linear lamps grew dramatically. According to the National Electrical Manufacturers Association (NEMA), by the beginning of 2018, TLEDs accounted for over 25 percent of national linear lamp sales after accounting for less than 3 percent of sales in 2015. This expansion has come at the expense of T8 LFLs, which, according to NEMA, have seen their sales volume fall 60 percent since 2011.[3] This trend is reflected in NEEA's publicly available data for RWLR participants as well. As shown in Figure 2, RWLR participants' TLED sales increased in every state from less than 5 percent in 2015 to more than 30 percent by the end of 2018. While not the focus of the RWLR program, the decrease in LFL market share caused by TLEDs reduced the opportunity for conversion of 32W LFLs to RW LFLs.

[3] National Electrical Manufacturers Association. 2019. "Linear Fluorescent Lamp Indexes Continue Year-Over-Year Decline in First Quarter 2019 while T-LED Market Penetration Increases." Retrieved April 21, 2020, no longer available at nema.org.

Figure 2: Change in Participant Sales Share of TLEDs within Linear Lighting Market 2015 - 2018



Ultimately, the RWLR program was able to dramatically increase the percentage of participating distributors' sales of LFLs that consisted of RW LFLs. At the same time, the LFL market itself was shrinking as the market increasingly adopted TLEDs. The combination of participants' increased RW LFL sales share and reduced opportunity for conversion to RW LFLs (as a result of TLEDs) led to NEEA's decision to discontinue active engagement in this market via the RWLR program and transition the program to long term monitoring and tracking (LTMT). In fact, the ability of the program to meet its participant RW LFL sales share target and the rise of LED alternatives led NEEA to transition the program to LTMT a year earlier than expected. Full details on the reasons that the RWLR program was transitioned to LTMT can be found in the 2019 RWLR Transition Market Progress Evaluation Report (TMPER).[4]

2.1.1 Study Objectives and Purpose

Having transitioned the RWLR program to LTMT, NEEA aims to track the program's continued market effects. The 2019 RWLR TMPER, which documents the transition of the RWLR program to LTMT, outlines five diffusion indicators (DI) for monitoring and tracking the RWLR program's continued effects on the LFL market, as well as the continued effects of TLEDs on the larger linear

[4] Cadeo Group. 2019. *2019 Reduced Wattage Lamp Replacement Transition Progress Market Evaluation Report*. https://neea.org/img/documents/2019-Reduced-Wattage-Lamp-Replacement-Transition-Progress-Market-Evaluation-Report.pdf

lighting market. Table 3 presents the DIs and the source of information relevant to the DI. The objective of this LTMT study is to track the DIs. The results of the LTMT study provide inputs to NEEA's model for estimating energy savings for reduced wattage LFLs.

Table 3: Diffusion Indicators and Associated Data Sources

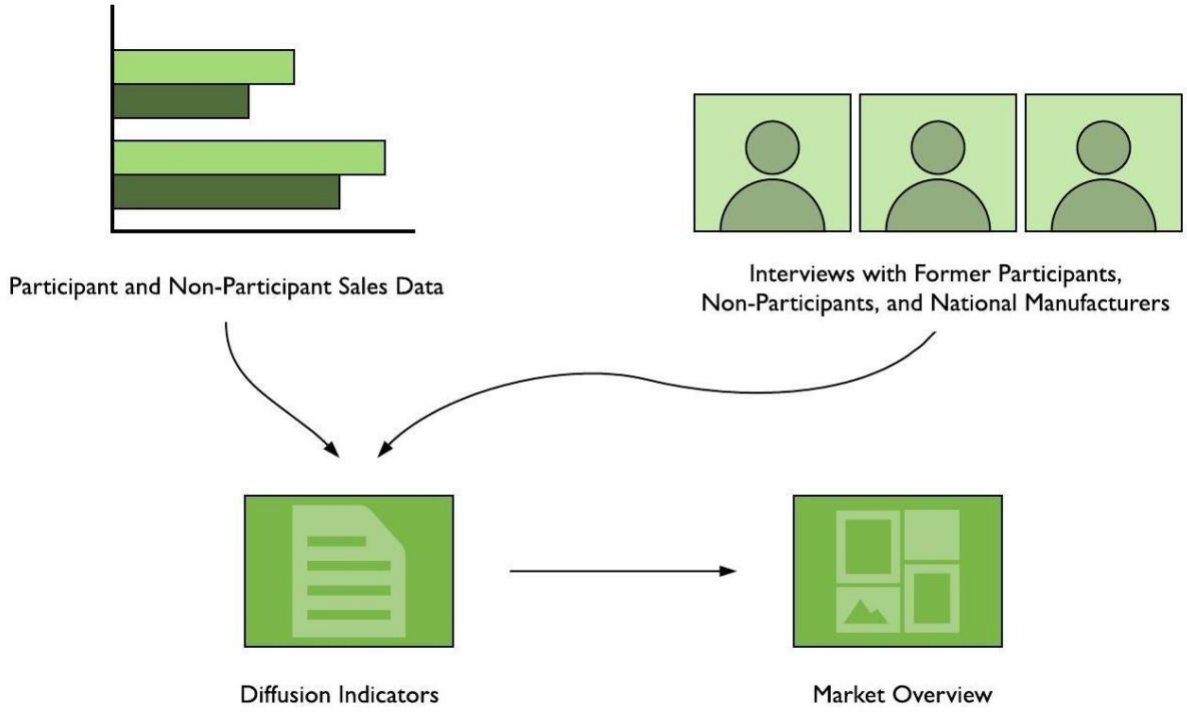
Focus Area	Diffusion Indicator	Data or Information Source
RW LFL Share of Regional LFL Sales	DI 1. RW LFL sales as a percentage of total regional LFL sales remain constant or increase.	NEEA modeled estimate for total 2019 regional sales of LFLs
		2018 and 2019 RWLR participant sales data
		2015 through 2018 non-participant data from the annual Non-Residential Lighting Data Collection effort
		Interviews with non-participants
		Interviews with former participants
RW LFL Share of National LFL Sales	DI 2. RW LFL sales as a percentage of total national LFL sales remain constant or increase.	Interviews with major manufacturers
		Other information sources and methods (e.g. NEMA)
Price	DI 3. The price differences between RW LFLs and 32-watt LFLs remain constant or decrease and the price difference between RW LFLs and TLEDs remains constant or increases.[5]	Interviews with former participants
		Interviews with non-participant distributors
		Interviews with major manufacturers
Stocking	DI 4. RW LFLs stocked by former RWLR participants as a percentage of all linear fluorescents they stock remains constant or increases.	Interviews with former participants
Sales Practices	DI 5. RWLR participants' encouragement of their customers to purchase RW LFLs when technically feasible remains constant or increases.	Interviews with former participants

[5] We want to see an increase in the price difference because RW LFLs are less expensive than TLEDs.

2.1.2 Description of Methods

Figure 3 summarizes the approach used by Evergreen Economics to track the diffusion indicators. Overall, our approach aimed to augment sales data with in-depth interviews conducted with regional distributors including former RWLR program participants, non-participants, and national manufacturers.

Figure 3: Summary of Approach to Track DIs



Sales data were a primary source of market insights. Datasets provided by NEEA included sales data from all 14 of the former program participants for 2018 and 2019, and sales data from 16 non-participants from the Non-Residential Lighting Data Collection (NLDC) study for 2013–2018. The participant sales data came from self-reports of full-category data to NEEA from former participants and included detailed monthly sales summaries by program participant including lamp type, sales price, sales quantity, and delivery state for 2018 and 2019. The NLDC data contained annual sales summaries for regional distributors by lamp type for 2013 to 2018; 2019 data were not available. In addition to data on non-participants, the NLDC data contained records for former participants and non-participating distributors that did not sell LFLs.

According to NEEA's estimates[6] of the regional LFL market, the 14 RWLR participants sold an estimated 2.23 million 4-foot linear fluorescent T8s in 2018, while non-participants sold an estimated 3.52 million. We were able to analyze the 2018 and 2019 sales records for all RWLR participants. For non-participants, the NLDC study (our primary data source for non-participant sales data) accounts for approximately 10 percent of NEEA-estimated regional non-participant LFL sales from 16 non-participating distributors. Table 4 presents the sales data sources used for this study and the DIs these data addressed.

Table 4: Sales Data Sources and Associated DIs

Sales Data Source	Distributor Group	Years Analyzed	DIs Covered
RWLR Participant Sales Data	Former RWLR Participants	2018 - 2019	DI 1, DI 2
Non-Residential Lighting Data Collection (NLDC) Study	Non-participants	2015 - 2018	DI 1, DI 2

In addition to utilizing sales data, we also conducted interviews with former participants, non-participants, and national manufacturers. These interviews were necessary to address the DIs that were not covered by the sales data – such as stocking practices and RW encouragement. To keep our interviews focused, our questions asked respondents to reflect on the experience of their own manufacturer/distributor without estimating broader market trends. To augment existing datasets, we also asked respondents about how their sales have changed over time. Table 5 summarizes our sources of interviews and the DI those interviews tracked. Additional details on our interview effort are provided in Appendix A. The interview guides we used in this study are located in Appendix B.

Table 5: Interview Data Sources and Associated DIs

Interviewee Group	NEEA-Provided Contacts	Interviews Completed	DIs Covered
Former Participants	11	8	All DIs
Non-participants	21	6	DI 3
National Manufacturers	6	2[7]	DI 2, DI 3

[6] Estimated by NEEA's Planning Group using a market model

[7] One national manufacturer we interviewed produces both LFLs and TLEDs, while the other produces only TLEDs.

Our interview effort and success varied with each target population we interviewed.

Interviews with Former Participants

As part of the RWLR program, participants had already provided much of the data to NEEA that were necessary for addressing many of the DIs, but additional data were required to understand:

- The extent to which distributors (continue to) encourage RW LFLs;
- The outlook for TLEDs in the linear lighting market; and
- Any changes in stocking practices of RW LFLs.

NEEA provided former RWLR participant contact information to Evergreen, and the original list included 11 distributors in the Northwest. NEEA and D+R International conducted the initial outreach, sending emails to all 11 former participants asking for their cooperation in the interview process. For former participants who did not respond to the initial email, Evergreen continued outreach, following up with former participants over both email and phone at least twice. In general, former participants were very responsive to the initial email outreach and were very willing to participate.

Of the 11 initial contacts, we conducted interviews with eight former participants representing 10 total regional distributors. Based on 2019 participant sales data, our interviews with distributors accounted for 87 percent of all participant sales in 2019, including nine of the 10 largest participating distributors in terms of sales. Interviews of former participants represented all four states in the geographic areas covered by NEEA's funding utilities. Distributors also varied in the number of branches (1-300+), as well as company size, with smaller distributors having fewer than 10 employees and the largest distributors having over 1,000 employees.

Interviews with Non-Participants

While NLDC data provided some insights into non-participants, much of the data used in this study came from the non-participant interviews. These data included:

- The percentage of their LFL sales that are RW and 32W;
- The percentage of their linear lighting sales that are TLEDs;
- The typical prices for RW, 32W, and TLED lamps;
- The extent to which they encourage reduced wattage LFLs; and
- The outlook for TLEDs in the linear lighting market.

Overall, we completed five interviews with non-participants who sell LFLs. These five regional non-participant interviewees were drawn from 21 non-participant contacts given to Evergreen by NEEA.

To assess how well our five non-participant interviewees represent the population of non-participating distributors, we compared our interview results against non-participant data in the

NLDC study. Of our five non-participant interviewees, the NLDC study contained data for three. Respondents with NLDC data accounted for approximately 18 percent of all non-participant sales represented in the NLDC study. Based on a list of regional distributors provided by NEEA, the non-participant respondents that did not provide data to the NLDC study are relatively small in terms of numbers of staff and branches. As a result, our results for non-participants are less representative than our results for former participants given that we were able to interview a higher proportion of the former participant population both in terms of number of distributors and total sales.

Interviews with National Manufacturers

To put regional market metrics in context and understand broader trends, we also interviewed national manufacturers. We focused our interviews on:

- RW LFL share of the national LFL market;
- TLED share of the national linear lighting market; and
- Price differences among RW LFLs, 32W LFLs, and TLEDs

Starting from a list of six contacts known to NEEA as national manufacturers, we were able to complete two interviews. Both interviewees currently work as Commercial and Industrial Utility relationship managers for their respective manufacturers. One of these manufacturers produces both LFLs and TLEDs, while the other only produces LED products. As a result, while we have two interviews that gave us insight into TLEDs, only one of our national manufacturer interviewees was able to address RW LFLs and the LFL market. To augment our national interviews, we also made use of analysis of the linear lighting market conducted by NEMA. This analysis tracks, on a quarterly basis, the market shares for TLED and LFLs within the linear lighting market, and how the total number of LFL sales has changed since 2011. Analysis from NEMA, our interviews with national manufacturers, and insights gained from the regional market informed our analysis of the market characteristics of LFLs nationally.

Data Cleaning and Analysis

With the assembled data sources, we conducted analysis to track the DIs for 2019. To begin the analysis process, we cleaned the sales datasets to ensure that they would support our analysis. This included:

- Restricting sales to only T8 LFLs and TLEDs;
- Restricting sales to only the region covered by NEEA (Idaho, Montana, Oregon, and Washington);
- Removing former participants and LED-only distributors from the NLDC data; and
- Restricting participant sales data to distributors with complete 2018 and 2019 data.

For quantitative analysis of interview results (like price), results were weighted by sales records as well as other information on distributor size. Given our access to the complete sales records for former participants, we weighted interview results by the sales made by each distributor. Given that some non-participant interviewees were not represented by the NLDC data, we created a weighting scheme for non-participants that also accounted for the distributor size based on number of branches and number of staff. This enabled us to approximate the size (and relative weight) of each non-participant interviewee independent of NLDC sales data. Qualitative interview results (like encouragement of RW LFLs) rely on the unweighted number of respondents or direct quotes from interviewees. We used analysis of sales data, and/or quantitative interview results and/or qualitative interview results to address each of the DIs.

2.2 Research Findings

After completion of our data collection efforts, we conducted analysis to address the diffusion indicators, the result of which is presented here.

2.2.1 Results by Diffusion Indicator

Diffusion Indicator 1

Finding: The share of reduced wattage linear fluorescents in the Northwest held steady within a shrinking LFL market.

Diffusion Indicator Results at a Glance (DI 1)

⇒ DI 1 – *RW LFL sales as a percentage of total regional LFL sales remain constant or increase.*

- *Sales data for former participants indicated that their RW LFL sales share increased slightly by 1.2 percent between 2018 and 2019.*
- *Based on non-participant NLDC data and interviews, there appears to be no change in the RW LFL sales share for non-participants.*
- *Two former participants expect their 2020 RW LFL sales share to decrease while the rest expect no change.*

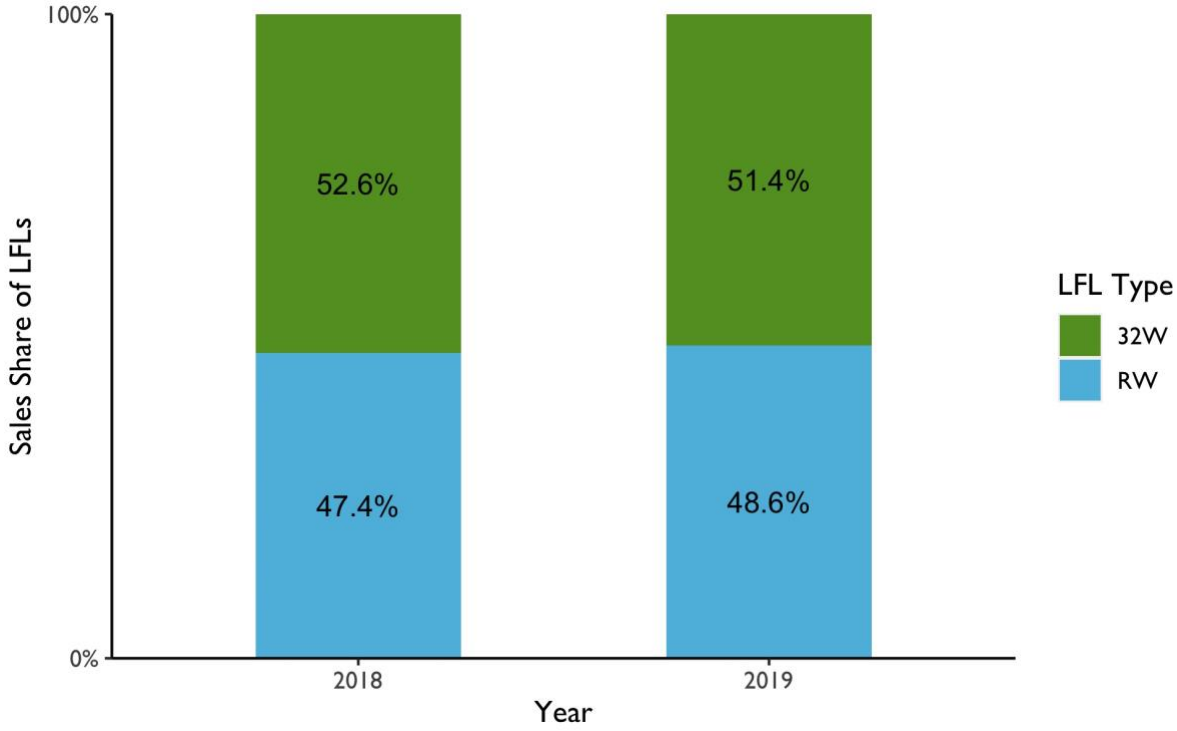
⇒ *Distributor sales of linear fluorescents are giving way to TLEDs, so the overall sales of full wattage and reduced wattage LFLs are both falling.*

⇒ *These findings indicate that program effects on RW market share persisted in 2019 even after NEEA's exit from the market.*

To address DI 1 ("*RW LFL sales as a percentage of total regional LFL sales remain constant or increase."*), we assessed the sales share for former participants and non-participants separately using sales data and interview results. These results were then combined to assess changes in market share at the regional level.

Using former participants' sales data, we estimated their RW LFL sales share in 2018 and 2019. For 2018, participants'[8] RW LFL sales as a percentage of their overall LFL sales was 47.4 percent. This is a weighted average across participants (weighted by each participant's LFL sales). RW LFL sales shares for individual participants varied from 21 percent to nearly 100 percent. For 2019, former participants' weighted average RW LFL sales share was 48.6 percent, a slight increase of 1.2 percent. Changes in RW LFL sales share between 2018 and 2019 for individual former participants varied widely from a 16 percent increase to a 15 percent decrease, but given that the three largest former participants in terms of sales all showed increases in RW sales share, the average change is positive. Figure 4 compares the 2018 and 2019 RW and 32W LFL sales share among former participants based on sales data.

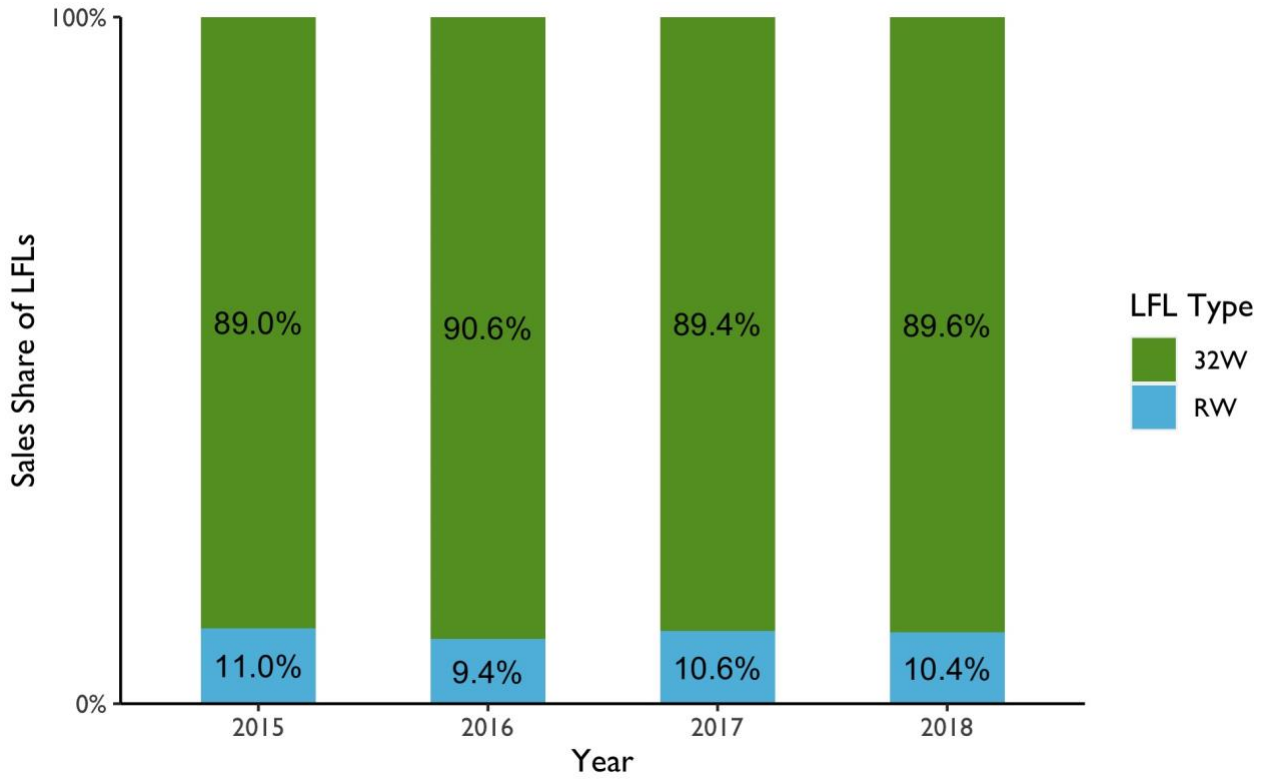
Figure 4: Changes in Participant RW LFL Sales Share 2018 - 2019



[8] "Participants" and "former participants" are the same distributors. In 2018, when the RWLR program was on-going, these distributors were participants. After the program was transitioned to LTMT, participants became former participants.

Based on 2018 NLDC data, RW LFL sales make up a much smaller share of non-participant total LFL sales – around 10 percent. Our non-participant interview results give us little reason to expect change in these values, as no respondents indicated a substantial change moving from 2018 to 2019. Additionally, the NLDC data indicate that since 2015, the RW LFL sales share among LFLs for non-participants has shown little variation, with values remaining around 10 percent. Figure 5 shows the NLDC estimates for non-participant RW LFL sales as a percentage of their total LFL sales since 2015.

Figure 5: NLDC Non-Participant LFL Sales by Type 2015 - 2018



Combined, these results suggest that former participants' RW LFL sales as a percentage of their total LFL sales increased slightly and that non-participants' RW LFL sales as a percentage of their total LFL sales was unchanged between 2018 and 2019. Therefore, we conclude that the *effects of the program on the region's RW LFL market share persisted even after NEEA's exit from the market.*

Looking to 2020, our interview results suggest that former participants anticipate a decrease in their RW LFL sales share. Of our eight interviews with former participants, two reported that they expect a decrease in their RW LFL sales share while none expect an increase. Non-participants expect no change in their RW LFL sales share. While this serves as an advance look to 2020, further research and 2020 sales data will be required to verify these results.

In addition to insights into the place of RW LFLs within the LFL market, our data also enabled us to evaluate the relative positions of LFLs and TLEDs within the linear lighting market. According to our data, the sales share of TLEDs among all linear lamps will continue to increase, decreasing the market share of LFLs. Although participant sales data indicated that their TLED sales share only increased a minor amount from 36.1 percent in 2018 to 36.2 percent in 2019, in their interviews, seven out of eight respondents indicated that they expect continued growth in the sales share of TLEDs. According to the NLDC data, 52.5 percent of non-participants' 2018 linear lamps sales were TLEDs, up from 42.7 percent in 2017. Similar to former participants, four out of five non-participant interviewees expect their TLED sales share to increase near-term. Table 6 summarizes the expected change between 2019 and 2020 in TLED share of all linear lamp sales.

Table 6: Expected Change in TLED Sales Share of All Linear Lamps

Direction	Former Participants	Non-Participants
Increase	7	4
Stay the same	1	1
Decrease	0	0

Overall, this indicates that the effects of the program on the region's RW LFL market share persisted in 2019 even after NEEA's exit from the market. Interviews suggest that some former participants may move away from RW LFLs in 2020, but updated 2020 sales data will be able to confirm this finding. More broadly, our analysis confirms the continued rise of TLEDs, reaffirming the findings in the 2019 RWLR TMPER that 32W LFL to RW LFL conversion opportunities are decreasing because of increasing TLED market share.

Diffusion Indicator 2

Finding: The share of reduced wattage linear fluorescents across the country appears to have held steady within a shrinking LFL market.

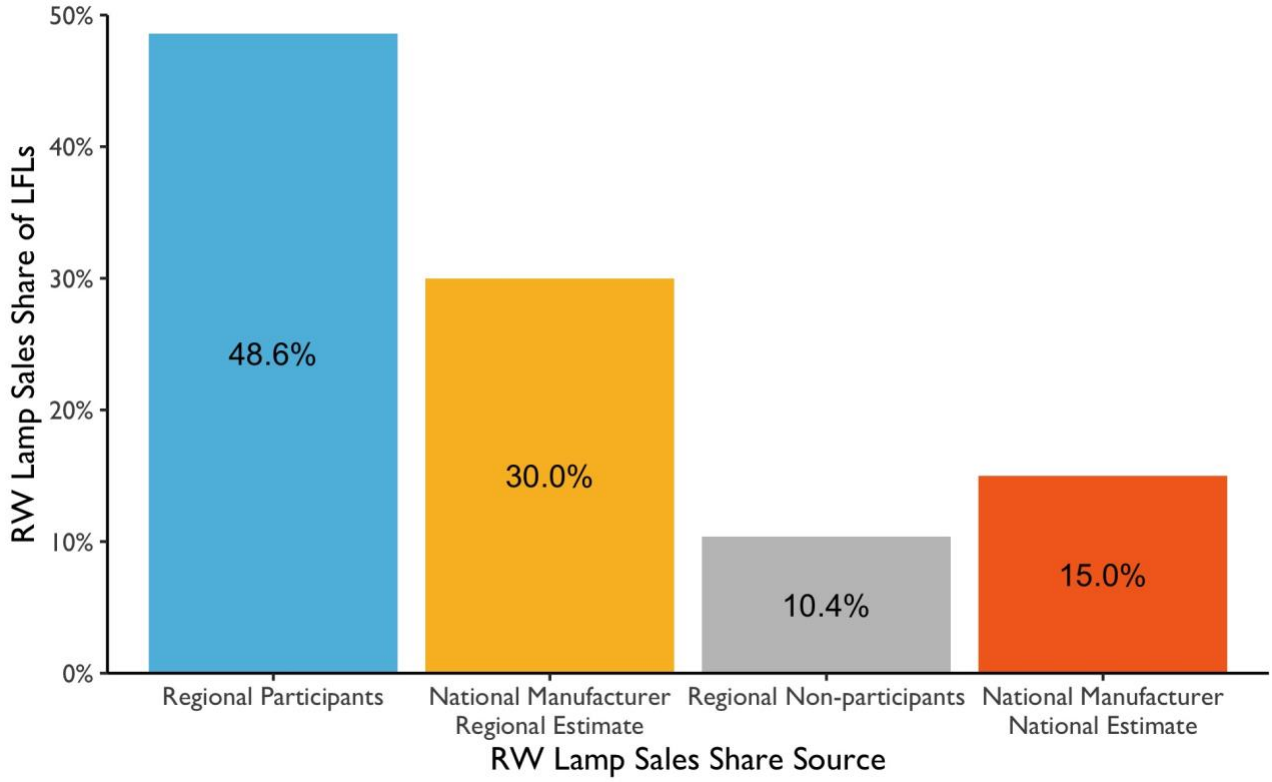
Diffusion Indicator Results at a Glance (DI 2)

- ⇒ *DI 2 – RW LFL sales as a percentage of total national LFL sales remain constant or increase.*
  - *An interview with a national manufacturer of LFLs and TLEDs suggests that the national RW LFL market share has shown no change between 2018 and 2019.*
  - *No change is expected between 2019 and 2020.*
- ⇒ *National manufacturers and NEMA see linear fluorescents giving way to TLEDs, so the overall sales of LFLs are falling.*
- ⇒ *Regional results for DI 1 also showed little change.*
- ⇒ *These findings indicate that national trends mirror those seen in the region covered by NEEA.*

To address national market metrics, we conducted interviews with two national manufacturers, one of which was able to provide insights into the LFL market. We used this interview as well as corroborating sales data to address DI 2 (*"RW LFL sales as a percentage of total national LFL sales remain constant or increase"*).

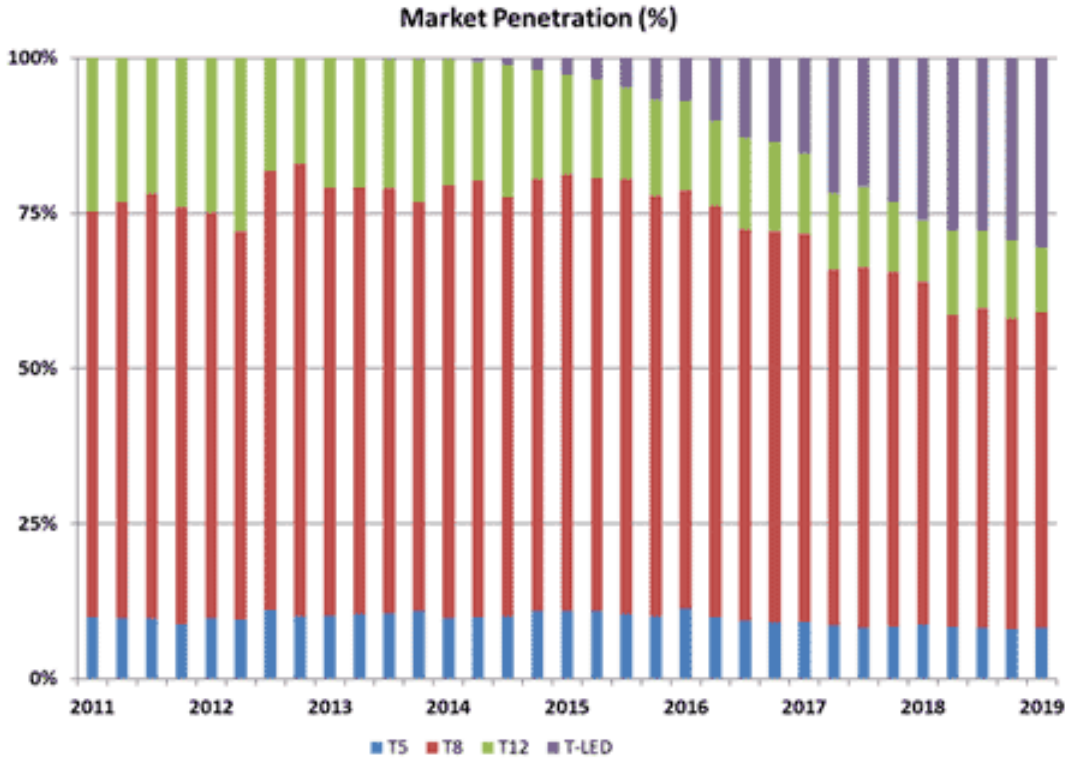
Our interview with a national manufacturer of LFLs and TLEDs suggested that their sales share of RW LFLs has not changed for some time, and that no change is expected soon, both in the Northwest and nationally. Our interviewee reported that, nationally, RW LFL sales made up 15 percent of their total LFL sales in 2019, while regionally, RW LFL sales made up 30 percent of their total LFL sales in 2019. While these estimates reflect the experience of one manufacturer, this regional estimate falls within the range of participant and non-participant values (48.6% and 10.4% RW within LFL, respectively), and the national sales share (15% RW within LFL) is more in line with non-participant sales share (10%). Figure 6 shows the estimated RW LFL sales shares by source. In addition, our interviewee's response that their sales share for RW LFLs is unchanging was corroborated by 11 of the 13 regional distributors we interviewed who said they expect no change in their RW LFL sales share moving forward. In sum, these findings suggest that like the regional market share of RW LFLs within the LFL market, the national market share also shows little change.

Figure 6: RW LFL Sales Share of LFLs – Estimates by Region and Source



In the broader linear lighting market, our interviewees echoed the trend that TLED sales share within the linear lighting market is continuing to grow. According to our interviewee who manufactures LFLs and TLEDs, their national sales share of TLEDs among all linear lighting – currently at 74 percent – will continue to increase, as will the percentage of their Northwest linear lamp sales that are TLEDs – currently at 50 percent. NEMA, a market actor with national perspective has also documented this trend. Figure 7 shows NEMA's estimates for the growth of TLEDs relative to LFLs from 2011 to the first quarter of 2019. While inclusive of non-T8 lamps, the trend of increasing market share for TLEDs (purple) is clear.

Figure 7: NEMA Estimates for TLED Market Share[9]



Overall, our interview with a major national manufacturer of LFLs and TLEDs, analysis from NEMA, and evidence from the sales data of Northwest distributors support the conclusion that the national RW LFL market share has not changed and is not expected to change. At the same time, national trends reflect the expansion of TLEDs and the reduction of the overall LFL market size.

[9] National Electrical Manufacturers Association. 2019. "Linear Fluorescent Lamp Indexes Continue Year-Over-Year Decline in First Quarter 2019 while T-LED Market Penetration Increases." Retrieved April 21, 2020, no longer available at nema.org.

Diffusion Indicator 3

Finding: Prices for RW LFLs are falling, but so are prices for TLEDs.

Diffusion Indicator Results at a Glance (DI 3)

- ⇒ *Part 1 of DI 3 – The price differences between RW and 32-watt lamps, remain constant or decrease.*
  - *All regional interviewees (former participants and non-participants) indicated that their RW LFL prices remained the same or decreased in 2019 compared to 2018.*
  - *An interview with a national manufacturer of LFLs and TLEDs indicated that RW LFL prices remained the same between 2018 and 2019.*
- ⇒ *Part 2 of DI 3 – The price difference between RW lamps and TLEDs remains constant or increases.*
  - *All regional distributors interviewed indicated that TLED prices remained the same or decreased in 2019, but that the decrease in price was greater than that of RW LFLs.*
  - *Both national manufacturers interviewed for this study also saw decreasing prices for TLEDs.*
- ⇒ *Findings were consistent across all respondent groups.*
- ⇒ *While the cost difference between RW LFL and 32W LFLs decreased, so too did the cost difference between RWL LFLs and TLEDs, making TLEDs more price competitive with RW LFLs.*

To address price, we interviewed former participants, non-participants, and national manufacturers about their experience with lamp prices for 2018 through 2020. Based on these interviews, we conclude that between 2018 and 2019, 1) *the price differences between RW and 32W lamps remained constant or decreased,* and that *2) the price differences between RW lamps and TLEDs decreased,* as well.

First, while costs can vary, our interviews suggest that the additional cost of RW LFLs relative to 32W LFLs is decreasing. For 2018, some interviewees estimated that the price difference was as high as 47 percent, while others reported that they sold 32W and RW LFL options for the same price. Overall, former participants indicated an average RW LFL premium of 30 percent, while non-participants reported a similar value of 26 percent. Moving to 2019, both former participants and non-participants consistently reported that they expected this premium to stay the same or decrease. Table 7 summarizes the direction that respondents expected 2019 RW LFL prices to move relative to 32W LFLs. Based on the values provided by respondents, we estimate that the

2019 RW LFL price premium was approximately 23 percent for former participants and 16 percent for non-participants.

Table 7: Expected Change from 2018 to 2019 in RW LFL Price Relative to 32W LFLs

Direction	Former Participants	Non-Participants
Increase	0	0
Stay the same	7	3
Decrease	1	2

The finding that the majority of the distributors said that the premium would stay the same in 2019 was echoed in our interview with a national manufacturer of LFLs and TLEDs, who indicated that their 30 percent price premium between RW and 32W LFLs in 2018 continued, unchanged, into 2019 and would be unchanged in 2020. Given that no respondents indicated an increase in relative price, we conclude that between 2018 and 2019, *the price differences between RW LFLs and 32W LFLs remained constant or decreased.*

As RW LFL prices have been falling relative to 32W LFLs, so too have prices for TLEDs. Among regional interviewees, estimates for the 2018 premium for TLEDs relative to 32W LFLs varied between 60 percent and 500 percent with a participant average of 157 percent and a non-participant average of 143 percent. In our interviews, respondents indicated that these price premiums are likely to drop. Table 8 shows the count of responses among former participants and non-participants regarding the relative change in price between TLEDs and 32W LFLs between 2018 and 2019. Based on our interview results, we estimate that the overall price premium for TLEDs above 32W LFLs dropped to approximately 105 percent for former participants and to 100 percent for non-participants in 2019.

Table 8: Expected Change from 2018 to 2019 in TLED Price Relative to 32W LFLs

Direction	Former Participants	Non-Participants
Increase	0	0
Stay the same	3	0
Decrease	5	6

The finding that TLED prices are dropping was echoed by both of our national manufacturer respondents. While our national respondents indicated lower TLED premiums of 20 percent than

the 30 percent premiums cited by distributors in 2018, they too saw these values drop in 2019, to around 10 percent.

Given the more rapid decline in the price of TLEDs (a drop in the premium against 32W LFLs from 157 percent to 105 percent for former participants) relative to the price drop of RW LFLs (a drop in the premium against 32W LFLs from 30 percent to 23 percent for former participants), the price gap between TLEDs and RW LFLs is also expected to fall. Interviewees indicated that this pattern is expected to continue into 2020 when RW LFL prices are expected to flatten, but TLED prices are expected to continue to fall.

Our interview results clearly show that the price between RW and 32W LFLs is decreasing or remaining constant. Given that RW LFL prices are largely expected to remain the same (see Table 7), and that the same respondents saw TLED prices drop, we conclude that *the price differences between RW LFLs and TLEDs decreased between 2018 and 2019.*

Overall, the cost difference between RW LFLs and 32W LFLs decreased. The cost difference between RWL LFLs and TLEDs also dropped to the lowest price premium yet. Thus, while RW LFLs remain the lowest cost lower-wattage alternative to 32W LFLs, the decrease in TLED price has made them more competitive with RW LFLs, while providing even greater energy savings potential.

Diffusion Indicator 4

Finding: Some former RWLR participants stocked fewer RW LFLs as a result of TLEDs' increasing market share.

Diffusion Indicator Results at a Glance (DI 4)

⇒ *DI 4 – RW lamps stocked by former RWLR participants as a percentage of all linear fluorescents they stock remains constant or increases.*
- *Two former participants indicated that they moved away from stocking RW LFLs, while none indicated that they increased their stock of RW LFLs.*

⇒ *The primary motivation for decreased RW stocking was increased stocking of TLEDs. Four out of eight former participants plan to increase their stock of TLEDs.*

⇒ *While stocking of RW LFLs is decreasing, this is only true for a minority of former participants and appears to be the result of increased interest in TLEDs, not a shift in preference toward 32W LFLs.*

To address DI 4 (*RW lamps stocked by RWLR participants as a percentage of all linear fluorescents they stock remains constant or increases*), we asked former participants about recent changes in their stocking practices. These interviews suggest that while many former participants did not change their stocking practices between 2018 and 2019, two former participants are moving away from stocking RW LFLs while none are increasing their stock of RW LFLs.

In general, former participants did not report changing their stocking practices of LFLs between 2018 and 2019. This was echoed by all non-participant interviewees who indicated that they did not make any changes in stocking practices of RW LFLs among all LFLs. Two former participants we interviewed did indicate, however, that they reduced their stock of RW LFLs to accommodate more TLEDs. This included one of the largest distributors in the region. This increased stocking of TLEDs, combined with no change in the stocking of 32W LFLs, resulted in 32W LFLs taking up a higher percentage of all LFLs stocked. Table 9 shows the anticipated change in RW stocking among all LFLs.

Table 9: Expected Change from 2018 to 2019 in RW LFL Stocking

Direction	Former Participants	Non-Participants
Increase	0	0
Stay the same	6	5
Decrease	2	0

Most former participants did not change their stocking practices. However, given that two former participants did decrease their stocking of RW LFLs and that no former participants increased their stocking of RW LFLs, our conclusion is that stocking of RW LFLs decreased across former participants as a whole.

An important caveat to this conclusion, however, is the motivation that the two respondents cited for their decreasing stocking of RW LFLs – an increase in TLED stocking. Overall, five out of eight former participant respondents and three out of five non-participant respondents indicated that their stocking of TLEDs relative to LFLs would increase, indicating a strong trend toward TLEDs. This includes the two former participants who decreased their RW stock, the largest of which cited TLEDs as their primary motivation for decreasing their RW stock.

Overall, while there is some indication that stocking of RW LFLs decreased, the stronger trend is that TLED stocking increased. As a result, the more meaningful conclusion is that any decreases in RW stocking are being driven by a shift toward TLEDs, not a shift in preference toward 32W LFLs.

Diffusion Indicator 5

Finding: Encouragement of RW LFLs is down, but encouragement is high for lower-wattage options generally.

Diffusion Indicator Results at a Glance (DI 5)

⇒ *DI 5 – Former RWLR participants' encouragement of their customers to purchase RW lamps when technically feasible remains constant or increases.*

- *Half of the eight former participants interviewed indicated that they encourage RW LFLs less frequently now than they did during the program.*

⇒ *However, encouragement of lower-wattage options is still high among former participants.*

- *All but one former participant indicated that they "often" or "always" encourage lower-wattage alternatives to 32W LFLs. However, the most commonly recommended lower-wattage alternative is TLEDs, not RW LFLs.*

⇒ *While encouragement of RW LFLs has decreased since the end of the program, encouragement of lower-wattage alternatives to 32W LFLs (both RW LFLs and TLEDs) is still high among former participants.*

To address DI 5 (*Former RWLR participants' encouragement of their customers to purchase RW lamps when technically feasible remains constant or increases*), we interviewed former participants to see how their encouragement of RW LFLs has changed since the end of the program. Based on our interviews, encouragement has decreased slightly among former participants, with four of eight interviewees deemphasizing RW LFLs and the remainder maintaining their level of encouragement. All non-participants reported no change in their RW LFL encouragement. Table 10 summarizes how former participants and non-participants changed their encouragement of RW LFLs from 2018 to 2019 (the year after completion of the RWLR program).

Table 10: Change in Encouragement of RW LFLs 2018 - 2019

Direction	Former Participants	Non-Participants
Increase	0	0
Stay the same	4	5
Decrease	4	0

While encouragement of RW LFLs may have decreased among some former participants, overall encouragement of lower-wattage options (both RW LFLs and TLEDs) is still very high, especially

when comparing former participants to non-participants. Overall, all but one former participant indicated that they encourage lower-wattage options "often" or "always". This is opposed to non-participants, among whom two of five respondents indicated that they "seldom" or "never" encourage lower-wattage options. While former participants tend to encourage TLEDs above RW LFLs, encouragement levels for both are higher than those of non-participants.

As with other DIs, our analysis relies on our interviews, which account for most former participants in terms of sales. In addition to participant interviews, we also asked the same encouragement-related interview questions of our non-participant interviewees. The consistency with which respondents indicated that they decreased their encouragement of RW LFLs adds to the representativeness of this result.

Overall, the end of the RWLR program has led former participants to recommend RW LFLs to customers less often. However, despite the end of the program, former participants still frequently recommend lower-wattage alternatives to 32W LFLs including both RW LFLs and TLEDs. While encouragement of RW LFLs is decreasing, former participants appear to still be committed to encouraging lower-wattage alternatives to their customers.

2.2.2 Research Conclusions about the Market

Table 11 summarizes each DI, our results, and the data source associated with each result. DI 3 has been split out to reflect its two distinct findings.

Table 11: Summary of DI Findings

Diffusion Indicator	Key Findings	Source of Result
DI 1. RW LFL sales as a percentage of total regional LFL sales remain constant or increase	• Slight 1.2 percent increase in the RW LFL sales share among LFLs for former participants No change in the RW LFL sales share among LFLs for non-participants.	• Sales data for all 14 former RWLR participants • Sales data from the NLDC study representing 10 percent of all non-participant sales
DI 2. RW LFL sales as a percentage of total national LFL sales remain constant or increase	• National market share of RW LFLs among LFLs has shown no change between 2018 and 2019.	• One interview with a major national manufacturer of LFLs • Analysis from NEMA, a market observer • Results from DI 1
DI 3. The price differences between RW and 32-watt lamps remain constant or decrease	• All regional interviewees indicated that RW LFL prices remained the same or decreased relative to 32W LFLs.	• Interviews with 8 of 11 former participants

Diffusion Indicator	Key Findings	Source of Result
DI 3. The price difference between RW lamps and TLEDs remains constant or increases	• Regional interviewees indicated that the price drop of TLEDs was greater than that of RW LFLs.	• Interviews with 5 of 21 known non-participants • One interview with a major national manufacturer of LFLs and TLEDs • One interview with a major national manufacturer of TLEDs
DI 4. RW lamps stocked by RWLR participants as a percentage of all linear fluorescents they stock remains constant or increases	• Two of the eight former participants interviewed moved away from stocking RW LFLs, while none increased their stock of RW LFLs.	• Interviews with 8 of 11 former participants
DI 5. RWLR participants' encouragement of their customers to purchase RW lamps when technically feasible remains constant or increases	• Four of the eight former participants interviewed encourage RW LFLs less frequently now than they did during the program.	

Overall, this indicates that the effects of the program on the region's RW LFL market share persisted even after NEEA's exit from the market. Rather than reverting to 32W LFLs, the regional sales share for RW LFLs (within the LFL market) has been maintained, and among former participants, the sales share for RW LFLs has slightly increased. Similarly, while total stocking of RW LFLs among all former participants may have decreased, most former participants are not changing their stocking practices of LFLs. Prices of RW LFLs relative to 32W LFLs also continue to reflect the intent of the RWLR program, with RW LFL prices continuing to fall. The only regression has been in how often former participants encourage RW LFLs. As NEEA has become less active in encouraging RW LFLs through the RWLR program, formerly participating distributors have also become less active in encouraging RW LFLs to their customers. At the same time, however, encouragement of lower-wattage alternatives to 32W LFLs, including RW LFLs and TLEDs, has remained high.

Our research also shows that the broader market trends in TLEDs that in part led to the RWLR program being transitioned to LTMT have continued. This is reflected in the TLED market share, which has increased at both the regional and national levels. This increase has been the primary motivation for two former participants to move their stocking practices away from RW LFLs.

Overall, while market share, stocking, and encouragement of RW LFLs may fluctuate within the LFL market, these fluctuations are at the margin of an ever increasing TLED market share while TLEDs become the standard lower-wattage alternative to 32W LFLs. The opportunity for conversion to RW LFLs will continue to fall as a result of TLED expansion, making variations within the LFL market (whether towards or away from RW LFLs) less impactful on the savings that can be realized from RW LFLs overall.

2.3 Recommendations for Future Research

Based on our findings, the RWLR program has maintained many of its effects on the LFL market after being transitioned to LTMT. In the process of this research, additional questions have come to light that may further clarify the place of RW LFLs within the LFL market and the impact of TLEDs. We present these questions and recommended future research below.

Considering interviewee responses that predict a decrease in RW LFL sales share within the LFL market in 2020, *how will the sales share of RW LFLs within the LFL market change another year removed from the intervention of the RWLR program*? We recommend that future research continue to focus on answering this question. Analysis of the 2020 versions of the datasets used in this analysis will likely be sufficient to address this question.

Sales data indicate that the sales share for RW LFLs among LFLs is higher for former participants (49%) than for non-participants (10%). At the same time, the same data sources suggest that TLED sales share among all linear lighting is higher among non-participants (52%) than former participants (36%). *Are there additional or alternative datasets that can confirm a lower TLED sales share among former participants?* While secondary to understanding RW LFL sales share within the LFL market, increases in TLEDs may become critical to understanding changes in the LFL market. We recommend that future research look for additional ways of tracking not just the regional LFL market but the regional market for TLEDs as well.

Our interview with a national manufacturer of LFLs and TLEDs suggests that the LFL market in the region covered by NEEA has a higher market share of RW LFLs (30%) than the rest of the country (15%), but also a lower TLED market share in the region (50%) than the rest of the country (74%). *Do other manufacturers, whether individually or in aggregate, also see lower market share of TLEDs in the region covered by NEEA?* While the success of the RWLR program has been well documented, other energy savings opportunities may exist in the region covered by NEEA outside of the LFL market. We recommend that future research look for additional ways of tracking how the region covered by NEEA differs from the rest of the country in terms of both RW LFL and TLED market share.

Overall, our research suggests that changes in the balance of RW LFLs and 32W LFLs within the LFL market are best understood with the added context of TLEDs as the alternative lower-wattage option. Future research should contextualize changes within the LFL market with changes in TLEDs

and aim to better understand how and why the market shares of TLEDs and RW LFLs vary within the region, and between the region and the rest of the country.

Appendix A: Additional Details on Interview Effort

To address many of the diffusion indicators (DIs), we conducted interviews with former participants, non-participants, and national manufacturers. These interviews were necessary to address the DIs that were not covered by the sales data, such as stocking practices and RW encouragement. Our interview effort also intended to supplement the sales datasets by asking respondents about how their sales have changed over time. Appendix B details the specific interview guides that were used with each population. Table 12 summarizes our interviews and the DI that those interviews addressed.

Table 12: Interview Data Sources and Associated DIs

Interviewee Group	NEEA-Provided Contacts	Interviews Completed	DIs Covered
Former Participants	11	8	All DIs
Non-participants	21	6	DI 3
National Manufacturers	6	2[10]	DI 2, DI 3

Our interview effort and success varied with each target population we interviewed.

Interviews with Former Participants

As part of the RWLR program, participants already provided much of the data that were necessary for addressing many of the DIs, but interviews were required to understand:

- The extent to which they (continue to) encourage RW LFLs;
- The outlook for TLEDs in the linear lighting market; and
- Any changes in stocking practices of RW LFLs.

Former RWLR participant contact information was provided to Evergreen by NEEA, and the original list included 11 distributors in the Northwest. NEEA and D+R International conducted the initial outreach, sending emails to all 11 former participants asking for their cooperation in the interview process. For former participants who did not respond to the initial email, Evergreen continued outreach, following up with former participants by both email and phone at least twice. In general, former participants were very responsive to the initial email outreach and were very willing to participate.

[10] One national manufacturer we interviewed produces both LFLs and TLEDs, while the other produces only TLEDs.

Of the 11 initial contacts, eight contacts (73%) expressed interest in participating in the interview. We conducted interviews with these eight former participants, who represented 10 regional distributors. Based on 2019 participant sales data, we conducted interviews with former participants that accounted for 87 percent of all participant sales, including nine of the 10 largest former participants in terms of lamp sales. The 10 distributors represented by our eight interviewees covered all four states in the Northwest, which allowed Evergreen to more accurately analyze lamp sales across the region. Distributors also varied in the number of branches (1-300+), as well as company size, with smaller distributors having fewer than 10 employees and the largest distributors having over 1,000 employees. As a result, we have reason to believe that our results are representative of the population.

Given that these former participants were active participants in the RWLR program, it is also important to consider potential limitations of these interviews. As all of these former participants were familiar with NEEA and were aware that the interview was focused on the RWLR program, responses may have been influenced by respondents' social desirability bias, where respondents may have answered the questions in a way that would be viewed favorably by NEEA (e.g., by potentially overreporting their RW LFL sales).

Interviews with Non-Participants

While NLDC data provided some insights into non-participants, much of the data used in this study came from interviews with regional distributors that did not participate in the RWLR program. These data included:

- The percentage of their LFL sales that are RW or 32W LFLs;
- The percentage of their linear lighting sales that are TLEDs;
- The typical prices for RW, 32W, and TLED lamps;
- The extent to which they encourage RW LFLs; and
- The outlook for TLEDs in the linear lighting market.

Overall, we completed five non-participant interviews and one interview with an LED-only distributor that the team chose to omit from the overall results. The five regional non-participant interviewees represent a larger group of 21 known non-participant contacts with whom the team attempted to conduct interviews.

Outreach began with an email to introduce the research and gauge availability for a short interview with Evergreen. Distributors that responded positively to the initial email were scheduled for an interview to discuss trends in the market for reduced wattage lighting options. If distributors did not respond to the initial email, follow up emails were sent, up to a total of three times. If distributors still did not respond, Evergreen attempted to contact distributors with phone calls and voicemails (up to three attempts). When distributors did not respond after those attempts were exhausted, they were marked as unavailable for interview.

As a result of a low response rate from non-participants, the team began asking LED-only distributors to schedule interviews. Evergreen saw a high response rate with LED-only distributors, but after one interview was conducted with an LED-only distributor, we determined that the current interview guide was not a good fit for an LED-only niche, and the overall research objectives would not benefit from additional interviews with LED-only distributors. The responses were ultimately left out of the non-participant results.

Of the five respondents, three had data in the NLDC study while two did not. Respondents with NLDC data accounted for approximately 18 percent of all non-participant sales represented in the NLDC study. Based on a list of regional distributors provided by NEEA, the non-participant respondents that did not provide data to the NLDC study are relatively small in terms of numbers of staff and branches.

All non-participants that completed interviews represented Oregon, Washington, or both. Two interviewees also represented Idaho and Montana. To avoid one or two distributors overrepresenting entire states, the team created a weighting scheme that was applied to diffusion indicator questions to keep overall market insights from being over or understated.

Interviews with National Manufacturers

To put regional market metrics in context and understand broader trends, we also interviewed national manufacturers. We focused our interviews on:

- National linear fluorescent market share of RW LFLs;
- National linear lighting market share of TLEDs; and
- Price differences between RW LFLs, 32W LFLs, and TLEDs.

NEEA provided Evergreen with national manufacturer contact information, with the original list including six contacts. Evergreen conducted the initial outreach to these national manufacturers via email, asking for their response. For potential interviewees who did not respond to the initial outreach email, Evergreen followed up with each potential interviewee by both email and phone (up to four contact attempts).

Of the six initial contacts, two manufacturer representatives (33%) expressed interest in participating in the interview. Both interviewees were involved with utility relations at their respective companies and were very willing to participate. These manufacturers were knowledgeable about trends in the industry and spoke candidly about their perceptions of trends in the national linear lamp market. However, one of the two interviewees only produces LED lamps, which limited their insights into the LFL market.

After exhausting the original list of manufacturer contacts provided by NEEA, Evergreen pivoted to LinkedIn searches to recruit for participation, beginning with searches for individuals who worked at the same companies as the individuals from the original contact list. Once a potential list of six

individuals was developed, Evergreen conducted Google searches to find contact information and attempted to reach out to these people via email when available. For those that did not have additional contact info, Evergreen used the LinkedIn Premium feature to reach out to these potential interviewees directly through LinkedIn, asking for their participation. Evergreen maximized the possible outreach with LinkedIn Premium, but received no responses.

Appendix B: Interview Guides

Former Participants Interview Guide

Background Info for Interviewer

- Distributor Company
- Interviewee Name
- Note if the interviewee is someone different than the NEEA program's contact
- Number of branches in each state where active
- Size (sm/med/lrge) and # employees
- Sales shares from 2019 RWLR data:
- RW lamps as percentage of total linear fluorescent lamp (LFL) sales for replacement: _____%
- 32W lamps as percentage of total LFL sales for replacement: _____%
- TLEDs as a percent of total linear lamp sales for replacement: _____%
- Average price per lamp – 2019 RWLR data:
- 25W LFL: $_____
- 28W LFL: $_____
- 32W LFL: $_____
- TLED: $_____

Background / Overview

- A1. In 2019, about what percentage of [distributor's] linear lamp sales were for the lamp maintenance market as opposed to sales for projects?

The rest of the interview questions will just be asking about replacement lamps for maintenance. Specifically, we are asking about four-foot T8 linear fluorescents and TLEDs.

Replacement Lamp Sales

- B1) Let's start with your sales shares of T8 fluorescents and TLEDs. Based on the 2019 sales data [distributor] has provided to NEEA, your replacement lamps sales were [xx%] T8 fluorescents and [xx%] were TLEDs. Does this sound correct?
- [IF NO PRIOR DATA FOR A PARTICULAR PARTICIPATING DISTRUBTOR, ASK THE FOLLOWING QUESTION INSTEAD:] Let's start with your 2019 sales shares for T8 fluorescents and TLEDs. In

2019, about what percentage of your company's sales for replacement lamps was T8 fluorescents and about what percentage was TLEDs?

- B2) Do you think these percentages will change in 2020? [YES/NO/DON'T KNOW]
- [IF YES, ASK]
    - In what direction do you think the percentages will change? [If needed: Will T8 fluorescents go up and TLEDs down or the other way around?]
    - If you had to guess, by how many percentage points? [If needed: Just a round number estimate is fine.]
    - What do you think will drive that change?
- B3) Now I have some questions just about T8 fluorescent replacement lamps. Your sales data also indicated that [xx%] of all the T8 fluorescent replacement lamps your company sold in 2019 was reduced wattage. Does this sound correct?
- [IF NO PRIOR DATA FOR A PARTICULAR PARTICIPATING DISTRUBTOR, ASK THE FOLLOWING QUESTION INSTEAD:] In 2019, approximately what percentage of your sales of these lamps was reduced wattage?
- B4) Do you think the percentage of reduced wattage lamps will change in 2020? [YES/NO/DON'T KNOW]
- [IF YES, ASK]
    - In what direction will it change?
    - By how many percentage points?
    - What do you think will drive that change?

Stocking Practices

Next, I have some similar questions about your stocking practices for replacement lamps in 2019 and your predictions for 2020. Here, we just want to get a sense of what you keep available on hand.

- C1. First, please think about all of the four-foot T8 fluorescents and TLEDs you kept in stock for lamp replacements in 2019. About what percentage was TLEDs?
- C2. During 2020, do you think that percentage of TLEDs will be higher, lower, or about the same?
- [IF HIGHER OR LOWER, ASK:]
    - What do you think will drive that change?
- C3. Now, please think about only the four-foot T8 fluorescents you kept in stock for lamp replacements in 2019. About what percentage was reduced wattage fluorescents?
- C4. During 2020, do you think that percentage will be higher, lower, or about that same?

- [IF HIGHER OR LOWER, ASK:]
    - What do you think will drive that change?

Lamp Prices

Now, I'd like to ask a few questions about lamp prices. We are interested in how alternatives to 32W T8s compare in price and how those prices have been changing. Here we are interested in percentage differences and not asking about absolute prices.

- D1a. Please consider your typical customer who needs to replace 32-watt T8s. How much more or less would that customer pay per lamp for 28W T8s than for 32W T8s? [IF NEEDED: Please answer in percentage terms, as in 3 percent more or 10 percent less.]
- D1b. What about a year ago? How much more or less would a customer have paid for a 28W lamp than a 32W lamp toward the end of 2018? [Note: For future years, this question would drop 2018 and simply ask about one year ago. We want to be sure to capture late 2018 for this comparison even if that ends up being slightly more than one year ago.]
- D1c. And in one year? How much more or less do you think a customer will pay for a 28W T8 lamp than a 32W lamp in one year?
- D2. Do any of these price differences account for utility incentives? Which years?
- D3. Do any of these price differences include special pricing agreements from manufacturers? Which years?
- D4a. Now, I'd like to ask the same question for the TLEDs, starting with the current per lamp price. How much more or less would a customer pay per lamp for TLEDs than for 32W lamps?
- D4b. What about a year ago? How much more or less would a customer have paid for a TLED than a 32W lamp toward the end of 2018?
- D4c. And in one year? How much more or less do you think a customer will pay for a TLED than a 32W lamp in one year?
- D5. Do any of these TLED prices account for utility incentives? Which years?
- D6. Do any of these TLED prices include special pricing agreements from manufacturers? Which years?
- D7. [Alternative question if interviewee is unable to provide the detail above:] Generally, could you walk me through how 28W T8 prices have changed compared to 32W T8s in the past year or so and what you expect them to do in the next year? What about TLED prices compared to 32W T8s?

Promoting Reduced Wattage and Customer Reaction

Finally, I have a few questions about [distributor's] interactions with customers who need to replace T8s. If others work more closely with these customers, just answer the best you can based on what you know about your colleagues' practices or let me know if you don't know.

- E1. When customers are replacing 32 W T8 lamps, how often would you say you encourage customers to buy a lower wattage option when technically feasible? Would you say that happens practically always, often, sometimes, seldom or never?
- [IF SOMETIMES OR MORE FREQUENTLY, ASK:]
    - Do you point them to reduced wattage T8s or TLEDs?
- E2. Has your practice changed at all since the RWLR program ended? Are you finding yourself suggesting reduced wattage options more often, less often, or about the same?
- [IF CHANGED, ASK:]
    - What is driving this change?
- E3. In your experience, what might lead to a customer switching to TLEDs for replacements, aside from the encouragement of your staff?
- E4. Relatedly, what are the barriers to a customer switching from fluorescents to TLEDs?
- E5. In your experience, what might lead to a customer switching to reduce wattage fluorescents for replacements, aside from the encouragement of your staff?
- E6. Relatedly, what are the barriers to a customer switching from 32W to reduced wattage fluorescents?

Regional Non-Participants Interview Guide

Background Info for Interviewer

- Distributor Company
- Interviewee Name
- Note if the interviewee is someone different than the NEEA program's contact
- Number of branches in each state where active
- Size (sm/med/lrge) and # employees

Background / Overview

- A1. In 2019, about what percentage of [distributor's] linear lamp sales were for the lamp maintenance market as opposed to sales for projects?

The rest of the interview questions will just be asking about replacement lamps for maintenance. Specifically, we are asking about four-foot T8 fluorescents and TLEDs.

Replacement Lamp Sales

- B1. Let's start with your sales shares of T8 fluorescents and TLEDs. In 2019, about what percentage of these sales for replacement lamps was T8 fluorescents and about what percentage was TLEDs?
- B2) Do you think these percentages will change in 2020? [YES/NO/DON'T KNOW]
- [IF YES, ASK]
    - In what direction do you think the percentages will change? [If needed: Will T8 fluorescents go up and TLEDs down or the other way around?]
    - If you had to guess, by how many percentage points? [If needed: Just a round number estimate is fine.]
    - What do you think will drive that change?
- B3. Do these percentages of T8 fluorescents versus TLEDs for replacement lamps differ much among the Northwest states you serve?
- [IF YES, ASK:]
    - How do you think those percentages differ?
    - What drives those differences?
- B4. Now I have some questions just about four-foot T8 fluorescent replacement lamps. In 2019, approximately what percentage of your sales of these lamps was reduced wattage? [IF NEEDED: I.e., What share was 25 or 28 watts?]
- B5. Do you think the percentage of reduced wattage lamps will change in 2020? [YES/NO/DON'T KNOW]
- [IF YES, ASK]
    - In what direction will it change?
    - By how many percentage points?
    - What do you think will drive that change?
- B6. Does the percentage of reduced wattage lamp sales versus full wattage sales differ much among the Northwest states you serve?
- [IF YES, PROBE]
    - Where and in what way (what direction / how much)?
    - What drives those differences?

Stocking Practices

Next, I have some similar questions about your stocking practices for replacement lamps in 2019 and your predictions for 2020. Here, we just want to get a sense of what you keep available on hand.

- C1. First, please think about all of the four-foot T8 fluorescents and TLEDs you kept in stock for lamp replacements in 2019. About what percentage was TLEDs?
- C2. During 2020, do you think that percentage of TLEDs will be higher, lower, or about the same?
- [IF HIGHER OR LOWER, ASK:]
    - What do you think will drive that change?
- C3. Now, please think about only the T8 fluorescents you stocked in 2019. About what percentage of them was reduced wattage?
- C4. During 2020, do you think that percentage will be higher, lower, or about that same?
- [IF HIGHER OR LOWER, ASK:]
    - What do you think will drive that change?

Lamp Prices

Now, I'd like to ask a few questions about lamp prices. We are interested in how alternatives to 32W T8s compare in price and how those prices have been changing. Here we are interested in percentage differences and not asking about absolute prices.

- D1a. Please consider your typical customer who needs to replace 32-watt T8s. How much more or less would that customer pay per lamp for 28W T8s than for 32W T8s? [IF NEEDED: Please answer in percentage terms, as in 3 percent more or 10 percent less.]
- D1b. What about a year ago? How much more or less would a customer have paid for a 28W lamp than a 32W lamp toward the end of 2018?
- D1c. And in one year? How much more or less do you think a customer will pay for a 28W T8 lamp than a 32W lamp in one year?
- D2. Do any of these price differences account for utility incentives? Which years?
- D3. Do any of these price differences include special pricing agreements from manufacturers? Which years?
- D4a. Now, I'd like to ask the same question for the TLEDs, starting with the current per lamp price. How much more or less would a customer pay per lamp for TLEDs than for 32W lamps?
- D4b. What about a year ago? How much more or less would a customer have paid for a TLED than a 32W lamp toward the end of 2018?

- D4c. And in one year? How much more or less do you think a customer will pay for a TLED than a 32W lamp in one year?
- D5. Do any of these TLED prices account for utility incentives? Which years?
- D6. Do any of these TLED prices include special pricing agreements from manufacturers? Which years?
- D7. [Alternative question if interviewee is unable to provide the detail above:] Generally, could you walk me through how 28W T8 prices have changed compared to 32W T8s in the past year or so and what you expect them to do in the next year? What about TLED prices compared to 32W T8s?

Promoting Reduced Wattage and Customer Reaction

Finally, I have a few questions about [distributor's] interactions with customers who need to replace T8s. If others work more closely with these customers, just answer the best you can based on what you know about your colleagues' practices or let me know if you don't know.

- E1. When customers are replacing 32 W T8 lamps, how often would you say you encourage customers to buy a lower wattage option when technically feasible? Would you say that happens practically always, often, sometimes, seldom or never?
- [IF SOMETIMES OR MORE FREQUENTLY, ASK:]
    - Do you point them to reduced wattage T8s or TLEDs?
- E2. Has your practice changed at all in the last year? Are you finding yourself suggesting reduced wattage options more often, less often, or about the same?
- [IF CHANGED, ASK:]
    - What is driving this change?
- E3. In your experience, what might lead to a customer switching to TLEDs for replacements, aside from the encouragement of your staff?
- E4. Relatedly, what are the barriers to a customer switching from fluorescents to TLEDs?
- E5. In your experience, what might lead to a customer switching to reduce wattage fluorescents for replacements, aside from the encouragement of your staff?
- E6. Relatedly, what are the barriers to a customer switching from 32W to reduced wattage fluorescents?

National Manufacturers Interview Guide

Replacement Lamp Sales

- 1a. Please think back to your company's linear lamp sales in 2019 nationwide. About what percentage of those linear lamp sales was T8 fluorescents and what share was TLEDs?

- 1b. In what direction did the percentage of T8 fluorescent sales change from 2018 to 2019?
- 1c. By about how many percentage points?
- 1d. What drove that change?
- 1e. How do you think the percentage of T8 fluorescent sales will change from 2019 to 2020?
- 1f. What is driving the change?
- 2a. Now, please think about just your T8 linear fluorescent lamp sales and ignore the TLEDs for a moment. In 2019, what percentage of those linear fluorescent sales was reduced wattage fluorescent lamps and what share was full wattage fluorescent lamps, that is 32 W?
- 2b. In what direction did the percentage of 32W sales change from 2018 to 2019?
- 2c. By about how many percentage points.
- 2d. What drove that change?
- 2e. How do you think this will change from 2019 to 2020?
- 2f. What is driving the change?
- 3a. NEEA works across the Northwest states of OR, WA, ID, and MT, so we're interested in how our region's linear lamp sales compare to national sales. What difference have you noticed in the share of linear lamp sales that are TLEDs in the Northwest, compared to nationally?
- 3b. And what differences have you noticed in the share of linear fluorescent lamps that are reduced wattage fluorescents in the Northwest compared to nationally?

Lamp Prices

- 4a. Next, I'd like to ask about lamp prices and trends - specifically for how TLEDs and reduced wattage linear fluorescents compare in price to 32W linear fluorescents. First, would you say you are more familiar with the lamp prices that end-use customers pay, or the prices that distributors pay?
- 4b. How much more (or less) do TLEDs currently cost than full wattage 32W linear fluorescents? Please think of the price difference in percentage terms. [If unable to quantify, ask: Are they much more, a little more, about the same, a little less, or much less?]
- 4c. In the past 12 months, has that price differential increased, not changed, or decreased? By how many percentage points would you say it has changed?
- 4d. How much do you expect the price differential to change in the next 12 months?
- 5a. Now, I'd like to ask the same thing for reduced wattage linear fluorescents compared to 32W fluorescent lamps. About how much more (or less) do reduced wattage linear fluorescent lamps cost than full 32W ones? [If unable to quantify, ask: Are they much more, a little more, about the same, a little less, or much less?]

- 5c. In the past 12 months, has that price differential increased, not changed, or decreased? By how many percentage points would you say it has changed?
- 5d. How much do you expect the price differential to change in the next 12 months?