IMPACTS OF EISA 2020

EWR COLLABORATIVE MEETING

JUNE 19, 2018

DTE Energy
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Content of Report

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PROJECT OVERVIEW

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The potential savings gap in the DTE Energy (DTE) residential electric portfolio due to changing LED lighting standards and market characteristics is 79.1 – 91.5 GWh in 2025.

» Historically, residential energy efficiency program managers could count on CFL and LED bulbs and fixtures to provide a significant portion of their annual electric energy savings targets.

» Over the next decade, electric utilities throughout the U.S. will see their savings opportunities from residential lighting decrease with anticipated changes in federal Energy Independence and Security Act (EISA) lighting standards in 2020, market characteristics, and technology development.

» As a result, DTE has worked with Navigant to identify research questions (Figure 1-1) to better understand the potential LED lighting savings gap over the next several years.

FIGURE 1-1. IMPACTS OF EISA 2020
Key Research Questions

	KEY RESEARCH QUESTIONS
1	What is the electric savings potential of LEDs in the residential sector through 2035?
2	How might this potential be reduced as standards and other market changes come into effect? What is the amount of savings LEDs will no longer supply to DTE residential Energy Optimization (EO) programs following standards changes in 2020?

Source: Navigant

The objective of this study was to better prepare DTE for decreased potential savings from LEDs.

FIGURE 1-2. IMPACTS OF EISA 2020
Overview of Project Tasks

	TASK	TASK DESCRIPTION
1	Build Lighting Potential Model	Build the model framework which calculates savings that could be expected in response to specific levels of incentives and assumptions about policies, market influences, and barriers. Incorporate the data collected from the 2017 DTE Baseline Study into the model to forecast the potential for A-type and reflector LEDs in DTE's residential sector through 2035.
2	Estimate Gap in Electric Energy Savings	Quantify the potential savings gap in DTE's EO portfolio from LED standards changes using Task 1 results.

DETAILED METHODOLOGY & RESULTS

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Navigant estimated achievable potential for A-line and reflector LEDs using data from the MEMD, retailer shelf-surveys, and baseline study. This model accounts for market size and saturation, technology standards, measure characteristics, stock turnover, and market share.

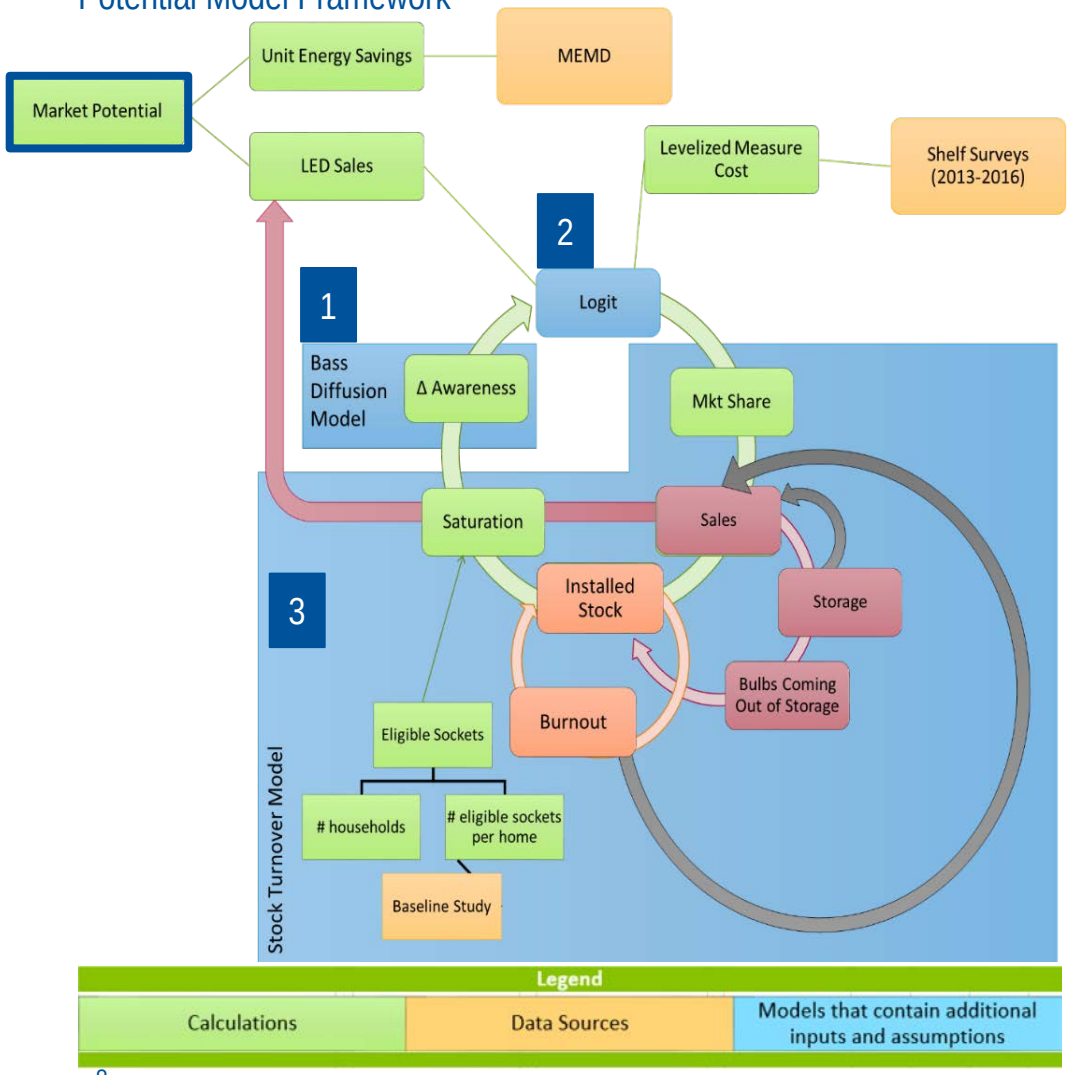
Market potential represents the energy savings that could be expected in response to specific levels of incentives under certain assumptions about policies, market influences, and barriers, some studies also refer to this as "achievable potential."

Navigant used the following three analytic components to forecast the LED sales in DTE's territory (Figure 2-1):

1. » Bass Diffusion Model: forecasts technology adoption
2. » Economic Logit: forecasts market share
3. » Stock Turnover Model: simulates turnover of installed bulbs

- » The model was calibrated by comparing past technology market share values predicted by the model to actual historical values from the 2016 shelf survey data.
- » Unit energy savings values for when CFLs become the baseline in 2022 were based on equivalent measures in the MEMD.
- » Saturation starting point values leveraged the 2017 DTE Baseline Study onsite survey data.

FIGURE 2-1: IMPACTS OF EISA 2020 Potential Model Framework

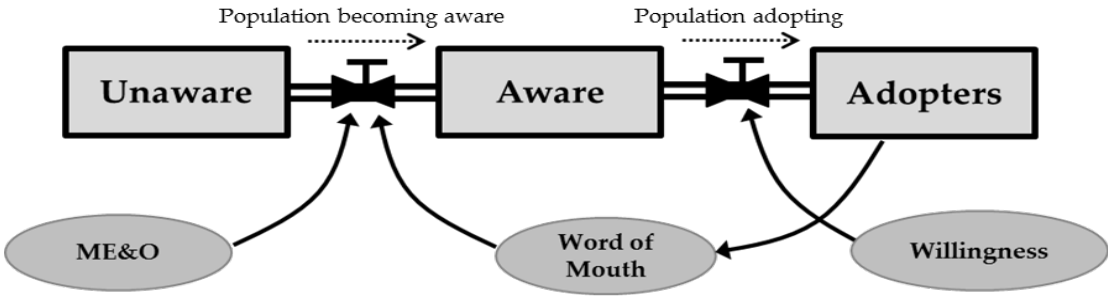


Source: Navigant

The Bass diffusion model forecasts technology adoption; with growing awareness, the adoption of LEDs increases.

The Bass diffusion model is a dynamic approach to simulate market adoption that accounts for the parameters shown in Figure 2-2. Willingness and initial awareness were calibrated to 100% for both CFLs and LEDs to reach the high levels of market share exhibited in DTE's territory from the 2016 shelf survey data.

FIGURE 2-2: IMPACTS OF EISA 2020
Bass Diffusion Model



Source: Mahajan, Muller, Wind. New Product Diffusion Models. © 2000. Springer Science + Business Media

» Marketing, Education, and Outreach (ME&O) moves customers from the unaware group to the aware group at a consistent rate annually. ME&O is often referred to as the "Advertising Effect" in Bass diffusion modeling.

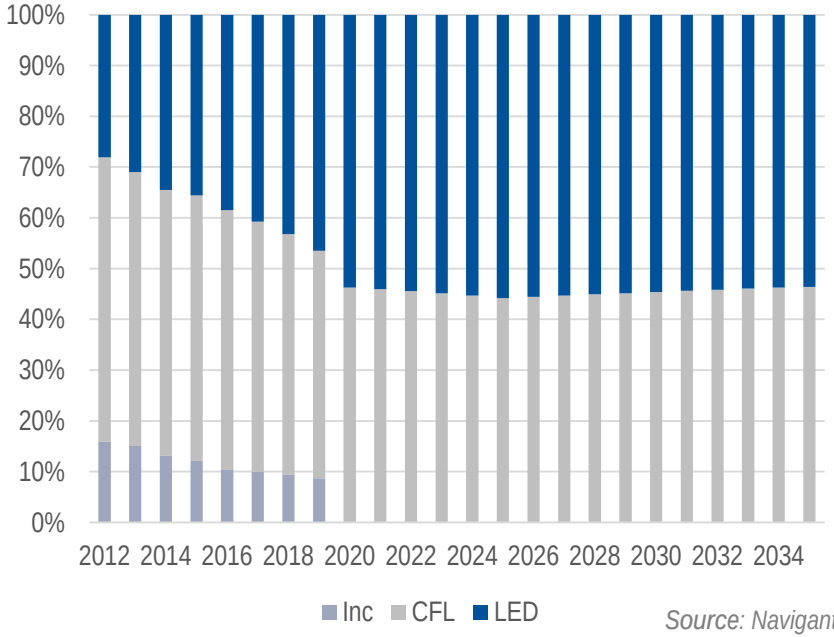
» Word of Mouth represents the influence of adopters (or other aware consumers) on the unaware population by informing them of CFLs or LEDs and their attributes. This influence increases the rate at which customers move from the unaware to the aware group. As more customers become aware and adopt, however, word of mouth can have a greater influence on awareness than ME&O, and leads to exponential growth. This exponential growth is ultimately dampened by the saturation of the market, leading to an S-shaped adoption curve, which has been repeatedly observed for new technology diffusion.

» Willingness is the key factor affecting the move from an aware customer to an adopter. Once customers are aware of the measure, they consider adopting the technology based on its financial attractiveness.

The Logit function forecasts the market share of the different technologies based on how they compete economically; the market share of LEDs increases when standards force incandescents out of the market.

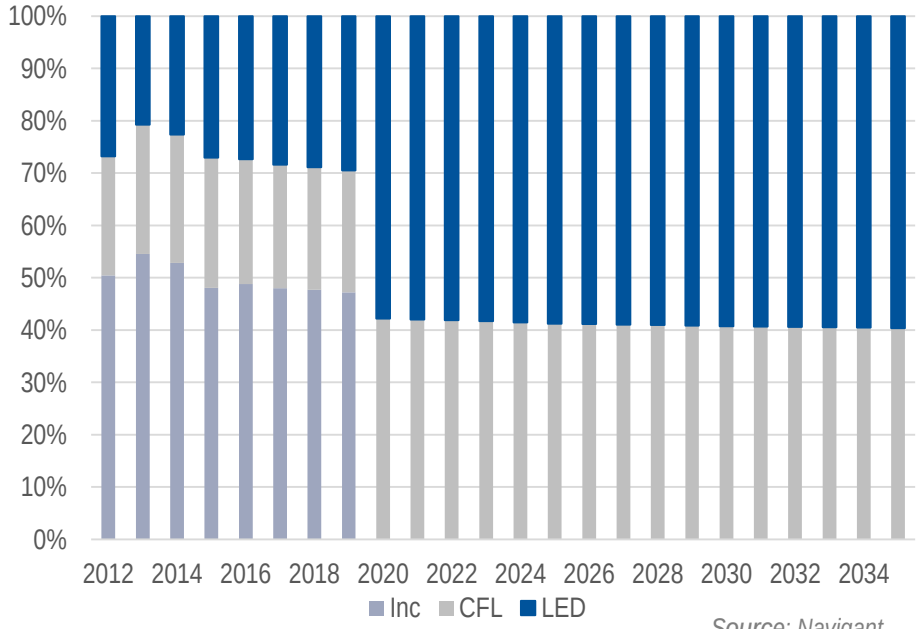
Navigant used a conditional Logit model (also used by DOE[1]) to award available market share to multiple competing lighting technologies. In this model, lighting purchasing decisions are primarily governed by two economic parameters, first cost and annual operation and maintenance (O&M) cost (in this case, annual energy cost). DTE shelf survey data from 2013 to 2016 was used to calculate the weighted average bulb cost in the market as well as the average DTE incentive and percent of bulbs receiving an incentive. This data was used to calculate the levelized measure cost for the logit model to forecast market share for each technology. O&M cost depends on the mean bulb life, annual operating hours, and annual electricity cost. Figure 2-3 and Figure 2-4 show the market share of the three technologies – Incandescent, CFL, and LED – from 2012 to 2035.

FIGURE 2-3: IMPACTS OF EISA 2020
Market Share Forecast – A-line Bulbs



Source: Navigant

FIGURE 2-4: IMPACTS OF EISA 2020
Market Share Forecast – Reflector Bulbs



Source: Navigant

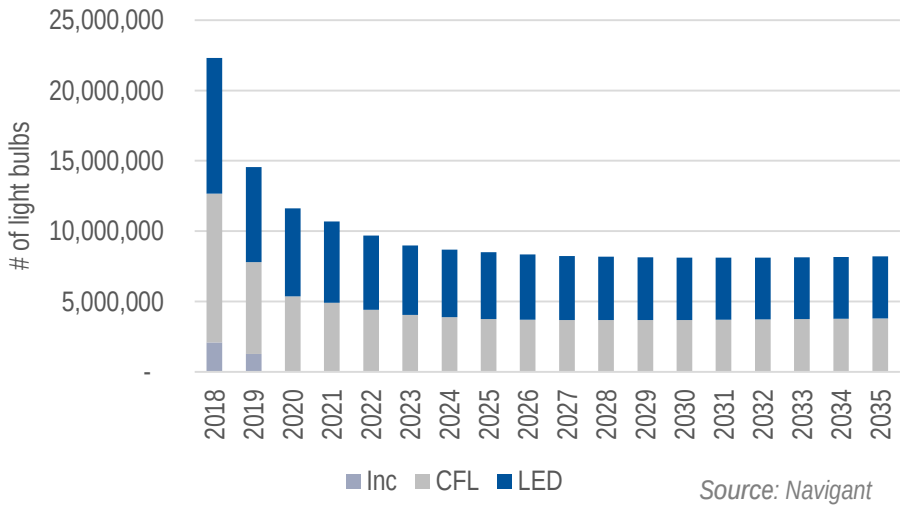
[1] *Energy Savings Forecast of Solid-State Lighting in General Illumination Applications, prepared by Navigant for the US Department of Energy, September 2016.*

The stock turnover model simulates the turnover of installed bulbs; longer bulb lifetimes of newer technologies results in decreased annual sales as the technology mix of installed bulbs shifts.

The stock turnover model simulates the dynamic flow of different technologies. Each year, light bulbs are purchased to replace those that burn out and to fill sockets in newly constructed homes. The use of a stock turnover model more accurately reflects the timing of program impacts, considering bulbs that first go into storage. Though sales data reflects when bulbs are purchased, studies have shown many bulbs first go into storage in the home. Using a stock turnover model shifts when new bulbs are purchased based on the dynamics of when those installed burn out and need replacing and how many bulbs come out of storage to be installed.

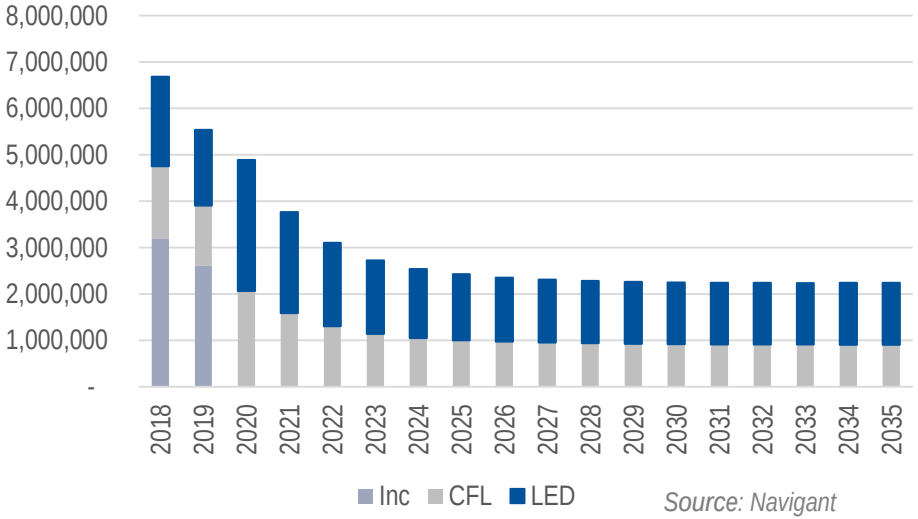
- The 2017 DTE Baseline Study onsite survey data provided a starting point for the saturation of each technology relative to eligible A-line sockets. Reflector saturation starting point was based on the 2017 audits for the Focus on Energy Wisconsin program.
- As bulbs burn out, customers face the decision of what technology to replace it with. The replacement market share of each technology, obtained from the logit function, reflects this customer decision.
- In the residential market, 27% bulbs first go into storage and come out of storage over the following two years[1].

FIGURE 2-5: IMPACTS OF EISA 2020
Sales of A-line Bulbs by Technology



Source: Navigant

FIGURE 2-6: IMPACTS OF EISA 2020
Sales of Reflector Bulbs by Technology



Source: Navigant

[1] *Cadmus. Compact Fluorescent Lamps Market Effects Final Interim Report. 2009*

The change in national lighting standards has prompted the MEMD Developer to reduce the claimable savings for LEDs by an average of about 85%.

The 2017 MEMD notes unit energy savings for residential LED measures will be re-evaluated in 2017, and new values will go into effect in 2020, but more recent communications indicate these changes will not take effect until 2022. The MEMD already uses CFLs as the baseline technology instead of incandescents for the commercial sector. Therefore, Navigant assumed the unit energy savings from the equivalent commercial measures would be used in the residential sector in response to the new standards.

FIGURE 2-7: IMPACTS OF EISA 2020
Comparison of MEMD Unit Energy Savings for A-line LEDs in 2017 and 2022 Due to 2020 EISA Standard Change

WATTAGE (W)	2017 TARGET KWH PER BULB (KWH)	EXPECTED 2022 TARGET KWH PER BULB (KWH)	PERCENT DECREASE
29	19.3	2.5	87.0%
43	28.5	3.8	86.7%
53	33.6	5.4	83.8%
100	46.2	3.4	92.7%

Source: Navigant

FIGURE 2-8. IMPACTS OF EISA 2020
Comparison of MEMD Unit Energy Savings For Reflector LEDs in 2017 and 2022 due to 2020 EISA Standard Change

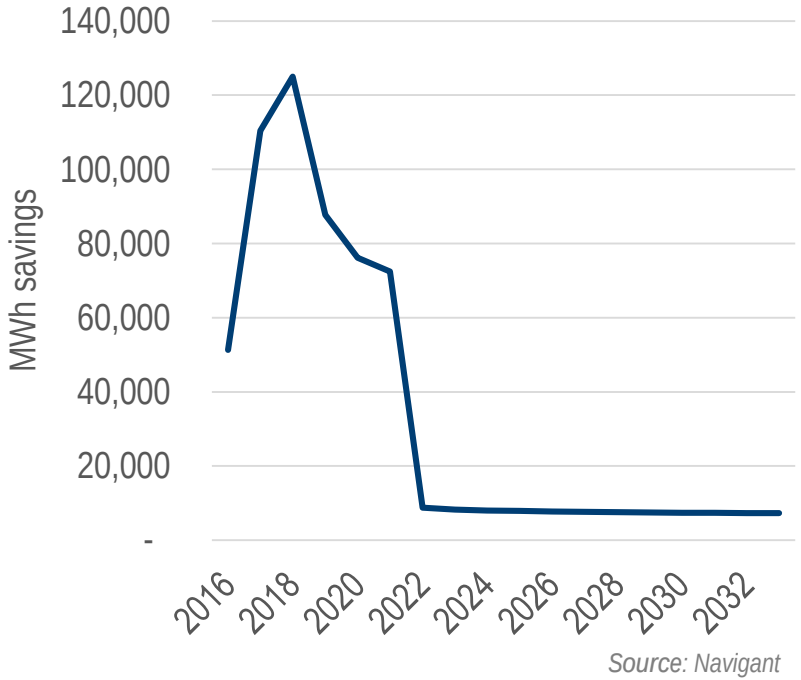
REFLECTOR TYPE	2017 TARGET KWH PER BULB (KWH)	EXPECTED 2022 TARGET KWH PER BULB (KWH)	PERCENT DECREASE
Indoor	54.0	3.8	93.0%
Outdoor	276.4	47.6	82.8%

Source: Navigant

The 2020 EISA standard prompts the MEMD to change the baseline for calculating unit energy savings in 2022, resulting in a drop in the LED electric savings potential. After 2022, it remains relatively stable through 2035.

FIGURE 2-9: IMPACTS OF EISA 2020

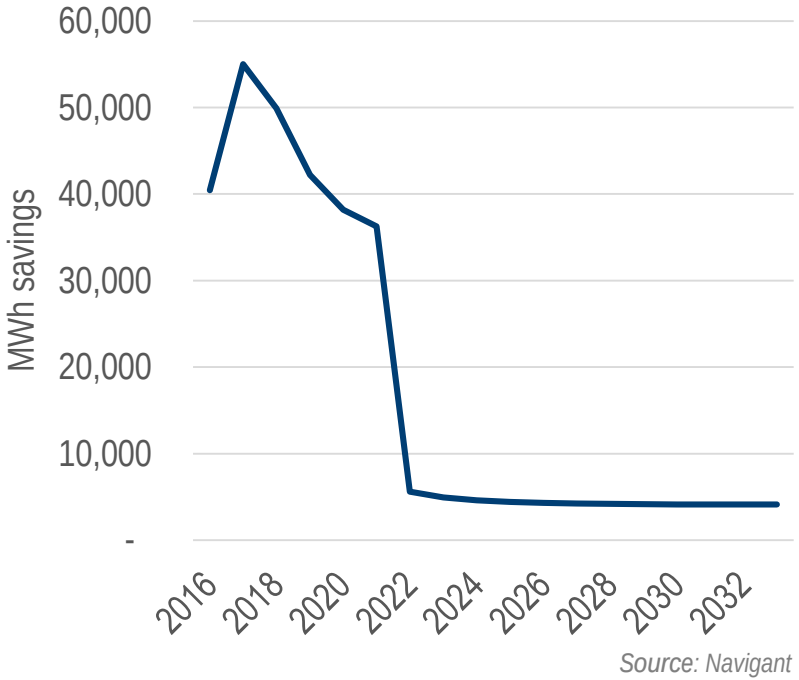
Savings Potential – A-line Bulbs



Source: Navigant

FIGURE 2-10: IMPACTS OF EISA 2020

Savings Potential – Reflector Bulbs



Source: Navigant

The model was calibrated against two data sets:

» Market share of different technologies was matched to 2016 DTE shelf survey data. This calibration made the market share forecast more reliable.

» Savings potential for each bulb type was matched to the 2018 EWR plan filing forecast to reflect the share of market potential DTE's programs expect to capture.

The total potential savings gap in the DTE residential electric portfolio due to changing LED lighting standards and market characteristics is 79.1 - 91.5 GWh in 2025.

- Navigant forecasted a baseline in which DTE's LED programs engage the market at the level forecasted for 2018. (Shown in grey.)
- Navigant also forecasted two scenarios that include the ramp up of LED programs reflected in the 2018-2019 EWR Plan filing.*
  - Scenario 1 assumes the MEMD changes the baseline in 2022, and DTE's LED programs continue to engage the market at the level forecasted for 2018. (Shown in red.)
  - Scenario 2 assumes the MEMD changes the baseline in 2022, and DTE's LED programs cease to be cost effective and are discontinued. (Shown in blue.)

FIGURE 2-11: IMPACTS OF EISA 2020
Savings Potential – A-line Bulbs

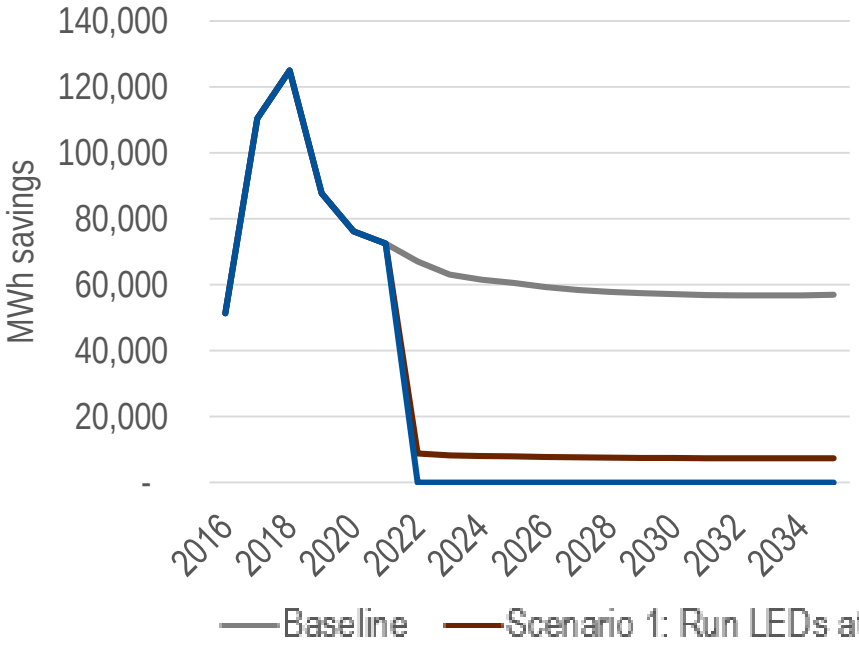
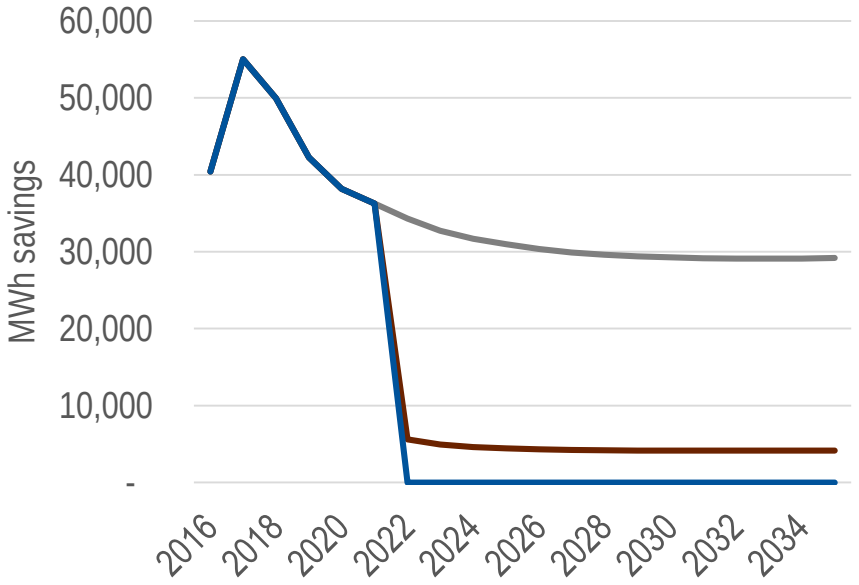


FIGURE 2-12: IMPACTS OF EISA 2020
Savings Potential – Reflector Bulbs



Source: Navigant

**Note: The total (A-line + reflector) LED savings from the 2018 Plan filing was redistributed across the two technologies according to the proportion of savings expected from the 2018 programs given year-to-date savings data from ICF on April 13, 2018.*

CONCLUSIONS AND RECOMMENDATIONS

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Navigant identified areas for further research during our analysis regarding the data and program cost-effectiveness.

FIGURE 3-1: IMPACTS OF EISA 2020
Areas for Further Research

AREAS FOR FURTHER RESEARCH	
Sales	The market share data used to calibrate the logit function was based on the 2016 DTE Shelf Survey or shelf space. This proxy does not account for stores who may value having a variety of options even if that means stocking less popular products. *How well do the stocking patterns for A-line and reflector bulbs reflect the purchasing behavior of customers, and how do retailers foresee shelf stocking changing over time?*
Saturation	The data captured in DTE's baseline studies to-date do not align well with the measures defined by the MEMD, making it difficult to determine accurate saturation values for A-line and reflector bulbs for this particular study. *How might the survey tools for baseline studies be refined to better capture measure-by-measure opportunities for DTE's EO Portfolio of energy efficiency programs?*
Program Cost-Effectiveness	Residential lighting has historically had high cost effectiveness for multiple programs, and it is uncertain how the cost-effectiveness for DTE's programs will change with the lighting standards. *What is the impact of the lighting standards on the cost-effectiveness of the DTE residential portfolio?*

Navigant suggests DTE consider the following activities for 2018 to address the conclusions from this study.

FIGURE 3-2: IMPACTS OF EISA 2020
Possible Activities for 2018

POSSIBLE ACTIVITIES FOR 2018
• Analyze the impact to DTE's portfolio cost-effectiveness from lighting standards
• Develop whitepapers for existing measures from other states
• Identify underperforming electric EO programs that could be enhanced in future years to provide greater savings
• Conduct additional research into emerging technologies in preparation for potential pilots
• Review the program level impacts from lost lighting savings (e.g., multi-family direct install, single- and multi-family low-income, etc.)