



AUGUST 2018

Insights into EISA 2020:

A Gradual Decline or a Steep Cliff?

*In partnership with
Illume Advising and Apex Analytics*



TABLE OF CONTENTS

Executive Summary	3
1. Introduction	5
2. Summary of Implications on Utility Programs.....	11
3. Literature Review	13
4. Stakeholder Interviews.....	15
5. Appendix	19
Appendix A. Summary of Findings by State	19
Appendix B. 2017 Lighting Sales Model Findings.....	24
Appendix C. Approach of Evaluation Firms for Lighting Program Savings.....	28
Appendix D. Bibliography.....	30

EXECUTIVE SUMMARY

Research Objectives and Methods

Many utility energy efficiency portfolios across residential and commercial are dominated by lighting to achieve desired savings levels at a cost-effective rate. A variety of these portfolios will be impacted by the changing lighting technology landscape and the impacts of the Energy Independence and Security Act (EISA) lighting portion of the legislation. The intention of this report is to shed light on the drivers of uncertainty, share what varying stakeholders anticipate will happen to lighting standards over the next five years, and discuss what plans other entities are making among this ambiguous legislative landscape.

The data gathered through market research was used to better understand how utilities have leveraged lighting baselines and research, how evaluators are assessing current impacts and cost-effectiveness of lighting measures, and how they are planning for this measure in their portfolio.

Additional research was conducted through stakeholder interviews with manufacturers and retailers, a government agency, evaluation firms, utilities, and other implementation firms. All these data sources provide a comprehensive view of 15 states and their varying approaches to addressing the uncertainty around lighting in energy efficiency portfolios.

Key Findings

- *Finding 1: There is currently significant uncertainty regarding the EISA 2020 backstop.* The interviewed stakeholders were evenly split on whether the backstop had been triggered, or they felt the situation was too unclear for any educated assumptions to be made. Respondents were also mixed on whether the backstop would be fully enacted in 2020, enacted with some modifications, or fully repealed. The uncertainty is further magnified because several respondents noted that halogens are significantly more profitable for manufacturers than LEDs; as such, manufacturers, through the National Electrical Manufacturers Association (NEMA), are fighting the legislation that would outlaw these profitable technologies.
- *Finding 2: LEDs are expected to become the dominant technology in the lighting market.* Stakeholders believe the lighting market is transitioning toward LED technologies regardless of the implementation of the backstop. When asked to explain why stakeholders believed LEDs would take over, respondents discussed the role of utility programs in subsidizing bulbs, allowing consumers that would typically shy away from the high price point to experience LEDs with lower risk. They also believed that consumer education has and will continue to play a large role in the market transformation.
- *Finding 3: Direct install and exchange programs may allow utilities to continue claiming savings from lighting measures if EISA is fully implemented.* Based on evaluation firms' feedback, opportunities for direct install or exchange programs (where participants bring inefficient lighting in exchange for new bulbs) could still yield cost-effective savings, albeit with shorter lifetimes. Recent evaluation studies have found that 64

percent of *installed* bulbs and around seven *stored* bulbs in an average home are still inefficient technologies (Cadmus, 2017).¹ Depending on regulatory requirements, utilities may be able to use the wattage of these installed bulbs as a baseline, (compared to minimally code-compliant wattage) and capture the savings from this inefficient installed lighting stock.

- *Finding 4: Additional lifetime savings may be available if more states recognize the uncertainty of the EISA backstop through longer LED lifetimes.* All states researched assume the backstop will be adopted for both standard and specialty bulb types. The variation between the states occurs around the *timing* of adoption. While some states have assumed a CFL-equivalent baseline beginning in January 2020 (and thus minimal potential savings after that), several other states, including Arkansas and Massachusetts, have recognized the uncertainty over EISA and assume savings for current lamps will continue to 2022 and 2023, respectively.
- *Finding 5: Advanced lighting technologies may provide savings opportunities.* While many manufacturers feel LED lighting technology has become the dominant efficient lighting technology, manufacturer respondents believe advanced lighting technologies may offer savings going forward. However, savings from these technologies have not been thoroughly vetted and should be treated with caution until they are evaluated.

¹ Focus on Energy. Potential Study, Appendix A. Baseline Data. Cadmus 2017.
https://www.focusonenergy.com/sites/default/files/Focus%20Potential%20Study%20Appendices_0_0.pdf

1. INTRODUCTION

Recent changes in government administration priorities, such as the rollback of automobile efficiency standards², have thrown uncertainty into the future of utility-led energy efficient lighting programs. Recently, the current administration “took a major step toward dramatically weakening an Obama-era rule designed to cut pollution,” as an interviewed manufacturer described. While this action currently only affects the automobile industry, many manufacturers are wondering if the same rollbacks will also affect the lighting industry.

Central to this uncertainty is the EISA backstop requirement that increases the efficiency standards of general service bulbs in 2020 to 45 lumens per watt (EISA 2007). If enacted, the baseline wattage for energy efficient lighting would decrease from a halogen technology to a CFL or CFL-equivalent technology and would substantially decrease claimable savings from energy efficient lighting programs. However, the current federal administration has attempted to weaken some efficiency standards enacted by prior administrations³, and some stakeholders interviewed for this project, including manufacturers and government employees, believe the EISA backstop legislation will receive similar treatment.

In addition to the EISA backstop requirements, there is compounding uncertainty amongst leaders in the lighting industry regarding the general service bulb (GSL) definition. The change in definition will expand the reach of EISA and other lighting standards to bulbs previously considered exempt, such as reflectors (DOE Jan. 2017). While we detail these and other changes, it is important to realize that the lighting industry and lighting policies are in flux, and that these changes could potentially impact future lighting savings. Each statute, settlement, and rulemaking will have varying impacts to the lighting market and probability of adoption. Further, as revealed through interviews with key stakeholders, this uncertainty is affecting plans for manufacturers, utilities, and program implementers alike.

With these issues in mind, the team set out to research the following topics:

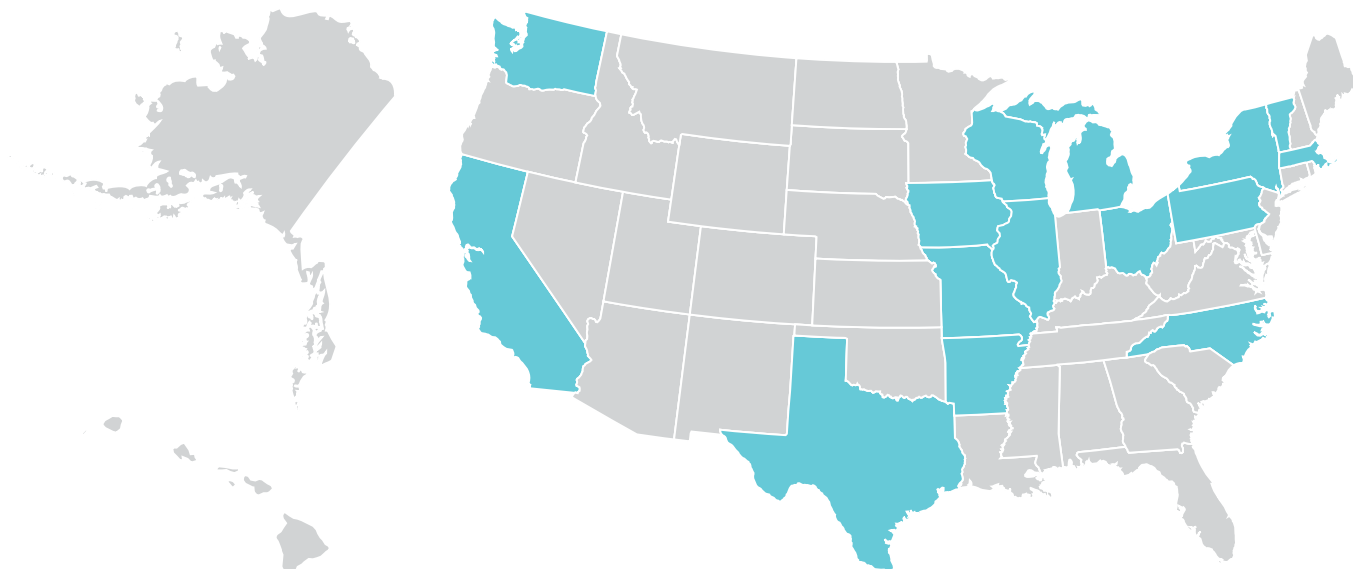
- How the EISA 2020 backstop will affect residential lighting energy savings, including impacts over time, for different implementation delivery strategies and bulb types
- What savings assumptions are currently planned in 2020 and beyond
- How manufacturers are changing their manufacturing practices based on EISA and other legislation
- What lighting technologies will be available after 2020

The analysis focused on the following states: California, Illinois, Iowa, Michigan, Missouri, New York, North Carolina, Ohio, Pennsylvania, Texas, Washington, and Wisconsin (Figure 1). Arkansas, Massachusetts, and Vermont were added based on information provided through interviews and research in additional states.

² Davenport, Coral. The New York Times. “E.P.A. Takes a Major Step to Roll Back Clean Car Rules” May 31, 2018 <https://www.nytimes.com/2018/05/31/climate/epa-car-pollution-rollback.html>

³ Ibid.

FIGURE 1. STATES INCLUDED IN THE ANALYSIS



1.1 RESEARCH ACTIVITIES & STRUCTURE OF THE REPORT

Research was conducted through a literature review, stakeholder interviews, and informal discussions with other stakeholders (Table 1). For the literature review, multiple data sources were analyzed, including technical reference manuals (TRMs), utility program evaluation reports, lighting potential studies, and government legislation. Interviews were conducted with four manufacturers and distributors, one implementer, and one analyst from the California Energy Commission (CEC). Shorter and more informal discussions were conducted via email with four evaluation experts, two utility staff, and one additional implementer.

It is important to note that there was difficulty getting companies and individuals to express an opinion on the state of the EISA legislation. There is a lot of uncertainty around how or when EISA will go into effect, what the impacts on the lighting industry and utility-led energy efficient lighting programs will be, and how consumers will adopt new technologies. Therefore, many companies and individuals were hesitant at the offer to participate in our research due to their own uncertainty or apprehension of how the EISA legislation may impact them or their businesses. Also, several of the interviewed stakeholders expressed apprehension of stating their opinions too strongly.

TABLE 1. RESEARCH ACTIVITIES

	DATA ANALYZED
RESEARCH ACTIVITY	
Literature Reviews	Technical Reference Manuals (TRMs) Utility program evaluation reports Potential studies Regulatory filings Program plans
Stakeholder Interviews	Four manufacturers and distributors One analyst from the California Energy Commission (CEC) One implementer
Evaluation and Utility Discussions	Four evaluation experts Two utility staff One implementer

In the next section, background on the EISA and the California/NEMA legislations are provided as a backdrop for much of what our stakeholders reference in their interviews. Chapter two gives a brief synthesis of our findings' implications for utility programs. In chapters three and four, the literature and interview findings are reviewed.

1.2 BACKGROUND ON EISA LEGISLATION

The residential lighting industry has undergone significant changes over the past few decades due to advances in technology, success of outreach programs, and motivational mandates and legislation. As the market readies itself for full transformation, having moved most consumers away from halogen and incandescent bulbs towards CFLs and LEDs in the past decade, **there are many questions about what the future will hold for lighting programs.**

Utility companies have historically claimed large amounts of lighting savings towards their energy efficiency program portfolios (often more than 50%), but such savings are expected to decrease with shifting standards. However, uncertainty around adoption of the EISA backstop requirements has caused confusion around the path forward and opportunities for achieving similar savings through utility-led energy efficiency programs. In the section below, we discuss each of the relevant pieces of the EISA legislation that informs this confusion.

In 2007, EISA established minimum efficiency standards for various technologies, including lighting. Within the stipulations for screw-based lighting requirements, **EISA established three standards:**

- 1. Adopted a technology-neutral standard for lighting**, providing broad expectations for lighting efficiencies and flexibility for manufacturers in meeting them. This technology-neutral stance expanded the reach of lighting legislation, regulating minimum performance of bulbs to include General Service Incandescent Lamps (GSILs), Compact Fluorescent Lamps (CFLs), general service light-emitting diode (LED) or organic light-emitting diode (OLED), and “any other lamp that the Secretary of Energy determines are used to satisfy lighting applications typically served by GSILs, with certain exceptions” (EISA, 2007).
- 2. Set minimum efficiency standards** regarding the importation and manufacturing for GSILs in 2012 through 2014, incrementally increasing the demand for better performance. In response, the market replaced traditional and inefficient incandescent bulbs with halogens.
- 3. Put forth a requirement by the Department of Energy (DOE) to reevaluate** the standards between 2014 and 2016 and issue a ruling by January 1, 2017 that either confirms or amends the stipulations established by EISA in 2007. In the absence of this rule, a backstop requirement was included, setting a minimum efficiency standard of 45 lumens per watt beginning January 1, 2020.

While the initial phase-in of the EISA lighting efficiency standards occurred relatively smoothly, general industry consensus is that the EISA backstop adoption is not as straightforward. Specifically, the EISA legislation required the secretary to finalize a rulemaking assessing effectiveness of the initial 2012-2014 standards prior to January 1, 2017. The legislation further stated that if the secretary fails to make that rulemaking, 45 lumens per watt efficacy standard – required of sales not allowing for any “sell-through” of remaining inefficient technologies that do not meet this standard – should be enacted on January 1, 2020. This rule was intended as a “failsafe to inaction.” However, for any new standards to come into effect, the DOE must issue a final rule to codify the statute in the Federal Register, which has not happened.

Specifically, at the time of this report, the secretary has not published a rulemaking assessing the initial phases of the EISA phase-in, nor has the DOE published a final rule turning the 45 lumens per watt standard into law. As such, there is heated debate in the lighting industry on whether the backstop has been triggered (EISA 2007).

Expanding the debate, on January 19, 2017, the DOE filed two rules with the Federal Register that expanded the definition of GSILs starting in 2020 to include specialty bulb types formally exempt from EISA legislation, such as candelabras, globes, and reflectors (DOE, Jan. 2017). This rulemaking does not explicitly confirm or amend the original EISA efficiency standards set by the bill in 2007 and implemented between 2012 and 2014. As such, this expanded definition of GSILs without guidance on the impending performance requirements has left many stakeholders in the lighting industry confused about expectations moving forward.

In response to this uncertainty, NEMA filed a lawsuit against the DOE in March 2017 requesting clarity over the backstop requirement, lightbulb efficiency standards, and the definition of GSILs. In July of the same year, both parties signed a settlement agreement, dismissing the lawsuit and

providing a path forward for clarifying regulations in the lighting industry⁴. Based on the settlement agreement, the DOE agreed to:

1. Issue a Notice of Data availability for halogen bulbs to increase data available to adequately assess the impact and value of current standards (released August 15, 2017).
2. Mitigate potential loopholes in the definition through consistent monitoring of exempt bulb sales, looking for instances where sales exceed projections by 100% or more, suggesting a shift in purchasing behavior incongruent with the push towards energy efficiency.
3. Issue a Supplemental Notice of Proposed Rulemaking that addresses standards specifically for LEDs. (This was scheduled to be released in May of 2018.⁵ However, at the time of this report, nothing had yet been issued.)

California/NEMA Injunction

Based on the State Preemption Clause included in the EISA backstop, individual states are allowed to implement the federal standards of the backstop beginning in January 2018. As a result, the California Energy Commission (CEC) put forth new efficiency standards for bulbs that began to be phased in as of January 1, 2018. Title 20, the bill that defines the new requirements, states that no bulbs failing to meet the minimum standard for their technology shall be manufactured in the state after January 1, 2018 (Chief Counsel's Office, 2018). Bulbs already in stock that do not meet these requirements may be sold until depleted, but all new shipments into the state must abide by the stipulations outlined in the table below. Title 20 adopted the 2020 backstop requirement, based on the original (not expanded) GSL definition, on January 1, 2018.

It should be noted that Title 20 also adds a minimum Color Rendering Index (CRI) for general service bulbs and their concern that lighting manufacturers would not be able to meet such standards. The Correlated Color Temperature (CCT) and the CRI are the two numerical scales currently used to assess the "temperature" or color of the light being emitted, with CRI being the most commonly used in the industry for assessing light quality. CRI is not currently included in federal standards, but is for California as of January 2018, requiring a minimum CRI of 82 for GSLs and, beginning in 2019, a minimum CRI of 90 for LEDs (Chief Counsel's Office, 2018; 242-249).

The addition of CRI is intended to address a common issue of manufacturers sacrificing the color rendering performance of their bulbs to achieve the highest possible luminous efficacy. In a report from 2014, the CEC discusses in detail the importance of CRI when trying to convert consumers to a higher efficiency bulb. Consumers want to replace the lamp they have with a lamp that does exactly the same thing as their previous lighting. Unless CRI is considered, the likelihood that the consumer will get an

⁴ Doby and Molander, 2017; 5-8

⁴ Doby and Molander, 2017; 5-8

⁵ The full timeline for the DOE's Energy Conservation Standards and Definition for General Service Lamps docket can be found here: <https://www.federalregister.gov/documents/2018/06/11/2018-11238/unified-agenda-of-federal-regulatory-and-deregulatory-actions>

LED that does not emit the right color of light increases and the probability of adopting the new technology quickly declines. For manufacturers, however, this additional stipulation has the potential to significantly increase production costs, as alluded to by interviewed manufacturers.

**TABLE 2: CALIFORNIA TITLE 20 EFFICIENCY REQUIREMENTS FOR BULBS
(DOBY AND MOLANDER, 2018)**

STANDARD	BULB IMPACTED	MINIMUM EFFICACY	MINIMUM RATED LIFE
Effective date: 1/1/2018			
General Service Lamp	Medium screw base, omnidirectional general service incandescent, CFL, and LED lamps	45 lm/W	1,000 hrs
General Service LED, Tier 1 **	Most screw-base LEDs used in residential application	68 lm/W	10,000 hrs
Small Diameter Directional Lamp	All small diameter directional lamps across all light source technologies *	80 lm/W - OR - 70 lm/W and a compliance score of at least 165	25,000 hrs
Effective Date: 7/1/2019			
General Service LED, Tier 2 **	Most screw-base LEDs used in residential application	80 lm/W	10,000 hrs
*Excludes LED covered by the state-regulated LED standard **CRI and other performance metrics included in determining compliance score			

In response to Title 20, NEMA also filed an injunction against the CEC to halt the adoption of the legislation. Concerned with the lack of clarity from the DOE and the impact of California's high standards on manufacturers and retailers, NEMA challenged California's ability to implement such standards, despite the State Preemption. NEMA argued that preemption had not been triggered because the DOE had failed to acknowledge the backstop and its implications moving forward. Thus, should the DOE produce a ruling that conflicted with California's new standards, further confusion could overwhelm the market, significantly impacting lightbulb production and sales. In 2018, NEMA withdrew their injunction, and the Title 20 standards are currently in effect (NEMA, Aug 2017).

2. SUMMARY OF IMPLICATIONS ON UTILITY PROGRAMS

Through current lighting market uncertainty, certain implications are drawn for utility programs and their implementers. Findings from literature review, interviews, and discussions can be rolled into these four areas:

1. Consistency in opinion on the future of lighting programs
2. Current uncertainty for utility lighting programs
3. Remaining opportunities for lighting programs post-2020
4. How stakeholders can influence policies

2.1 CONSISTENCY IN OPINION ON THE FUTURE OF LIGHTING PROGRAMS

All states researched assume the backstop will be adopted for both standard and specialty bulb types. The variation between the states occurs around the *timing* of adoption. Some states, such as Arkansas and Illinois, assume a one to two-year sell-through period through 2022, during which halogens and incandescent bulbs may still be available and energy savings can still be achieved. In contrast, seven states - Iowa, Missouri, New York, Pennsylvania, Washington, Wisconsin, and Vermont- have adopted a stricter interpretation of the EISA backstop and, as a result, assume a CFL baseline starting in 2020.

When asked about the lighting market in general, all the respondents in our interviews believed that LEDs were naturally going to dominate the lighting market over the next few years. Specifically, all believe LEDs will secure 85-100% of the market for standard bulbs by 2022 and something similar for specialty and decorative bulbs shortly thereafter (around 2024).

Stakeholders were also consistent in their beliefs that EISA standards will not be federally enforced starting in 2020. However, manufacturers were quick to note that, irrespective of enforcement, they are planning to adhere to the law.

2.2 CURRENT UNCERTAINTY FOR UTILITY LIGHTING PROGRAMS

The uncertainty in the lighting market stems primarily from stakeholders' predictions surrounding adoption of EISA and expanded GSL definition. Stakeholders expressed varying opinions on the matter, from strongly expecting adoption, to expecting the rulemaking to be softened to such an extent that it would no longer be effective. The reality is that the political climate surrounding environmental protections (including energy efficiency) has changed dramatically since January 2017, requiring industries to be nimble in their forecasts and reactive to this administration.

**"I'm hearing yes.
I'm hearing no.
Your guess is as
good as mine."
- Manufacturer**

We found that while most of the documentation of the EISA backstop provided consistent interpretation of the rules, interviewee' opinions differed dramatically. We hypothesize that this difference is a factor of timing and

the current volatile political climate. TRMs and other prospective-looking documents attempt to predict the future three to four years in advance. Many of our reviewed documents were completed in 2016 or early 2017, prior to the new administration taking charge and making changes. We expect future TRM iterations to more thoroughly address the uncertainty around lighting standards and reflect this in their savings assumptions.

Similarly, the expanded GSL definition remains a wild card since it potentially expands the reach of the EISA backstop, rather than limiting it. This definition has largely been ignored from a legislative standpoint; there has been little to no communication on the definition change from the DOE after finalizing the rulemaking. One stakeholder insinuated that it was swept through the certification process as a last effort to expand lighting regulations prior to the new administration coming into power. Interviewed stakeholders believe the impact of this rulemaking will remain unclear until the EISA backstop adoption is resolved.

2.3 REMAINING OPPORTUNITIES FOR LIGHTING PROGRAMS POST-2020

While the timing around lighting market transformation is uncertain, stakeholders agreed that LEDs will be the predominant technology in the market over the next five to seven years, regardless of legislative activities. Several states, such as New York and Vermont, are enacting a 45 lumen per watt standard beginning in 2020, in the event that similar federal standards are not adopted at that time. As such, the savings potential for lighting through traditional upstream CFL and LED incentive programs is ending for these states. Utilities, particularly those in New York and Vermont, should plan to reduce their reliance on lighting programs over the next few years.

On the other hand, certain hard-to-reach populations and specialty bulbs may have prolonged savings opportunities in limited quantities. While TRMs have not yet incorporated these nuances in their policies, opportunities for direct install programs or exchange programs may still yield cost-effective savings, albeit with shorter lifetimes. Specifically, a recent study found an average home contains seven inefficient bulbs in storage and 64 percent of installed bulbs were inefficient technologies (Cadmus, 2017).⁶ Removing these bulbs from use (or future use) results in reduced energy consumption for the household and savings at the utility level. The baseline for these bulbs could be the removed bulb, not the code minimum efficiency. Utilities looking to extend savings from lighting programs should consider these programs as an alternative savings source, assuming TRMs and governing bodies allow these options.

If the backstop is fully repealed and manufacturers continue to produce halogen bulbs at a large scale, utility programs could continue to incent LEDs to bring prices down to match halogens. Currently, manufacturers noted they are planning to enact backstop requirements, but have alternative scenarios in place in the event it is substantially altered.

The evaluators interviewed on this project discussed the need for capturing accurate data to best inform the process and help limit uncertainty. Educating the utility-led energy efficient lighting program stakeholders on the importance of understanding market

**“De-lamping save[s] energy, but it doesn’t necessarily help the customer reach their goals- energy savings should be top criteria but shouldn’t be the only value when judging the lighting sphere.
- Stakeholder**

⁶ Focus on Energy. Potential Study, Appendix A. Baseline Data. Cadmus 2017. https://www.focusonenergy.com/sites/default/files/Focus%20Potential%20Study%20Appendices_0_0.pdf

adoption models can help lead to more accurate savings assumptions for lighting baselines. A suggested approach to limit uncertainty is to take part in an iterative process involving evaluators, program administrators, and stakeholder consultants in which they review information, make predictions about future market share, discuss their estimates, and revise predictions on a continual basis (annual or semi-annual). In addition, there were ideas around including more data and findings on non-energy benefits (NEBs) to account for light distribution where NEBs aren't already considered.

Stakeholders should continue to plan for uncertainty. As one manufacturer put it, "We are planning for one outcome but have contingency plans in place for a spectrum of possibilities." When filing program plans and goals, utilities that want to extend their upstream lighting programs beyond 2020 should anticipate filing mid-cycle adjustments as standards become codified or market transformation accelerates.

2.4 HOW STAKEHOLDERS CAN INFLUENCE POLICIES

The most effective way to extend the life of lighting programs is to build specific exceptions into the governing TRM to account for the uncertainty in forthcoming efficiency standards. In particular, stakeholders could lobby for continued savings for exchange and direct installation implementation types, such as programs where implementers can document the precise wattage of the replaced bulb.

Should the EISA backstop be strongly modified or retracted, options for using researched market baselines, as opposed to code baselines, could be justifiable. Without the adoption of the backstop, the market is still expected to gradually transition to LED bulbs over the next few years, but the timeframe could extend beyond 2020. In this case, baselines should reflect current market conditions (e.g., availability and sales of halogens). This would reflect the reality of a transforming lighting market. The Uniformed Methods Project⁷ recommends applying a utility/state specific "sunset year" for which savings can be claimed, determined by the expected time consumers are unlikely to find LED alternatives. Proposed baselines would have to be thoroughly researched through sales data, shelf-stocking studies, and other available indicators on true bulb availability. Stakeholders could lobby for a market baseline option to be included into prospective TRMs and program plans, although they would have to be willing to pay for increased evaluation and assessment of accurate market baselines.

3. LITERATURE REVIEW

With questions of policies triggered by inaction and lawsuits challenging relevant state regulations, the tumultuous environment of the lighting landscape is readily apparent. Thus, to ensure a holistic understanding of what is happening in this space, we conducted a thorough review of over 70 documents across 15 identified states, including Technical Reference Manuals (TRM), potential studies, regulatory filings, and program plans. Documents were reviewed for information regarding EISA, the 2020 backstop, baseline adjustments, program adjustments, and Expected Use Life (EUL) assumptions.

TRMs and potential studies, when found, provided direct insight into the plans of states regarding the backstop. When such information was not readily provided, however, the baseline and program adjustments were utilized to

7. National Renewable Energy Laboratory. Chapter 6: Residential Lighting Evaluation Protocol. Uniform Methods Project: Methods for Determining Energy Efficiency Savings for Specific Measures. October 2017. <https://www.nrel.gov/docs/fy17osti/68562.pdf>

see if there were any changes that aligned with the backstop, even if not explicitly discussed. Similarly, we looked for adjustments to the EUL that aligned with regulations, even if not addressed specifically. All states but one (North Carolina) had TRMs, and one (Ohio) had not been updated in several years. In those instances, potential studies and program plans were reviewed to understand actions being taken in light of the impending backstop.

3.1 SUMMARY OF FINDINGS

All 15 states that were reviewed were preparing for the EISA 2020 backstop under the assumption that it will go into place. As a result, each of the states provide guidance on adjusted savings under the new standard of 45 lumens per watt and recommend a baseline that adjusts for the shift in calculated savings for bulbs with life spans that end after 2020 using a dual baseline approach. The key difference between the states, however, is when the backstop would take effect. In other words, it is not a question of *if* the more efficient baseline will take effect, but *when* it will take effect. Of the 15 states, one (California) has adopted the 2020 backstop standards as of 2018. States that believe the backstop will be in effect as of 2020 include Iowa, Missouri, New York, North Carolina, Pennsylvania, Washington, and Wisconsin. Illinois, Michigan, and Texas, however, believe that there will be a one-year delay to accommodate sell-through, putting the backstop into full effect in 2021. Massachusetts is allowing a savings for specialty and GSL LEDs through 2023 with their market adoption model (Table 3).⁸

TABLE 3. ASSUMPTIONS BY STATE

State	Assumes backstop will happen	45 lm/W is new baseline in 2020	45 lm/W is new baseline in 2021	45 lm/W is new baseline in 2022
Arkansas	✓			✓
California	✓			
Illinois	✓		✓	
Iowa	✓	✓		
Massachusetts	✓			
Michigan	✓		✓	
Missouri	✓	✓		
New York	✓	✓		
North Carolina	✓	✓		
Ohio	✓	✓		
Pennsylvania	✓	✓		
Texas	✓		✓	
Washington	✓	✓		
Wisconsin	✓	✓		
Vermont	✓	✓		

8. See RLPNC 17-6, Market Adoption Model Findings. <http://ma-eeac.org/studies/residential-program-studies/>

4. STAKEHOLDER INTERVIEWS

Conversations with key stakeholders provide access to expertise beyond that of secondary sources. Thus, to truly be able to report how the lighting industry is adapting in anticipation of changes triggered by EISA, the expanded GSL definition, and the recent litigation, data was gathered from six stakeholders, including a governmental official, a program implementer, and four manufacturers.

It is worth noting that each of the respondents expressed discomfort in making definitive statements regarding what is to come for the lighting industry. The consistency in their responses suggests that such discomfort might be widely felt across the industry during this uncertain time, and it may have impacted the pool of experts we interviewed for the study. As such, findings from these interviews may be biased in some ways we cannot fully understand at this time.

4.1 INTERVIEW OBJECTIVES

Each interview intended to uncover the respondent's perspective regarding:

- The future of EISA, as well as the rapidly evolving lighting market, more broadly
- Current manufacturing practices and projected changes in the coming years in response to the changing market
- The impact of the recent lawsuit between NEMA and the CEC on national policy and the uncertain fate of the EISA 2020 backstop

4.2 SUMMARY OF FINDINGS

Four major themes emerged across the six interviews.

Discontinuity of Beliefs Regarding Backstop

First was that of uncertainty regarding lighting requirements moving forward. Of the six stakeholders interviewed, two believed the backstop had been triggered, two believed it was not in play at all, and two felt the situation was too unclear for any educated assumptions to be made. Respondents were then asked to rate the likelihood of three different scenarios⁹:-

1. In which the backstop is fully enacted in 2020
2. In which the backstop is completely repealed
3. In which the backstop is implemented with some modifications

Scenario one, where the backstop would be fully adopted in 2020, was the only option that received a numerical rating from every respondent, with responses ranging from 1 to 7. The respondent that believed

⁹ Ratings were on a scale of 0 to 10, with 0 meaning "not at all likely" and 10 meaning "very likely".

there was no likelihood stated that they did not believe it could be enacted completely because the DOE had begun to recognize an inadaptable marketplace, and that manufacturers and retailers would continue to push back until victorious. Conversely, the respondent gave the highest likelihood rating of full adoption asked, “Who is going to fight back over selfish needs?” The remaining respondents provided moderate responses, with two respondents providing a rating of 3 and the other two rating the situation as a 5. Explanations for their ratings included issues regarding statutory regulations and timing; the expectation of adoption, but with modifications; and a level of uncertainty that could only justify a moderate rating.

“LEDs are quickly replacing incandescent and halogens from fixtures and screw-based lamps, all based on market conditions, regulations, pricing, and consumer acceptance. LEDs will get there anyway.”
-Manufacturer

The respondent that rated the aforementioned scenario 1 likelihood the lowest did so because they believe the backstop will be repealed, and they proceeded to give scenario 2 (the likelihood of a full repeal) an 8. Similarly, the respondent who believed that the backstop would be adopted, but only once modified, rated the likelihood of adoption with modifications (scenario 3) at an 8 and the likelihood of a complete repeal (scenario 2) a zero. The respondent was unsure of what modifications would be undertaken, but was certain that some would be.

Further supporting the climate of uncertainty on these scenarios, three interviewees expressed an expectation that the DOE will release something before the end of summer in 2018, providing much-needed clarity and direction. Of the three remaining respondents, one did feel confident in their ability to provide an answer to either question regarding the likelihood of complete repeal or adoption with modifications, and another was unsure about modifications but rated the likelihood of full repeal a zero. The last respondent rated both the second and third scenarios as somewhat likely, again expressing uncertainty in the current environment as the reason for their selection.

Finally, interviewees were asked to rate the likelihood that the backstop would be enforced in 2020 on the same 0 to 10 scale. Here, four of the six were unsure and chose not to provide a definitive answer. Of the two that did respond, both provided relatively low likelihood ratings – a zero and a 3.5. These respondents explained that the timing for the legislation had passed, resulting in an inevitable delay.

Impact and Enforcement

In addition to asking respondents to rate the likelihood of various implementation scenarios for the backstop, we also asked respondents to rate the likelihood that the backstop will be enforced. After Phase I of EISA, funding for the enforcement in the DOE was cut, impeding regulatory oversight. With the funding ban still in place, it is unclear if the DOE will be able to enforce the rules outlined by EISA or their extended definition of GSLs. All respondents viewed the likelihood of federal enforcement as very low (an average rating of 1.75).

However, manufacturers have historically evolved to meet the standards, regardless of enforcement – a trend the four interviewed stakeholders

Question: “Have you seen any stockpiling?”

Manufacturer Response:
“Yeah, we had a couple retailers that stockpiled- 4,000 sq ft warehouse- selling 4 incandescent for \$10.”

expect to continue in the years ahead. Thus, each of the respondents spoke of changes either being made or anticipated (i.e. transitioning factories from CFLs to LEDs) that would allow them to compete in a backstop-enforced market. They also mentioned backup scenarios to revert to lower efficiency manufacturing practices, should the backstop be repealed. In both scenarios, the goal is to be able to meet the regulatory demands as well as the market demands, no matter the outcome of the backstop debate.

LED's Inevitable Market Takeover

One way in which manufacturers are stabilizing their contingency plans is by migrating towards compliant products in tandem with the adaptations mandated by the market. As such, two of the companies surveyed only produce LEDs, and one company is transitioning plants in two states (one in the south and one in the west) from halogen to LED. As a consensus, all the respondents believed that LEDs were naturally going to dominate the lighting market over the next few years. However, they did not believe that halogens would be completely out of the picture, especially for specialty bulbs where the LED technology has not fully developed to meet the expectations of the market. On average, the interviewees estimated that LEDs would have an 80 to 90% share of the market for standard bulbs by 2022 and something similar for specialty and decorative bulbs by 2024.

When asked to explain why they believed LEDs would take over, respondents discussed the role of utility programs in subsidizing bulbs, allowing consumers that would typically shy away from the high price point to experience LEDs with lower risk. They also believed that consumer education has and will play a large role in the market transformation. According to respondents, complications with early CFLs (extremely hot bulb temperatures, incompatibility with fixtures, disposal issues, etc.) left many consumers weary of new lighting technologies, and most consumers are generally unsure what to look for when purchasing a replacement lamp. In response, utilities have funded various programs that help address these concerns by providing lighting guidance in stores, through the mass distribution of bulbs for consumers to try, and by providing information regarding the energy efficiency of LEDs in most of their programs. Several respondents also noted that halogens are significantly more profitable for manufacturers than LEDs. As such, manufacturers, through NEMA, are fighting the legislation that would outlaw these profitable technologies.

Additionally, respondents identified how the efficiency level of the LED made it no longer cost-effective to consider pursuing energy savings by modifying the lightbulb technology, leaving the LED currently uncontended. One respondent even stated, "This is the end of the lighting industry, as I know it. We are back to one technology, and there is no incentive to develop anything new." However, all respondents did not believe this stagnation in lamp technology necessarily meant stagnation in savings from residential programs. Four of the five respondents identified controls and connectivity as the next frontiers for potential savings from residential lighting, providing examples such as educating consumers on how to properly utilize dimmer switches and smart function integration. It should be noted, however, that these technologies offer limited savings compared to historic program production.

California as a Test Case

Though there is much unknown about what to expect regarding legislation and the lighting industry, some of the concerns posed by manufacturers have begun to play out as they strive to meet the new regulations in California. Three of the four manufacturers reported having already experienced hardships as a result of California's new standards, citing instances of being fined for an accidental shipment that failed the standard and not having enough time to redirect product at the beginning of the year, resulting in severely understocked shelves. For the manufacturer who reported having already been fined due to an accidental shipment of non-compliant bulbs, the company chose to alter its distribution model specifically to accommodate the special needs of California. This meant establishing a distribution center designated strictly for compliant bulbs. Should the backstop go through, such changes could be very useful, but the cost in an atmosphere of uncertainty was felt by the manufacturer. For the two manufacturers that only made LEDs, compliance was less of an issue than simply being able to supply the product. The lack of notice regarding the changes did not allow the manufacturers to adjust their production scales, resulting in a higher demand than was available to supply.

"We understand that California is frustrated with the slowness of federal regulation and that states can be an efficiency driver for the US. We get that. But we also get the effect it has on the market when its' consumers want cheaper items that manufacturers cannot provide. Our market shrinks and their options dissolve."
- Manufacturer

5. APPENDIX

APPENDIX A. SUMMARY OF FINDINGS BY STATE

Arkansas

Version 7.0 of the Arkansas Technical Reference Manual, published in August of 2017, assumes that the 2020 Backstop will go into play and instructs users that the new baseline will be 45 lumens per watt minimum standard after that time. However, Arkansas diverges from the other states in that it mandates waiting to change the baseline to the second tier of EISA until 2022. In a footnote rationing its logic, the TRM explains that halogens have an EUL of four years. Thus, if halogens will not be discontinued until *after* 2019, replacement bulbs will not be needed until *after* 2022, making it necessary to maintain first tier standards until the effective halogen phase-out period has ended. Differentiated policies by bulb and program type were not discussed.

California

In 2016, the California Energy Commission updated the 2015 Appliance Efficiency Regulations, also known as Title 20 (Chief Counsel's Office, 2018). These updates included a two-tier roll out. Tier 1 took effect on January 1, 2018 and includes new standards for small-diameter directional lamps and general purpose LEDs. Tier 2, which will enact more regulations for LEDs, is scheduled to go into effect on July 1, 2019 (California Lighting Technology Center, 2016). Essentially, Title 20 preemptively adopted the standards of the 2020 Backstop, as well as the DOE ruling, making 45 lumens per watt and 1,000 hours of expected life the new standard for many bulbs on the market. Lamps that remain exempt include general service linear, fluorescent, and incandescent reflectors.

Illinois

Version 6.0 of the Illinois Statewide Technical Reference Manual for Energy Efficiency (Illinois Energy Efficiency Stakeholder Group, 2017) explicitly addresses EISA and the upcoming changes in 2020. Volume 3, covering residential measures, lists baseline standards for standard and specialty CFLs, as well as omnidirectional LEDs. In all three categories, the 45 lumens per watt minimum established under a triggered backstop is assumed to be the new standard. In effect, this baseline shift will remove savings currently able to be claimed, effecting time of sale, new construction, direct install, energy kit, and, in the case of LEDs, early replacement programs. However, the TRM also explicitly states that a year-long sell-through period is expected, due to delays in bulb replacement and retail stock exhaustion. Thus, the shift to the new baseline is not assumed to fully take place until 2021.

Iowa

Published in September of 2017, the Iowa Energy Efficiency Statewide Technical Reference Manual Version 2.0 (Iowa Utilities Board, 2017) clearly defines Iowa's plans moving forward regarding the 2020 Backstop. After

outlining the EISA legislation on page 21, the TRM provides new parameters for lighting moving forward. In footnote 558, the TRM states: “Since the replacement baseline bulb from 2020 on will be equivalent to a CFL, no additional savings should be claimed from that point moving forward.” This signals that they anticipate the 2020 Backstop to go into place.

Michigan

The Michigan Energy Measures Database (MEMD) is a large Excel workbook that serves as Michigan’s TRM (Morgan Marketing Partners, 2017). Within the MEMD, there is no discussion of baseline changes for CFLs, but there is a note in the baseline notes section for LEDs that states, “Anticipated baseline changes in 2020 due to legislation, CFL will become the baseline. Re-evaluate in 2019.” However, no further detail is provided. Other sources, including the *Michigan Lower Peninsula Electric Energy Efficiency Potential Study* (2017) prepared by GDS Associates, Inc. for the Michigan Public Service Commission showed plans for addressing the EISA 2020 Backstop are addressed at more length, building off the MEMD evidence of expected adoption. According to page 29, though not intended to predict policy changes, the study does assume that the baseline efficiency was assumed to be a halogen bulb through May 31, 2020, shifting to a CFL in 2021. However, the authors do not detail which standard applies from June 1, 2020 through December 31, 2020, perhaps leaving this to be discussed when the MEMD is updated in 2019.

Missouri

The 2017 Missouri Technical Reference Manual (Missouri Division of Energy, 2017) also explicitly acknowledges the EISA legislation and the 2020 Backstop, stating that a new baseline of 45 lumens per watt will be applied to CFLs and LEDs, beginning in 2020. Specialty CFLs are not addressed. For CFLs, this shift in baseline will affect savings available to be claimed for time of sale, new construction, direct install, and efficiency kit programs. For LEDs, retrofit, new construction, and time of sale programs will be affected.

New York

Intended to inform future Efficiency Transition Implementation Plans (ETIP), Version 5.2 of the *New York Standard Approach for Estimating Energy Savings from Energy Efficiency Programs - Residential, Multi-Family, and Commercial/Industrial* (Technical Resource Manual Management Committee, 2018) specifically outlines provisions for residential lighting programs on par with the backstop. The NY TRM 2018 states that the sale of general service lamps that fail to meet the minimum standard of 45 lumens per watt shall be prohibited “if more stringent regulations are not put into effect by that date” (152). This new standard for baseline savings will be added to the January 2020 TRM. As a result, the current TRM estimates that 20-70% of claimable savings tied to GSLs will be impacted, hence the preemptive information for future ETIP development.

North Carolina

Of the twelve states assessed, North Carolina was the only state without a state-specific TRM. To compensate, the team turned to more creative sources including a 2016 application from Duke Energy for approval of their

demand-side management approach (North Carolina Utility Commission, 2016), North Carolina's Residential Energy Codes, and literature from local lighting programs. From these documents, the team learned that North Carolina's lighting standards have included EISA regulations in the past, sighting baseline adjustments due to new standards in 2013 and 2014. However, none of the documents reviewed included information about the 2020 Backstop. Through researching the Mid-Atlantic Technical Reference Manual, it was found that the EISA 2020 Backstop is expected to go into effect in the designated year. A blended baseline should be used to account for the shift, and standard and specialty bulbs are treated the same.

Ohio

Ohio's assumptions regarding the 2020 Backstop remain unclear. Having not updated their TRM since 2010, the addressed EISA regulations include those for 2012 and, at times, 2014, but nothing beyond that scope. A review of other documents, including publications from the Ohio Environmental Council (2017), provided some insight into why this might be. The efforts of the TRM were originally supported by Senate Bill 221 (2008), signed into law on May 1, 2008, and established Ohio's Energy Efficiency Portfolio Standard (EEPS) and Alternative Energy Portfolio Standard (RPS), along with several other provisions. SB 221 established a gradual plan to help Ohio meet their goal of reducing electricity consumption by 22% by 2025. This foundational bill was the basis from which parts of the 2010 TRM were constructed. However, in 2014, another bill, SB 310 (2014), was passed, putting a two-year freeze on the energy efficiency improvement schedule. As of January 1, 2017, Ohio's energy portfolio standards (to have 2% of electricity needs met through energy efficient sources by 2019) have been reinstated, but the team was unable to find any publicly available information on what they are planning in anticipation of the 2020 Backstop.

Pennsylvania

Under the broad scope of "Energy Star Lighting," the Pennsylvania Technical Reference Manual (Pennsylvania Utilities Commission, 2016) outlines changes to come as a result of the EISA Backstop. Updating the savings algorithm to take into account the new 45 lumens per watt minimum standard, the TRM provides a chart of post-2020 adjusted baselines, demonstrating a reduction in savings, to assist in future planning.¹⁰ However, the TRM also states in footnote 30 that, should the backstop not be enacted, the baselines should be readjusted, and savings recalculated. This was the only example in all twelve states where retroactive action was considered and encouraged, acknowledging the uncertainty of what is to come.

Additionally, in their report published in February of 2018, the Statewide Evaluator (SWE) provides an overview of Phase II of EISA and what to expect. The expectation is that the backstop is being instated; however, the SWE explicitly states that it does not believe the DOE will receive funding to enforce the standards. Should they be enforced, however, the SWE believes that the DOE will allow for a sell-through period based on a footnote in their rulemaking. As a result, the report states that the SWE will need to track stockpiling and sell-through to determine if additional stipulations are needed in the PA TRM to ensure compliance with post-2020 EISA (NMR, 2017).

¹⁰ Table 2.2: Baseline Wattage by Lumen Output for General Service Lamps (GSL), PA TRM, pg 20

Texas

The Texas Technical Reference Manual Version 5.0 (Public Utilities Commission of Texas, 2017) covers all programs in 2018, including residential lighting programs, in anticipation of the EISA 2020 Backstop. Accordingly, the TRM states that the 2nd Tier EISA baseline will go into effect as of 2020. However, similarly to the Illinois provisions, Texas assumes a sell-through period of one year and will thus retain the 1st Tier EISA baseline until 2021. Modeled after Arkansas' TRM Version 4.0 (Arkansas Public Service Commission, 2016), Texas allows that a new standard going into effect prior to July of the program year can assume a one-year lag in application.¹¹ Thus, the backstop requirements will be in play in 2020, but the full adjustment to savings will not occur until 2021. The exception to this standard will be for lamps installed in 2020, which will be awarded savings based on the 2nd Tier - the standard present when installed. Though the TRM discusses each separately, the outlined parameters are the same for both standard and specialty CFLs, as well as LEDs.

Wisconsin

Though not addressed in the Wisconsin Focus on Energy 2017 Technical Reference Manual, planning in anticipation of the Backstop in Wisconsin can be found in the *Focus on Energy 2016 Energy Efficiency Potential Study*, published in June of 2017 (Cadmus, 2017). Solicited by the Public Service Commission of Wisconsin and prepared by the Cadmus Group, the potential study looked at current practices in Wisconsin's conservation portfolio, seeking to identify areas of opportunity in the years ahead. The results are expected to inform plans moving forward, including potential changes to the TRM, scheduled to be updated in the fall.

In the report, the Cadmus team discusses EISA and the looming changes to baseline values in 2020, should the backstop be instated. However, the report does not explicitly assume that the backstop is or is not triggered. Instead, it outlines three recommendations. First, they recommend continually monitoring legislative action, given all the uncertainty around the backstop. Second, recognizing the drastic decline in claimable savings from residential lighting programs, the study recommends adding other measures and direct-install elements to programs to increase savings. Finally, the team encourages Wisconsin to consider launching a "quick-start LED distribution program" to capitalize on as many savings as possible before the new standards take place (Cadmus, 2017; 88). Notably, none of these recommendations include the possibility of the backstop being repealed. Thus, as a document intended to inform future planning, this potential study essentially sets Wisconsin up to assume the backstop will come into play.

11 Foot note 1: This is consistent with the one-year lag applied in the Arkansas TRM Version 4.0 to new standards effective before July 1 of a given year. Arkansas Technical Reference Manual, Version 4.0. Prepared for the Arkansas Public Service Commission. Approved in Docket 10-100-R. Section II – Protocol E. Page 48. <http://www.apservices.info/EEInfo/TRM4.pdf>. (2-2) Texas

Washington

Within the Residential Lighting Workbook of their TRM (2017), the state of Washington's Regional Technical Forum states that a new wave of EISA regulations is to be expected in 2020 and provide a table of savings able to be claimed in the years surrounding 2020. Unsure if CFLs will remain the baseline or if LEDs will take over, they define the new provisions for a "technology-agnostic, minimally compliant lamp," capable of meeting the 45 lumens per watt standard. Interestingly, in a decision rendered on December 5, 2017, the RTF set January 31, 2019 as the sunset date for all applications in their Residential Lighting sector.¹² It is unclear if this early retirement of lighting measures is intended to accommodate a sell-through period or other delay of some sort, or if it is intended as a preemptive removal of measures that will soon yield little to no savings.

Vermont

Seeking to adopt federal standards to ensure they are in place at the state level, regardless of a repeal at the national level, Vermont took a similar approach to California for their lighting legislation. In the beginning of 2017, Act 042 (2017) was presented to the state legislature. The bill adopts the federal standards for appliances and lighting efficiencies in place at that time (January 19, 2017), as well as the new minimum of 45 lumens per watt, beginning in 2020. Differences in policy based on bulb or program type were not addressed, nor was a sell-through period. Vermont does, however, use a blended baseline like each of the other states. Act 042 was signed into law on May 22, 2017.

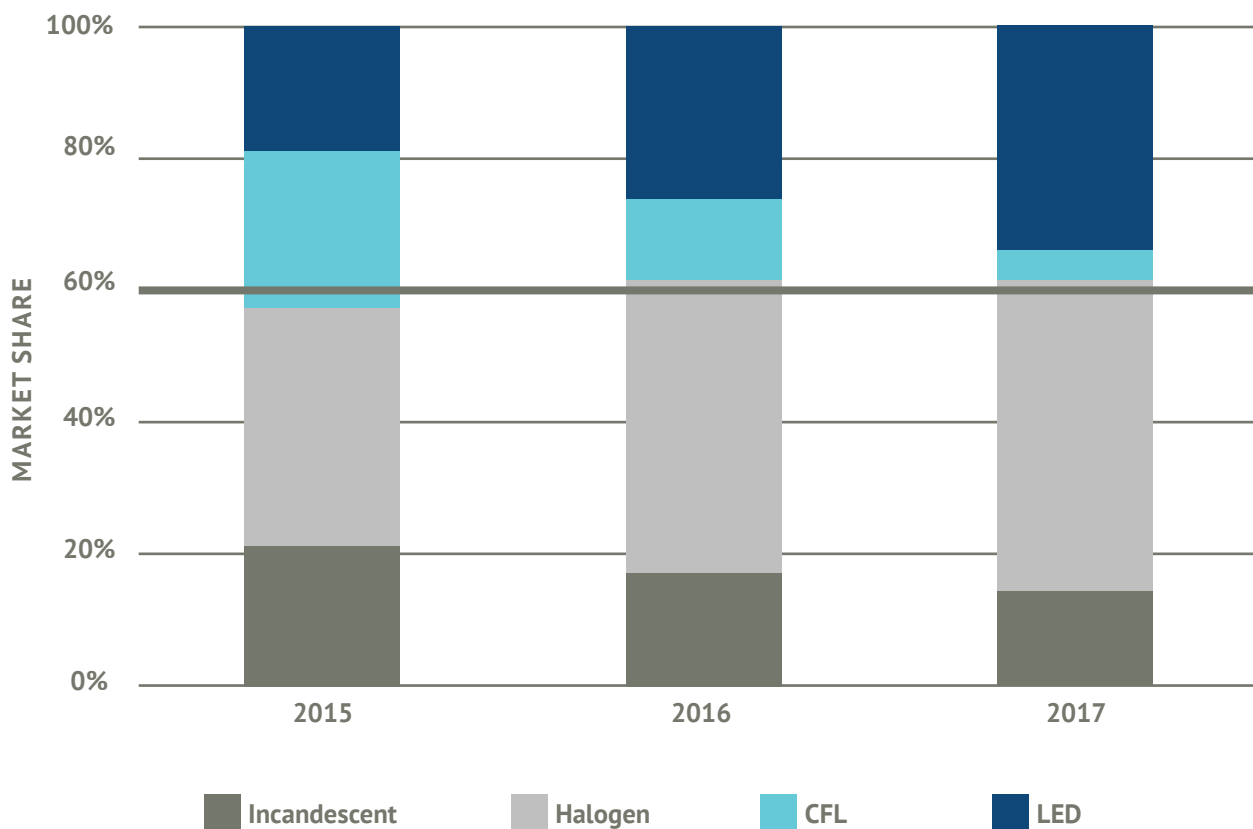
¹² <https://rtf.nwcouncil.org/decisions>

APPENDIX B. 2017 LIGHTING SALES MODEL FINDINGS

Data provided by LightTracker, an initiative of the Consortium for Retail Energy Efficiency Data.

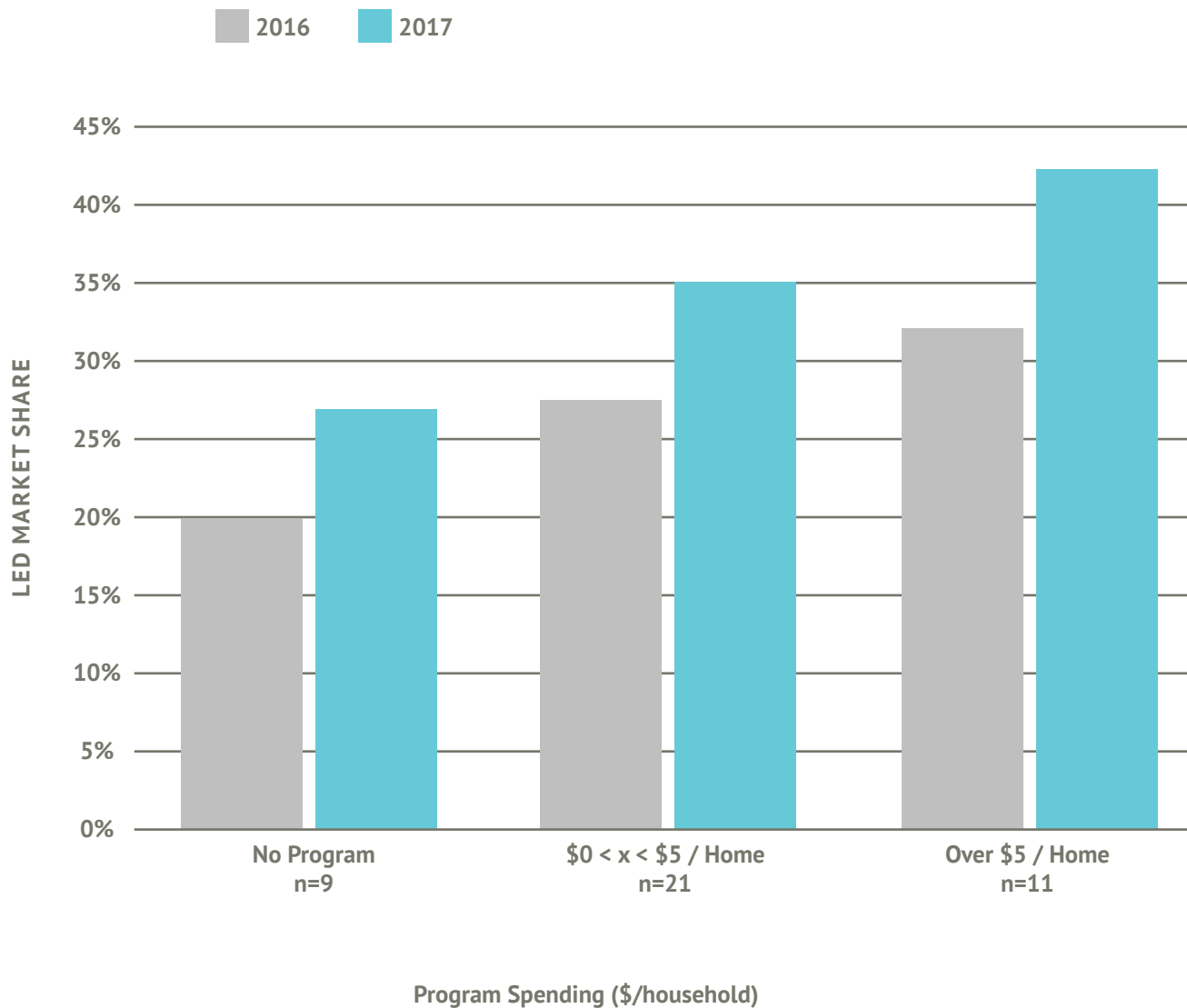
US Market Share

- LEDs continue to gain substantial market share
- LEDs have largely displaced sales of CFLs only
- Shares of inefficient lighting (incandescent and halogens) still represent over half (59%) of the market.

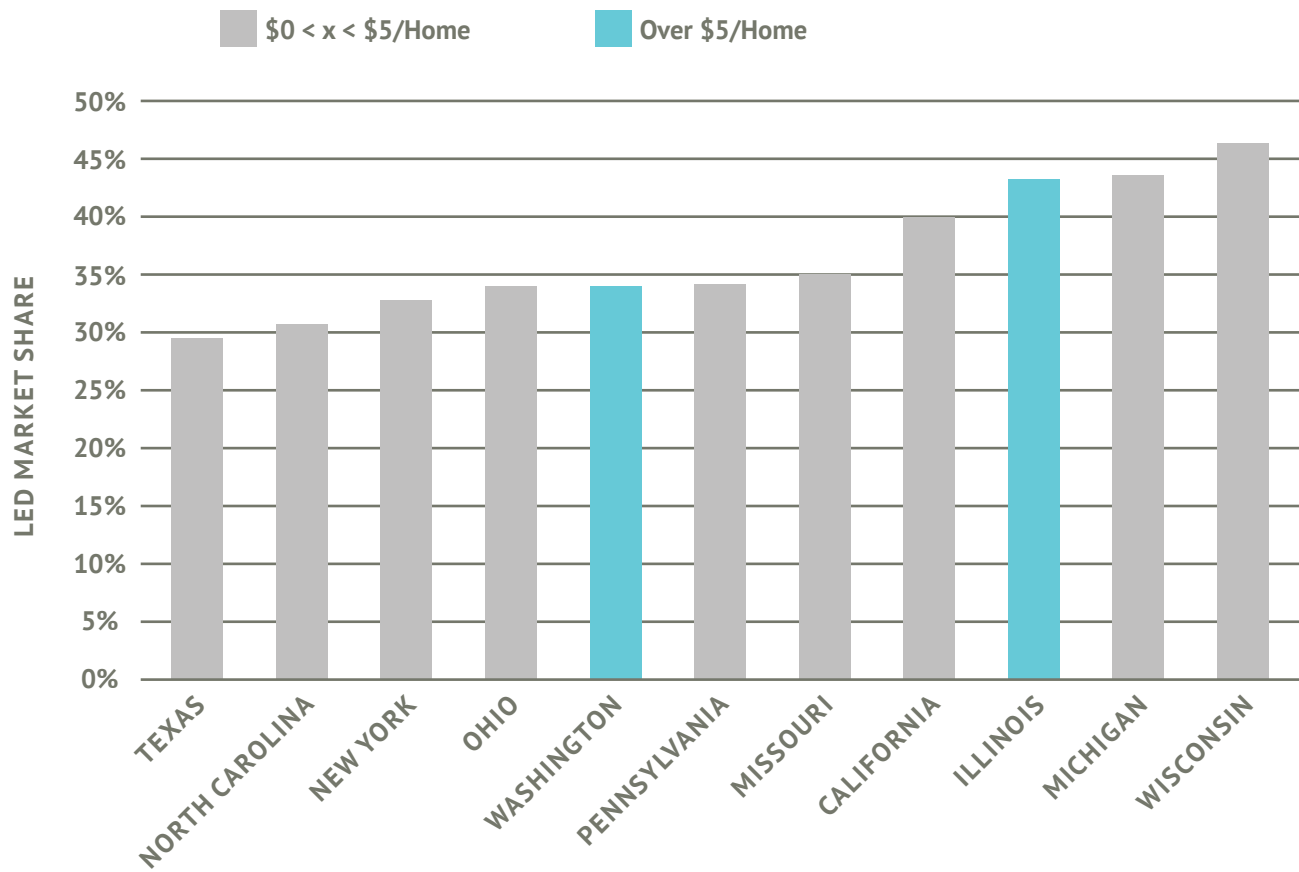


LED Market Share by Program Spending

- LED market share is related to program spending
- The most aggressive program states (i.e., those spending over \$5/home, including incentives, marketing and outreach, and other program expenses) have the highest LED market share

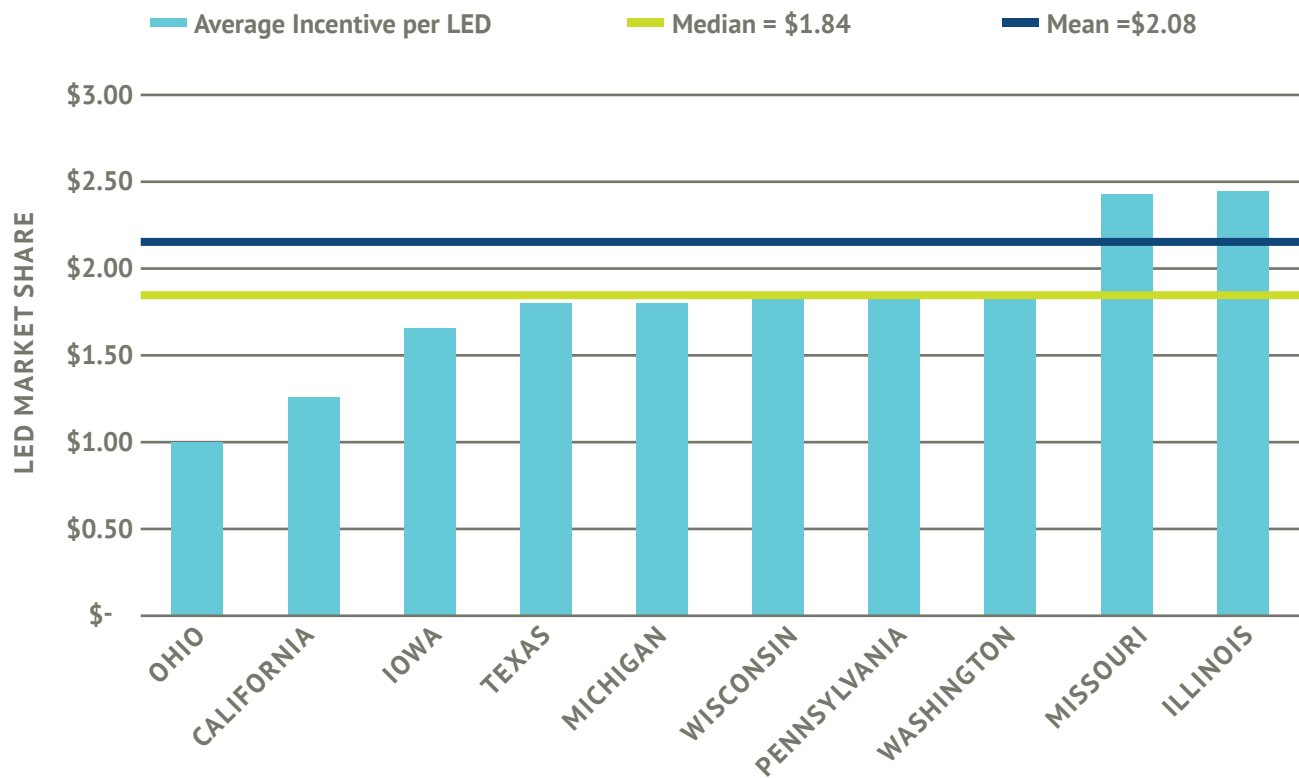


LED Market Share by State



Average LED Incentive by State

- Median and mean based on 24 states



APPENDIX C. APPROACH OF EVALUATION FIRMS FOR LIGHTING PROGRAM SAVINGS

On a national level, the UMP has tried to help close the gap on varying methods for evaluating residential lighting programs (NREL 2017). However, even with this document, many utilities have hired different third-party firms to address their regulatory reporting for residential and nonresidential lighting programs. The evaluation firms interviewed often work on a regional basis and work to ensure consistency in approach, within that region. Many times, this is required to meet each region's goal through a variety of methods that draw on inquiries of customers, suppliers (manufacturers and retailers), and implementation contractors as well as review of third-party data obtained from sources such as CREED, NEMA, market research firms, and benchmarking to similar programs elsewhere. For example, if market transformation and market effects are among the goals of a particular region, then on-site saturation studies (ideally with a panel that takes part over time) are essential to understanding market adoption.

The primary regions targeted in interviews were the Pacific Northwest, California, the Northeast, and the Midwest. There is a big emphasis on capturing the most accurate baseline to ensure the lighting impacts have been calculated correctly.

In the Pacific Northwest, they generally use two types of baselines: pre-condition (other regions often call in-situ) and current practice (other regions often call market or code baseline). Current practice or market baselines are challenging in this lighting market, because historically these were characterized by reliable data on current market average efficiency (inferred from data on shipments, purchases, or selected design/construction features) or the minimum requirements of applicable codes or standards, whichever is more efficient. Unfortunately, currently in the Pacific Northwest, that data is either lacking or very confusing.

In the Northeast, they have a market adoption model based on predicted future market share by technology (LED, CFL, halogen, incandescent) and shape (A-line/spiral, reflector, other specialty) and equivalent wattages/lumens (based on products sold through the program). Leveraging this data, they are able to use a blended baseline based on average delta watts given the predicted market shares.

Some utilities in the Midwest are either using a halogen baseline or developing very conservative savings assumptions, moving to a 2 kWh per lamp savings approach in their residential programs. In the Midwest, more than the other regions, we see the uncertainty of the EISA legislation affecting each utility's baseline approach as this region tends to be more reactive than some of the other reviewed regions.

Whatever the region, the data source is critical to the validity in the savings assumption. When utilities move away from using a lumen equivalency, additional research methods or sources such as current and predicted market share estimates (supplier/implementer predicted market share, CREED LightTracker sales data, in-store or in-home estimates of purchases, on-line or phone surveys, and other sales data sources) are used. Of course, this data and how it is applied varies by program. As shown in Table 4, the baseline is often used against a competition group (also known as efficient lighting group).

TABLE 4. BASELINE TYPE BY PROGRAM – PACIFIC NORTHWEST

PROGRAM TYPE	BASELINE USED	COMPETITION GROUP
Res lighting	Current practice (except for lamps installed through Direct Install program, those use Pre-Condition baselines) As short-lived lamps in the baseline die off (for any lamp installed in a res program)	Constant initial delivered lumens (initial lumens used for Residential because we do not expect residential consumers to account for lumen degradation in purchasing decisions, the way lighting designers would)
Non-Res Midstream	Current practice	Constant mean delivered lumens
Non-Res Retrofit	Pre-condition at measure install then Current Practice as short-lived lamps in the baseline die off	Constant mean delivered lumens
Display Cases	Pre-condition at measure install then Current Practice post RUL	Pre-Condition (excluding T12) and efficient case (LED) compete. No lumen matching

As for a forward-looking approach, many evaluation firms are advising and planning for the EISA lighting standards to go into effect. Where budgets allow, they are also trying to help their clients account for uncertainty in their current lighting program evaluations.

APPENDIX D. BIBLIOGRAPHY

1. Act 042. H. 411. (May 22, 2017). Vermont. <https://legislature.vermont.gov/bill/status/2018/H.411>
2. Arkansas Public Service Commission (August 31, 2016). Arkansas Technical Reference Manual Version 6.0, pp. 204-205, Tables 192, 193. Available online: <http://www.apscservices.info/EEInfo/TRM6.pdf>
3. Barclay, David, von Trapp, Kiersten, Miziolek, Claire (2017). Party Like It's 2020: EISA Phase 2 – An Examination of DOE Rule making and Implications for Programs. 2017 International Energy Program Evaluation Conference. <http://www.nmrgroupinc.com/wp-content/uploads/2017/09/Davids-poster-description.pdf>
4. Cadmus Group, Inc. (January 2017). Wisconsin Focus on Energy 2017 Technical Reference Manual. Prepared for the Public Service Commission of Wisconsin. <https://www.focusonenergy.com/sites/default/files/Wisconsin%20Focus%20on%20Energy%20Technical%20Reference%20Manual%20January%202017.pdf>
5. California Statewide Utility Codes and Standards Program (November 17, 2014). LED Lamp Quality. Prepared for the California Public Utilities Commission. http://www.energy.ca.gov/appliances/2014-AAER-01/prerulemaking/documents/2014-09-29_workshop/comments/California_IOUs_Response_to_the_CECs_Draft_Regulations_regarding_LED_Lamps_2014-11-18_TN-73993.pdf
6. Chief Counsel's Office (May 2018). California Code of Regulations Title 20. Public Utilities and Energy. Prepared for the California Energy Commission. <http://www.energy.ca.gov/2018publications/CEC-140-2018-002/CEC-140-2018-002.pdf>
7. Consumers Energy, DTE Energy, & GDS Associates, Inc. (August 11, 2017). Michigan Lower Peninsula Electric Energy Efficiency Potential Study. Prepared for the Michigan Public Service Commission. https://www.michigan.gov/documents/mpsc/MI_Lower_Peninsula_EE_Potential_Study_Final_Report_08.11.17_598053_7.pdf
8. Davenport, Coral (May 31, 2018). E.P.A. Takes a Major Step to Roll Back Clean Car Rules. <https://www.nytimes.com/2018/05/31/climate/epa-car-pollution-rollback.html>
9. Department of Energy (2017). Frequently Asked Questions: What is the Energy Independence and Security Act of 2007 (EISA 2007)?.
10. Department of Energy (January 19, 2017). Energy Conservation Program: Energy Conservation Standards for General Service Lamps (10 CFR Part 430). https://www.energy.gov/sites/prod/files/2017/01/f34/gsl_definition_finalrule_2016-12-29_0.pdf
11. Doby, Shana and Molander, Frank (2018). The Facts Behind the Lighting Backstop. <https://www.icf.com/resources/white-papers/2018/the-lighting-backstop>

12. Early Independence & Security Act of 2007 (EISA). Pub L. 110-140. 121 Stat. (December 19, 2007). <https://www.gpo.gov/fdsys/pkg/PLAW-110publ140/pdf/PLAW-110publ140.pdf>
13. ENERGY STAR Program Requirements for Lamps (Light Bulbs) (October 2016). Available online: https://www.energystar.gov/sites/default/files/ENERGY%20STAR%20Lamps%20V2_0%20Revised%20OCT-2016_1.pdf
14. Federal Trade Commission (May 2013). "The FTC 'Lighting Facts' Label: Questions and Answers for Manufacturers." Available online: <http://www.business.ftc.gov/documents/bus26-lighting-facts-questions-and-answers-manufacturers>
15. GDS Associates Inc. (January 13, 2014). Pennsylvania Statewide Act 129 2014 Commercial and Residential Lighting Metering Study. Prepared for the Pennsylvania Public Utilities Commission by the Statewide Evaluator Team (GDS Associates and Nexant).
16. GE (March 23, 2018). 2020 General Service Lamp DOE Rulemaking. Received from GE representative.
17. Illinois Energy Efficiency Stakeholder Advisory Group (February 8, 2017). IL Statewide Technical Reference Manual, Version 6.0. Page 243-245. Available online: http://www.ilsag.info/il_trm_version_6.html.
18. Iowa Utilities Board. (September 21, 2017). Iowa Energy Efficiency Statewide Technical Reference Manual Version 2.0. Facilitated and Managed by the Iowa TRM Oversight Committee. <https://efs.iowa.gov/cs/groups/external/documents/docket/mdax/njq1/~edisp/1645801.pdf>
19. Missouri Division of Energy (March 31, 2017). The Missouri Technical Reference Manual (MO TRM 2017). <https://energy.mo.gov/about/trm>
20. Morgan Marketing Partners (November 29, 2017). The Michigan Energy Measures Database (MEMD). Prepared for Michigan Utilities. https://www.michigan.gov/mpsc/0,4639,7-159-52495_55129---,00.html
21. National Electrical Manufacturers Association (NEMA) (April 27, 2017) NEMA Calls on Secretary of Energy to Complete Rulemaking for General Service Lamps. <https://www.nema.org/news/Pages/NEMA-Calls-on-Secretary-of-Energy-to-Complete-Rulemaking-for-General-Service-Lamps.aspx>
22. National Electrical Manufacturers Association (NEMA) (August 8, 2017). NEMA Files Light Bulb Federal Preemption Lawsuit. http://www.edisonreport.net/files/7715/0222/1163/NEMA_Files_Suit.pdf
23. NMR Group, Inc., EcoMetric Consulting, LLC, & Demand Side Analytics, LLC. (February 28, 2017). SWE Annual Report Act 129 Program Year 8 Version 1.1. Prepared for the Pennsylvania Public Utility Commission. http://www.puc.pa.gov/filing_resources/issues_laws_regulations/act_129_information/act_129_statewide_evaluator_swe.aspx

24. North Carolina Utilities Commission (July 12, 2016). Application of Duke Energy Carolinas, LLC for Approval of Rider 8, Demand-Side Management and Energy Efficiency for 2017. <https://dms.psc.sc.gov/Web/OrderIndex/KeywordDetail/1337>
25. Ohio Environmental Council. (2017) Ohio: Energy Efficiency Standards. Reported by the Midwest Energy Efficiency Alliance. www.mwalliance.org/initiatives/policy/ohio.
26. Pennsylvania Utility Commission (June 2016). Technical Reference Manual: State of Pennsylvania Act 129 Energy Efficiency and Conservation Program & Act 213 Alternative Energy Portfolio Standards. http://www.puc.state.pa.us/Electric/pdf/Act129/Act129_TRM-2016_Redlined.pdf
27. Public Utilities Commission of Texas (October 2017) Texas Technical Reference Manual Version 5.0 Volume 2: Residential Measures. Maintained by the Public Utility Commission of Texas'
28. Regional Technical Forum (December 5, 2017). Residential Lighting. Washington. <https://rtf.nwccouncil.org/meeting/rtf-meeting-december-5-2017>
29. S.B. 221 (May 31, 2008). Ohio. http://archives.legislature.state.oh.us/bills.cfm?ID=127_SB_221
30. S.B. 310 (June 13, 2014). Ohio. http://archives.legislature.state.oh.us/bills.cfm?ID=130_SB_310
31. Shelter Analytics (May 2017). Mid-Atlantic Technical Reference Manual Version 7.0. Prepared for Northeast Energy Efficiency Partnership http://www.neep.org/sites/default/files/resources/Mid_Atlantic_TRM_V7_FINAL.pdf
32. Technical Resource Manual Management Committee. (April 10, 2018). The New York Standard Approach for Estimating Energy Savings from Energy Efficiency Programs – Residential, Multi-Family, and Commercial/Industrial Measures, Version 5.2 (Rep.). Retrieved <http://www3.dps.ny.gov/W/PSCWeb.nsf/All/72C23DECFF52920A85257F1100671BDD?OpenDocument>
33. Tetra Tech, Inc. (2017). Residential HomeCheck Program Impact and Process Evaluation (Iowa). Prepared for the MidAmerican Energy Company. <http://puc.sd.gov/commission/dockets/gaselectric/2017/ge17-002/dr1-10attachment2.pdf>
34. The California Lighting Technology Center (April 13, 2016). Lighting Appliance Efficiency Regulations: What's New in the Title 20 Code?. <https://cltc.ucdavis.edu/publication/title-20-lighting-appliance-efficiency>
35. U.S. Department of Energy (December 29, 2016). Energy Conservation Program: Energy Conservation Standards for General Service Lamps. Definition. 10 CFR Part 430. Docket Number EERE-2013-BT-STD-0051. RIN 1904-AD09. Available online: https://energy.gov/sites/prod/files/2017/01/f34/gsl_definition_finalrule_2016-12-29_0.pdf

36. Vermont Energy Investment (August 1, 2010) Draft 2010 Ohio Technical Reference Manual. Prepared for the Public Utilities Commission of Ohio (PUCO). <http://dis.puc.state.oh.us/DocumentRecord.aspx?DocID=be39455f-350c43a3-8d46-971563809a01>
37. Vermont Energy Investment Corporation (August 6, 2010). State of Ohio Energy Efficiency Technical Reference Manual. Prepared for the Public Utilities Commission of Ohio. http://amppartners.org/pdf/TRM_Appendix_E_2011.pdf
38. Vermont Energy Investment Corporation (July 2011). Mid-Atlantic Technical Reference Manual, Version 2.0. Facilitated and Managed by Northeast Energy Efficiency Partnerships. http://neep.org/uploads/EMV%20Forum/EMV%20Products/A5_Mid_Atlantic_TRM_V2_FINAL.pdf