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NEEA CRE Standard Evaluation: Final Report

Prepared For NEEA:
Steve Phoutrides, Project Manager,
Market Research & Evaluation

Prepared by:
TRC Energy Services
436 14th Street Oakland, California, 97612
510-400-5374

Northwest Energy Efficiency Alliance
PHONE
503-688-5400
EMAIL
info@neea.org

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1 EXECUTIVE SUMMARY

On behalf of the Northwest Energy Efficiency Alliance (NEEA), TRC Energy Services (TRC) conducted an evaluation of NEEA's efforts in the development of the federal Commercial Refrigeration Equipment (CRE) standard. The objectives of the study were to:

1. Qualitatively assess activities that NEEA conducted to help establish the CRE standard and the effectiveness of NEEA's efforts, and

2. Quantitatively assess the combined influence of all energy efficiency organizations on the energy savings from the adoption of this standard.

As our data sources, TRC used a literature review and interviews with a variety of stakeholders that were involved in the adoption of this standard, including NEEA staff, energy efficiency organizations, and manufacturers.

NEEA's role in the CRE Standard: Overall, TRC found that NEEA played a moderate role in the development and adoption of this standard. In the early stages of the standard development process, NEEA submitted independent comments on the test procedure. As the standard development progressed, NEEA partnered with five other organizations to submit joint comments. Based on input from interviewees, this approach of submitting joint comments helps to strengthen arguments, presents a united front, and minimizes review time for DOE and other stakeholders. In addition, NEEA staff participated in a working group to develop certification requirements for CRE. As shown in Section 4.1, NEEA conducted most of the activities shown in the NEEA codes and standard logic model during the development of the CRE standard.

Effect of all efficiency stakeholder efforts: TRC collected data via a literature review and conducted interviews with a variety of stakeholders that were involved in the adoption of this standard, including NEEA staff, energy efficiency stakeholders and manufacturers. TRC found that NEEA played a moderate role in the development and adoption of this standard. TRC determined that the work of NEEA and the other energy efficiency stakeholders helped DOE adopt product certification requirements, conduct usable engineering analyses, and adopt a higher LED lighting efficacy assumption. TRC estimates that 15 percent of the total savings from the CRE standard resulted from NEEA and the energy efficiency stakeholder efforts.

Because the DOE calculated that the 30-year savings from TSL 3 was 2.844 quads, TRC estimates that savings from all energy efficiency organizations is 15% x 2.844 quads = 0.4 quads.

2 INTRODUCTION

2.1 Study Purpose

The Energy Policy Act (EPAct) of 2005 set standards for reach-in refrigerators and freezers, which took effect in 2010. In 2009, DOE issued standards for additional types of equipment including ice-cream freezers, self-contained equipment without doors, and remote-condensing equipment, which took effect in 2012.

The U.S. Department of Energy (DOE) updated these regulations through a Commercial Refrigeration Equipment (CRE) Standard, which is the subject of this report. On March 28, 2014, the DOE published its final rule to adopt the "Energy Conservation Standards for Commercial Refrigeration Equipment" (referred to here as "the standard") which took effect May 27, 2014, with a compliance date of March 27, 2017. This standard set new energy conservation requirements for CRE in the form of maximum daily energy consumption (MDEC) values, thereby replacing the requirements in the previous regulations. As part of its codes and standards program, NEEA supported this standard's development and adoption.

The scope of TRC's evaluation was to investigate the barriers to adoption for this standard, the activities that NEEA conducted, the activities that other energy efficiency organizations conducted, and the effectiveness of these activities. Based on the results, TRC provided two assessments:

1. A qualitative assessment of NEEA's influence in the establishment of the CRE Standard, which TRC developed based on the NEEA Standards Development Logic Model; and

2. A quantitative assessment of the savings from the standard due to all energy efficiency organizations, including NEEA.

2.2 Description of DOE Adoption Process

As background, TRC provides the following description of the DOE federal standard adoption process.

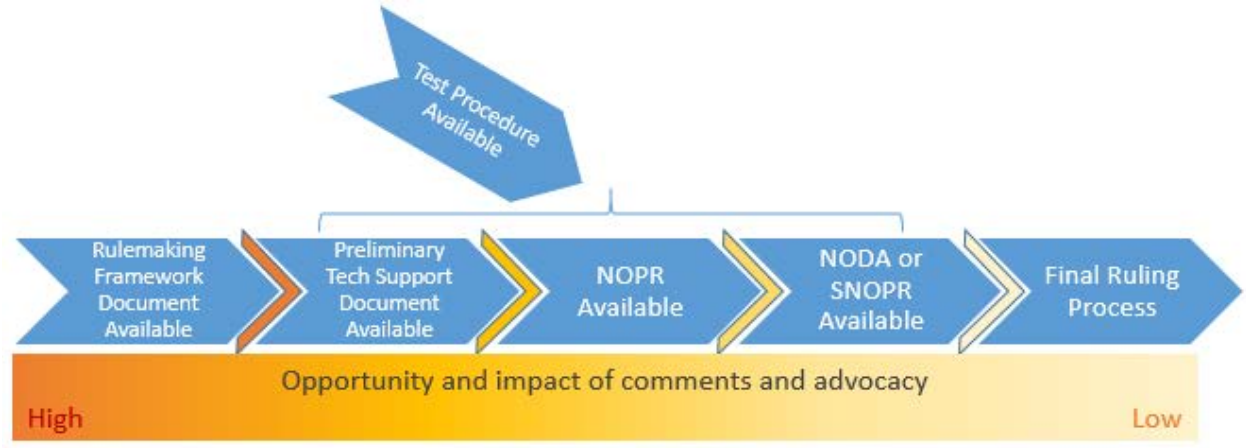
The DOE is the government agency responsible for developing and adopting national appliance energy standards. During the standard development process, the DOE seeks input from stakeholders, including comments regarding the feasibility of the proposed standard and its impact on consumers, manufacturers, and other stakeholders. Stakeholders can provide input during public meetings and comment periods, both of which occur after the public release of rulemaking documents. The DOE must address stakeholder comments and demonstrate that the benefit of a new or revised standard will exceed any burden that it may impose – e.g., that the energy savings (in dollars) from the new standard will exceed costs for implementation.

TRC developed Figure 1 to illustrate the general DOE standard development process and opportunities for stakeholder input.

Although DOE seeks input throughout the development process, a previous federal standard evaluation conducted by TRC[1] found that comments received at the initial stages are more likely to affect the direction of the development process and the final standard adopted. The DOE has a set timeline and limited resources, so it does not have opportunity to make significant changes to the standard or perform additional analysis in the latter stages of the process. Therefore, it is advantageous for stakeholders to be active during public meetings and comment periods between release of the rulemaking framework document and release of the Notice of Proposed Rulemaking (NOPR), rather than when the DOE releases the Notice of Data Availability (NODA).

In addition, NEEA and other stakeholders often provide comments on the proposed test procedure, and these comments can lead to changes in the test procedures, which in turn can influence energy savings.

Figure 1. DOE Standard Development Process and Opportunities for Stakeholders' Influence



[1] TRC 2016: NEEA Fluorescent Lamp Ballast Standard Evaluation: Final Report. https://neea.org/docs/default-source/reports/neea-fluorescent-lamp-ballast-standard-evaluation-final-report.pdf?sfvrsn=6

3 METHODOLOGY

This section provides an overview of the data collection activities and analysis methodology for this evaluation.

3.1 Data Collection Approach

To collect data for this evaluation, TRC:

1. Reviewed literature – primarily from the DOE, and
2. Gathered feedback from stakeholders involved in the rulemaking process for this standard, primarily through telephone interviews.

TRC's literature review included:

- DOE docketed comments from stakeholders, including manufacturers, energy efficiency organizations, and other interested parties
- DOE Notice of Proposed Rulemaking (NOPR) for the proposed test standard and Technical Support Document (TSD) for the NOPR
- DOE Final Rule for the energy conservation standard
- DOE Proposed and Final Rule for the test procedure
- DOE Final Technical Support Document (TSD)
- DOE Public meeting transcripts
- NEEA meeting notes
- Meeting notes and recommendations from a working group created by the Appliance Standards Rulemaking Federal Advisory Committee (ASRAC)[1]

TRC conducted phone interviews with staff at various organizations that were active in the adoption of this standard. This included:

- The NEEA staff members that led NEEA's support of this standard,
- Staff members from energy efficiency organizations that played a prominent role in supporting this standard's development. TRC interviewed a staff member from Appliance Standard Awareness Program (ASAP) and two consultants at different firms (Energy

[1] According to the DOE website, https://energy.gov/eere/buildings/appliance-standards-and-rulemaking-federal-advisory-committee: The Appliance and Equipment Standards Program established the ASRAC in an effort to further improve the DOE process of establishing energy efficiency standards for certain appliances and commercial equipment. ASRAC will allow DOE to use negotiated rulemaking as a means to engage all interested parties, gather data, and attempt to reach consensus on establishing energy efficiency standards. Rules drafted by negotiation may be more pragmatic and implemented at earlier dates than under a more traditional rulemaking process.

Solutions and an independent contractor[1]) that represented the California Investor Owned Utilities (IOUs) for this standard,

- CRE and related devices or component manufacturers and industry representative groups in phone interviews. TRC collected feedback from ebm-pabst, True Manufacturing, ZeroZone, and Hoshizaki, and
- A utility trade organization[2]

Figure 2 summarizes the interview dispositions. As shown in this figure, TRC met the total number of target interviews. TRC did not contact DOE for this standard because their input was not critical to analysis.

Figure 2. Number of Target and Completed Interviews by Stakeholder Category

Stakeholder Category	Target Interviews	Candidates Contacted	Completed Interviews
NEEA C&S Staff	1-2	2	2
Energy Efficiency Organizations	3-5	6	3*
Manufacturers and Trade Organizations	3-5	12	4
(OPTIONAL - Pending need and NEEA approval) DOE staff or consultants	1-2 limited interviews	0	0
Utility Trade Organizations	0	1	1
Total	**7-11**	**21**	**10**

**1 was a partial response, provided in an email to complete data gaps*

3.2 Limitations of Data Collection Efforts and Analysis

The findings of this study have several limitations due to data collection challenges, as described below.

One overarching limitation was that the DOE adopted this standard in 2014, so stakeholders (including NEEA) conducted most of their efforts in 2012 and earlier. TRC repeatedly heard from interviewees that it was difficult to recall details regarding the barriers to the standard's adoption and the work of individual efficiency stakeholders. To help address this, TRC sent

[1] For confidentiality reasons, TRC does not provide the company name for the independent contractor, because it contains the contractor's last name.

[2] This stakeholder requested that the organization remain anonymous.

interviewees a timeline of DOE's key activities for the standard, their organization's docketed comments and a summary of energy efficiency organizations' comments. TRC acknowledges that this may have introduced some bias into interviewees' responses, but prior to this action, interviewees could not recall much information. Due to the time lag, TRC also had difficulty reaching individuals who played a key role because they no longer worked for an organization.

An additional limitation is that interviewees conflated the CRE standard with a different standard on walk-in coolers and walk-in freezers (WICFs)[1] that DOE developed within a similar time frame (Sept 2016 – July 2017). TRC reminded interviewees that the study was for CRE standard, but interviewees may still have confused activities for CRE and WICFs.

Despite these challenges, TRC believes that our quantitative and qualitative assessments are defensible. The docket provides a high level of detail for comments and data provided by the efficiency organizations, manufacturers, and other stakeholders; how the DOE ultimately used that information; and the resulting change in analysis or requirements; and most interviewees were able to recall CRE-specific details consistent with the docket. Furthermore, TRC applied these data to a rigorous and well-documented framework to calculate the percent of savings from energy efficiency organizations.

3.3 Methodology to Assess NEEA's Influence

To assess NEEA's influence on the development and adoption of this standard, TRC compared the proposed activities from NEEA Standards Development Logic Model with activities that NEEA conducted, based on interviews and the literature review. TRC first identified barriers to the adoption of this standard, and then identified influential activities that addressed the barrier in which NEEA participated. Finally, TRC identified NEEA's role and contribution for each activity and output.

3.4 Methodology to Estimate Energy Savings from All Efficiency Stakeholders

To estimate savings from all energy efficiency organizations' efforts in support of the standard, TRC first developed a qualitative assessment of the impact of energy efficiency organizations' efforts. TRC used the results of the literature review and interviews to understand the barriers to the adoption of the CRE standard, activities that all organizations conducted to address these barriers – including comments and data provided to the DOE and other stakeholders, and the outcome of these activities – such as reduced manufacturer opposition or changes in DOE's rulemaking.

TRC then translated this qualitative assessment into a quantitative framework, to approximate the significance of energy efficiency organizations' activities as a percentage of energy savings

[1] https://www1.eere.energy.gov/buildings/appliance_standards/standards.aspx?productid=56&action=viewlive

resulting from activities during the development and rulemaking process. To develop the quantitative analysis, TRC grouped the efficiency organizations' activities into two buckets:

A. Savings from comments on LED efficacy: One energy efficiency organization (the California IOUs) commented that the DOE's assumption of LED efficacy was too low, and recommended incorporation of data from the DesignLights Consortium (DLC) database. The DOE followed this recommendation and reported in the docket that this led to a 20% increase in the LED efficacy assumption. Because the DOE analysis provides lighting energy use for each CRE product class as a percent of total energy use, TRC was able to calculate a weighted average lighting electricity use (as a percent of total CRE electricity use). TRC then multiplied the portion of electricity used for lighting by the increase in efficacy assumption from the baseline revision to determine savings from this comment.

Because TRC was able to calculate savings directly attributable to the LED efficacy comment, our analysis tracked savings from this comment separately from other activities.

B. Savings from all other comments, including support for a higher TSL, comments on the baseline model, and previous studies that supported analysis. For all other activities, TRC could not calculate savings directly attributable to comments. Consequently, TRC:

1. Used the incremental savings between the standard level adopted (TSL 3) and the next TSL (TSL 2) to estimate savings from the standard development process. This reflects energy savings that the standard may not have achieved without input from stakeholders, including the energy efficiency organizations.

2. Determined the role and significance of efficiency organizations' activities on the energy savings from the development and rulemaking process. TRC considered all activities conducted by the efficacy organizations (except the LED efficacy comment) and estimated the influence of these activities in overcoming barriers to adoption.

3. Multiplied the estimates from step 1 and step 2 to determine the impact of all energy efficiency organizations.

TRC added savings from the LED efficacy comment (A) with savings from all other comments (B) for total savings from the energy efficiency organizations.

4 FINDINGS

This section provides:

1. The results of TRC's assessment of NEEA's activities in comparison to the NEEA Standard Standards Development Logic Model;
2. TRC's findings of the overall impact of all efficiency organizations' efforts.

4.1 NEEA Effectiveness Assessment Results

Figure 3 summarizes the results of TRC's assessment of NEEA's influential efforts. TRC developed this figure using the NEEA logic model (provided in Section 6.1) as an assessment framework. Note that NEEA has one logic model for all codes and standards activities. NEEA adapts its activities to suit the specific needs for each particular standard; therefore, not all barriers or activities are relevant for every standard.

Using the assessment criteria from the NEEA logic model, TRC used information from the analysis to identify whether NEEA met each criterion. TRC identified logic model activities and outputs with a "Y" if NEEA accomplished the activity or output and "N" if NEEA did not. The figure provides a rationale for whether NEEA accomplished each objective, and also describes where some activities may not have been relevant or necessary for this standard.

Initially in the standard development process NEEA submitted comments individually. As the standard development progressed, NEEA partnered with five other energy efficiency organizations (American Council for and Energy Efficient Economy [ACEEE], Appliance Standards Awareness Project [ASAP], Alliance to Save Energy [ASE], Natural Resources Defense Council [NRDC], and Northwest Power and Conservation Council [NWPCC]) to submit joint comments. By working jointly, this helped to strengthen energy efficiency organizations' position collectively and the docket referenced these joint comments significantly.

Overall, NEEA was successful at accomplishing the majority of its planned activities from the logic model.

Figure 3. Assessment of NEEA's Activities on the CRE Standard

Barrier	Manufacturer opposition			Lack of data with which to conduct the necessary analyses in a rulemaking		Lack of common interest among certain stakeholders	Insufficient funding/staff for US DOE to run standards processes
Proposed Activity	Negotiation with manufacturers.	Attend public meetings held by DOE.	Analyze and critique organizations, manufacturers and rulemaking documents	Conduct primary research to create data for standards and test procedures.	Provide savings and economic analyses based on Northwest data.	Collaboration with other organizations under the umbrella of ASAP.	Encourage utilities to provide data and political support for standards.
Accomplished by NEEA? (TRC)	Y	Y	Y	N	Y	Y	Y
Rationale/ explanation (TRC)	NEEA did not negotiate with manufacturers on proposed CRE regulations. However, NEEA, manufacturers, and others participated in ASRAC-formed Working Group that developed CRE certification requirements.	Yes. NEEA attended all three public DOE hearings.	NEEA submitted sole comments on test procedure and joint comments on standard development. NEEA attended and actively participated in all public DOE hearings.	NEEA did not collect or provide primary data.	NEEA did not provide savings data for the Northwest. NEEA provided analysis for capabilities of efficient design options and data on LED incremental costs.	NEEA submitted joint comments, and held on-going communication and meetings. There was a uniform position from all energy efficiency organizations.	NEEA worked jointly with CA IOUs, who provided data in support of standard.
Outputs (NEEA logic model)	Consensus-based proposals to submit to DOE or better general understanding of manufacturer positions and concerns	NEEA adds valuable information at each stage of the rulemaking process.		NEEA adds valuable information at each stage of the rulemaking process.	NEEA information/ analysis referenced in rulemaking proceedings/ documentation	NEEA adds valuable information at each stage of the rulemaking process. NEEA information/ analysis referenced in rulemaking proceedings/ documentation	Utilities are present at hearings/ publicly support new standards.
Accomplished by NEEA? (TRC)	Y	Y		N/A	Y	Y	Y
Rationale/ explanation (TRC)	ASRAC accepted certification requirements from Working Group	NEEA provided comments in support of DOE and other efficiency organizations.		N/A, because NEEA did not complete any primary research for this standard.	NEEA research is contained in the docket prior to collaboration with other organizations.	DOE rulemaking documentation references NEEA joint comments. NEEA active during public stakeholder hearings.	NEEA worked jointly with CA IOUs to submit comments in support of the standard.

4.2 Influence of All Efficiency Stakeholders

As described in the Methodology, TRC calculated savings from LED efficacy comments separately, because we could calculate these savings directly. For all other comments, TRC approximated savings from the standard development process based on incremental savings between TSL 3 and TSL 2, and multiplied this by the influence of each activity of the energy efficiency organizations.

4.2.1 Energy Savings from LED Efficacy Comments

The California IOUs commented that DOE's assumed LED efficacy (54 lumens/watt) was very conservative. They recommended that the DOE include data from the DesignLights Consortium (DLC) online database[6] which has more recent (and higher) LED efficacy values. DOE adjusted its analysis in response to the California IOUs comment, and reported in the docket that this change resulted in an approximately 20% increase in modeled lumen output for all LED fixtures modeled.

The DOE savings analysis for the CRE standard breaks out lighting energy use as a percent of total energy use for each product class. TRC calculated a weighted average energy use for lighting, based on the percent of each product class shipped. As shown in Figure 4, TRC estimated that lighting comprises 11% of energy use for all CRE.

Figure 4. Weighted Average Lighting Energy Use (%) across CRE Classes

Equipment class	Lighting Energy Use (kWh)	Lighting % of Total Energy Use	% of Shipped LF of CRE	Weighted % Total Energy Use
VOP.RC.M	15.40	27%	10%	3%
VOP.RC.L	6.60	5%	1%	0%
VOP.SC.M	5.16	13%	1%	0%
VCT.RC.M	3.60	11%	1%	0%
VCT.RC.L	8.35	12%	11%	1%
VCT.SC.M	4.18	23%	5%	1%
VCT.SC.L	4.18	12%	0%	0%
VCT.SC.I	4.18	11%	0%	0%
VCS.SC.M	0.00	0%	25%	0%
VCS.SC.L	0.00	0%	15%	0%
VCS.SC.I	0.00	0%	0%	0%
SVO.RC.M	11.00	25%	8%	2%
SVO.SC.M	3.68	11%	1%	0%

[6] From its website, "The DesignLights Consortium® (DLC) is a non-profit organization dedicated to accelerating the widespread adoption of high-performing commercial lighting solutions." As one of its activities, the DLC works with utility program members, manufacturers, lighting designers, government entities, and others to develop specifications, and then lists products that meet these specifications in a publicly available database.

Equipment class	Lighting Energy Use (kWh)	Lighting % of Total Energy Use	% of Shipped LF of CRE	Weighted % Total Energy Use
SOC.RC.M	11.00	35%	2%	1%
SOC.SC.M	11.00	26%	0%	0%
HZO.RC.M	0.00	0%	1%	0%
HZO.RC.L	0.00	0%	4%	0%
HZO.SC.M	0.00	0%	0%	0%
HZO.SC.L	0.00	0%	0%	0%
HCT.SC.M	0.00	0%	0%	0%
HCT.SC.L	0.00	0%	0%	0%
HCT.SC.I	0.00	0%	0%	0%
HCS.SC.M	0.00	0%	4%	0%
HCS.SC.L	0.00	0%	1%	0%
PD.SC.M	4.18	32%	8%	2%
Total			**100%**	**11%**

Because DOE reported a 20% increase in lighting savings due to changes in the LED lighting efficacy assumption, TRC multiplied lighting use (as a percent) by the savings increase to estimate total savings from revising the LED efficacy assumption to incorporate DLC data. As shown in Figure 5, TRC estimated the improved LED lighting efficacy assumptions led to 2% of total savings from the standard.

Figure 5. Calculation of Savings from LED Efficacy Revisions

LED Lighting Efficacy Assumptions	
"Weighted Average" Lighting % of Energy for all Equipment Classes	11%
% increase in lighting savings due to LED efficacy change	20%
Energy Efficiency Organizations' Impact: % of Savings	**2%**

4.2.2 Energy Savings from Comments on TSL, Baseline Model, and Engineering Analysis

To estimate the percent of energy savings from all other comments (except LED efficacy), including support for a higher TSL, comments on the baseline model, and engineering analysis, TRC:

1. Calculated incremental savings from TSL 3 and TSL 2 to represent savings from the development and rulemaking process,
2. Estimated the energy efficiency organizations' influence using an analysis framework described below, and
3. Multiplied results of step 1 by step 2 to calculate savings.

Incremental Savings from TSL 3 and TSL 2

Because federal law requires DOE to regulate appliances, a substantial fraction of the savings from the CRE standard occurred because of federal regulation. To estimate the fraction of savings from the development and rulemaking process, TRC used the incremental savings between the TSL that DOE did adopt and the next lowest TSL that DOE might have adopted, as described below.

Based on the Final Rule, DOE developed the following TSLs as possible efficiency levels for adoption for the CRE standard:

- TSL 5 to represent maximum technical energy savings ("max tech")
- TSL 4 to represent maximum energy savings with net present value (NPV) to the customer (i.e., the person or company purchasing the equipment)[7] greater than zero,
- TSL 3 to represent efficiency levels with the highest customer NPV at a 7% discount rate; and
- TSL 2 and TSL 1 to provide intermediate efficiency levels that fill the gap between the levels of efficiency required in the previous regulations (those in 2005 EPAct and passed in 2009) and TSL 3.

As described in the next section, TRC found that the most significant barrier to DOE's adoption of the standard was manufacturer opposition, including opposition to the proposed TSL: TSL 4. Energy efficiency organizations supported adoption of TSL 4, while manufacturers expressed significant opposition against TSL 4, claiming it was not economically or technologically feasible, citing product availability issues with some product classes[8], and stating that they would need to phase out some classes of equipment under TSL 4 which would result in economic hardship. Although the docket does not indicate what TSL level manufacturers supported, a few manufacturers interviewed suggested they pushed for TSL 2, and Edison Electric Institute (a utility trade organization) argued that the marginal efficiency increase over TSL 3 did not justify the increased costs of compliance. Ultimately, DOE adopted TSL 3, a compromise between the energy efficiency organizations' and manufacturers' positions.

While dropping to TSL 3 helped address economic concerns for the customer (since it represented maximum NPV for the customer), DOE could have adopted an even lower TSL (e.g., TSL 2, particularly for some product classes) because of economic concerns for manufacturers, or product availability issues. As an illustration of this, as described in Section 6.2.1, a manufacturer and a trade organization filed a lawsuit on the final CRE rule, even after DOE had dropped the efficiency level to TSL 3. Consequently,

[7] The calculation of NPV to the customer includes the cost to purchase the equipment (which can be higher for more efficient equipment) and to operate the equipment (typically lower for more efficient equipment, because it consumes less energy).

[8] For example, Coca-Cola commented that TSL4 for Vertical Closed Transparent Self Contained Medium Temperature (VCT.SC.M) units were not technologically feasible – Final Rule, p. 17739.

TRC used the incremental savings between TSL 2 and TSL 3 to representing savings from the standard development process, including contributions from the energy efficiency organizations.

As shown in Figure 6, TRC calculated a 39% difference in energy savings from TSL 2 and TSL 3. Note that TRC uses TSL 2 as the denominator, since it roughly represents the baseline (i.e., what might have occurred in the absence of the standard development process, including contributions from the energy efficiency organizations).

Figure 6. Incremental Savings from TSL Adopted (TSL 3) and Next TSL (TSL 2)

Incremental Savings between TSL 2 and TSL 3	
TSL 2 Primary Energy Savings (Quads)	2.041
TSL 3 Primary Energy Savings (Quads)	2.844
Quad Savings (TSL 3 – TSL 2)	0.803
% Savings: (TSL 3 – TSL 2) / TSL 2	**39%**

Note that TRC reviewed the savings from this calculation to ensure that it was within the range of our qualitative assessment that there were moderate savings from the standard development process. If the incremental savings from the difference in TSLs resulted in very low (e.g., less than 20% of total) or very high (e.g., greater than 45% of total) energy savings, TRC would have adjusted our approach for this step.

Because the efficiency organizations were not responsible for all of the savings between TSL 2 and TSL 3, TRC multiplied the incremental savings difference between TSL 2 and TSL 3 (i.e., 39%) by the overall influence of the efficiency organizations, as calculated in the next step.

Estimate of Efficiency Organizations' Influence

TRC used the following steps to estimate the influence of efficiency organizations.

a. **Identified and estimated the relative significance of the barriers** to adoption of the standard. TRC identified three barriers that were significant for standard development. Based on the importance of each barrier, TRC assigned a weighting factor to each so that their sum would total 100%:
   i. Manufacturer Opposition to More Stringent Standard (High: 60%),
   ii. Lack of Data Availability and Accuracy (Medium: 30%), and
   iii. Lack of Accurate Test Procedure (Very Low: 10%).

b. **Identified and estimated the significance of each efficiency stakeholder activity to overcome <u>each</u> barrier.** As one example activity, the energy efficiency organizations supported adoption of TSL 4. TRC found that this activity had a low significance in reducing the barrier, "Manufacturer Opposition to More Stringent Standard", since DOE adopted TSL 3 in the final rule and estimated its significance as 20% for addressing this barrier, based on the following scale:
   None = 0%, Very Low = 10%, Low = 20%, Medium = 40%, and High = 60%

c. **Estimated the effectiveness of each efficiency stakeholder activity relative to all efficiency stakeholder activities to overcome <u>all</u> barriers**. As an example activity, "Adoption of TSL 4", TRC rated this activity as 20% of significance in addressing the "Manufacturer Opposition" barrier, and TRC rated this barrier as 60% of significance for all barriers. Consequently, TRC estimated that the significance of this energy efficiency organizations activity relative to all activities was 60% x 20% = 12%.

d. **Estimated the role of efficiency organizations in each activity relative to <u>all</u> participants to support DOE (i.e. all, primary, major contributor, minor, very minor).** TRC estimated efficiency organizations' role to support DOE and address each barrier and applied a weighting to the significance of their activities. TRC assumed efficiency organization roles could fall under the following categories and assigned the following weightings:

   - *All (100%):* Only stakeholder providing support to DOE.
   - *Primary (80%):* One of a few stakeholders, but led efforts.
   - *Major Contributor (50%):* One of a few stakeholders; did not lead efforts, but contributed significantly.
   - *Minor (30%):* One of a few stakeholders, but did not contribute significantly.
   - *Very Minor (10%)*: One of many stakeholders, but did not contribute significantly.

   Using our example activity ("Adoption of TSL 4"), efficiency organizations provided "All" support to the DOE for the adoption of TSL 3. For this example activity, the final estimated significance for this energy efficiency activity is 60% x 20% x 100% = 12%.

e. **Estimated the total impact of efficiency organizations' activities.** For each activity, TRC estimated the significance of each activity to overcome all barriers (step c), and multiplied this by the relative role of the organizations (step d). TRC then summed the significance of all activities. **TRC estimates the efficiency organizations' influence on the standard development process is 33%**[9]**.**

Figure 7 presents results. TRC provides a supporting rationale for each input in this figure in the appendix (Section 6.2). In addition to support for the adoption of a higher TSL (described in our example), TRC found that the efficiency organizations participated in a working group that developed certification requirements, provided comments to help increase the similarity of DOE's analysis compared with market availability and actual operating conditions of CRE, provided data (through previously published studies)

[9] This 33% excludes the impact energy efficiency organization had in the DOE changing the LED lighting efficacy assumption, since TRC calculated this influence separately.

that helped DOE conduct engineering and cost analysis, and provided minor comments on the test procedure.

Note that Figure 7 only presents results for activities that influenced the final rule. The efficiency organizations also provided other comments that did not influence the CRE standard, including recommendations to include additional design options in the analysis. Section 6.2.3 provides a brief description of these activities, and our rationale for finding that these had no impact.

Figure 7. Impact Assessment of Energy Efficiency Organizations' Activities for CRE Standard

Analysis Step	Barrier – Based on NEEA logic model	1. Manufacturer Opposition to More Stringent Standard	2. Lack of Data Availability and Accuracy				3. Lack of Accurate Test Procedure	Total
	Sub-Barriers (Specific to standard)	Adoption of TSL 4.	No existing certification requirements	Lack of data for engineering and cost analysis	Engineering analysis based on theoretical results, not actual real-world conditions.	Accuracy of baseline model compared to available products	Resistance to proposed test procedure	
a: Estimate significance each barrier	**Significance**	**HIGH**	**MEDIUM**				**Very Low**	**-**
	Significance (%)	**60%**	**30%**				**10%**	**100%**
b: Estimate significance of each activity		**Activities to Address Barrier 1**	**Activities to Address Barrier 2**				**Activities to Address Barrier 3**	
	Activities Conducted by All EE Organizations	In response to manufacturer pushback that TSL savings were not cost-effective, the efficiency organizations submitted written comment supporting TSL 4 as representing maximum energy savings that were cost-effective (i.e., with positive Net Present Value)	CRE equipment had not previously required certification, but was required under new regulation. ASRAC created a Working Group to develop certification requirements for CRE. Among the 22 members of Working Group, 4 (including NEEA representative) were from energy efficiency organizations.	EE organizations had previously conducted studies that DOE used (along with studies by others) for its analysis. Studies from EE organizations included data for night curtain effect, CRE utility rebates, CRE lifetimes, and product data for energy performance and market assessment	ACEEE & CA IOUs urged DOE to perform validation testing and physically demonstrate achievement of proposed efficiency improvement levels.	Submitted written comment urging DOE to update baseline to be more in line with Energy Star's product list. Noted many ENERGY STAR-qualified products were rated as being less efficient than the modeled baseline.	NEEA provided minor comments on test procedure, including support for DOE's proposal that equipment capable of operating in different equipment categories should comply with regulations for both; and recommending that DOE clarify language that "door" exclude night curtain	-

	Results – i.e., DOE response	DOE adopted TSL 3	DOE accepted the recommended certification requirements from the Working Group, and manufacturers must certify to DOE that each basic model of covered equipment meets the applicable standard before distributing that equipment	While DOE primarily used studies conducted by federal agencies, national labs, and manufacturers / trade organizations, DOE used EE organizations' studies to develop energy savings, cost-effectiveness, and other analysis.	DOE conducted testing; performed physical teardowns and inspections to quantify features; and updated engineering model to reflect actual conditions. Results showed alignment between model and physical tests, validating DOE's original model.	DOE adjusted its modeling of baseline units in analysis. Found agreement between the performance results from its engineering analysis and data points contained in the ENERGY STAR directory.	DOE maintained its position that equipment capable of operating in different categories meet the requirements of both categories; and clarified language that "door" exclude night curtains	-
	Effectiveness of activity for addressing barrier	**LOW**	**HIGH**	**HIGH**	**LOW**	**VERY LOW**	**VERY LOW**	-
	Significance for each barrier (%)	**20%**	**60%**	**60%**	**20%**	**10%**	**10%**	
c: Estimate significance across all barriers (a x b)	**Significance across all barriers (%)**	**12%**	**18%**	**18%**	**6%**	**3%**	**1%**	-
d: Estimate significance of each activity in comparison to all participants' activities	**Efficiency Organizations' role (Primary, main, or minor support to DOE)**	**All**	**Major contributor**	**Minor**	**Major contributor**	**All**	**All**	-
	Efficiency Organizations' Relative Role in Activity	**100%**	**50%**	**30%**	**50%**	**100%**	**100%**	-
e: Estimate Efficiency organizations' relative contribution (c x d)	**Significance of all efficiency organization activities relative to all**	**12%**	**9%**	**5%**	**3%**	**3%**	**1%**	**33%**

Influence of Comments on TSL, Baseline Model, and Engineering Analysis

As noted in Section 4.2.1, TRC estimates a 39% incremental savings difference between TSL 2 and TSL 3. Figure 4 notes the total estimate of energy efficiency organizations relative contribution to the standard development process at 33% (excluding the impact related to the improved LED lighting efficacy value). To estimate savings from energy efficiency organizations, TRC multiplied the energy savings from the standard development process (39%) by the estimate of energy efficiency organizations' influence in the standard development process (33%), to calculate that 13% of total energy savings resulted from the activities shown in Figure 7.

Total Savings from Energy Efficiency Organizations

TRC combined results from the LED lighting efficacy comments (2%) with the savings from all other energy efficiency organizations' comments (13%) to calculate total influence from the energy efficiency organizations as 15%.

Because the DOE calculated the 30-year savings from TSL 3 was 2.844 quads, TRC estimates that savings from all energy efficiency organizations is 15% x 2.844 quads = 0.4 quads.

4.3 Other Findings

This section provides results from interviews that do not directly impact the qualitative and quantitative assessment, but provide interesting findings not evident in the docket.

- It would be difficult to quantify the influence of any one individual energy efficiency organization: Because NEEA and many of the other energy efficiency organizations submitted joint comments, the docket mentions these "Joint Comments" more often than comments from individual organizations. In addition, in interviews, many of the manufacturers could recall comments made by the energy efficiency organizations collectively, but not comments from individual organizations (including NEEA). Several efficiency organization interviewees supported the concept of estimating savings from efficiency organizations collectively, rather than for an individual organization. TRC notes that:
  - The bulk of savings came from activities in which multiple energy efficiency organizations participated, including support for TSL 4 (NEEA co-signed comments), participation in the ASRAC-formed Working Group to develop certification requirements (NEEA participated), and providing data for analysis through previously published studies (no NEEA funded studies were used for this standard).
  - All of the savings from the LED lighting efficacy comment came from California IOU's activities
  - All of the savings for comments on the test procedure came from NEEA activities
- Some manufacturers and energy efficiency organizations reported their comments are not influential in the DOE process:

  - One efficiency organization staff member reported the energy efficiency organizations are generally ineffective at influencing the DOE standard development process, in part because the ASRAC process is a negotiated process (not data-based). Other efficiency organization interviewees reported feeling "outgunned" or outnumbered by manufacturers in the ASRAC process.

  - One manufacturer commented that he did not think his comments were influential: "The DOE had their idea of where the standard would fall from the start."

  - Thus, feedback from both sides of the process indicated some perceived ineffectiveness at influencing the DOE.

- From speaking with several manufacturers in interviews, TRC noted that they appeared to respect the energy efficiency organizations (including NEEA) and their work. The manufacturers disagreed with them on various issues, but made comments in interviews indicating that the efficiency organizations added value to the process and were generally making reasonable arguments. At least one interviewee (that was not from an efficiency organization) called out the NEEA staff member involved in this standard by name.

- A few manufacturers noted the final rule was too stringent and caused them to drop some product lines because it did not meet the standard. They also expressed concern on the impact of the test procedure as being too burdensome and having an adverse impact on smaller manufacturers who do not have the resources to complete physical testing. Although this is a hardship for manufacturers, this feedback indicates that the standard was effective at moving the market towards higher efficiency products.

- Total savings are not always proportional to the energy efficiency organizations' level of effort (or the number of comments they provide on a topic). For example:

  - Energy efficiency organizations provided various comments recommending that DOE include additional design options in its analysis (e.g., high-efficiency expansion valves, anti-sweat heater controllers, and triple pane doors). While the DOE considered these options, it ultimately removed them from its analysis because it found that the option either did not significantly change the energy use (based on its test procedure) or was not significantly available in the market. Thus, these comments made no impact, as described in Section 6.2.3.

  - In contrast, the CA IOUs recommended that DOE update its lighting efficacy market analysis to include products in the DLC database. An interviewee from the CA IOUs noted that this comment took very little effort. TRC found that this comment resulted in 2% of total savings from the standard – a significant amount of savings.

  While the finding that some large efforts bear no fruit, while others provide significant savings with minimal effort, may be expected for this type work, it supports TRC's approach of estimating savings based on impact (i.e., outcome), rather than level of effort expended by the energy efficiency organizations.

5 CONCLUSIONS

Based on the data collection, TRC's impact assessment was that efficiency stakeholders had a *moderate* influence on this standard. The evidence suggests that the efficiency stakeholders played a supportive role, but not a central role, in the development of this standard.

Overall, TRC estimates that 15%[1] of energy savings from the CRE standard came from the energy efficiency organizations' role in the CRE standard development and rulemaking process. These savings come from comments recommending that DOE adopt a higher TSL (which helped enable it to adopt TSL 3, instead of a lower TSL), participating in an ASRAC Working Group to develop certification requirements, publishing studies which DOE used as one of several data sources to conduct engineering and cost analysis, improving the accuracy of the baseline model to better reflect actual conditions, and providing comments on the test procedure; these activities resulted in 13% of total savings. A comment from the California IOUs to increase the assumed efficacy of LEDs resulted in 2% of total savings.

[1] Before rounding, the full value is 11.6%.

6 APPENDICES

6.1 Current Logic Model

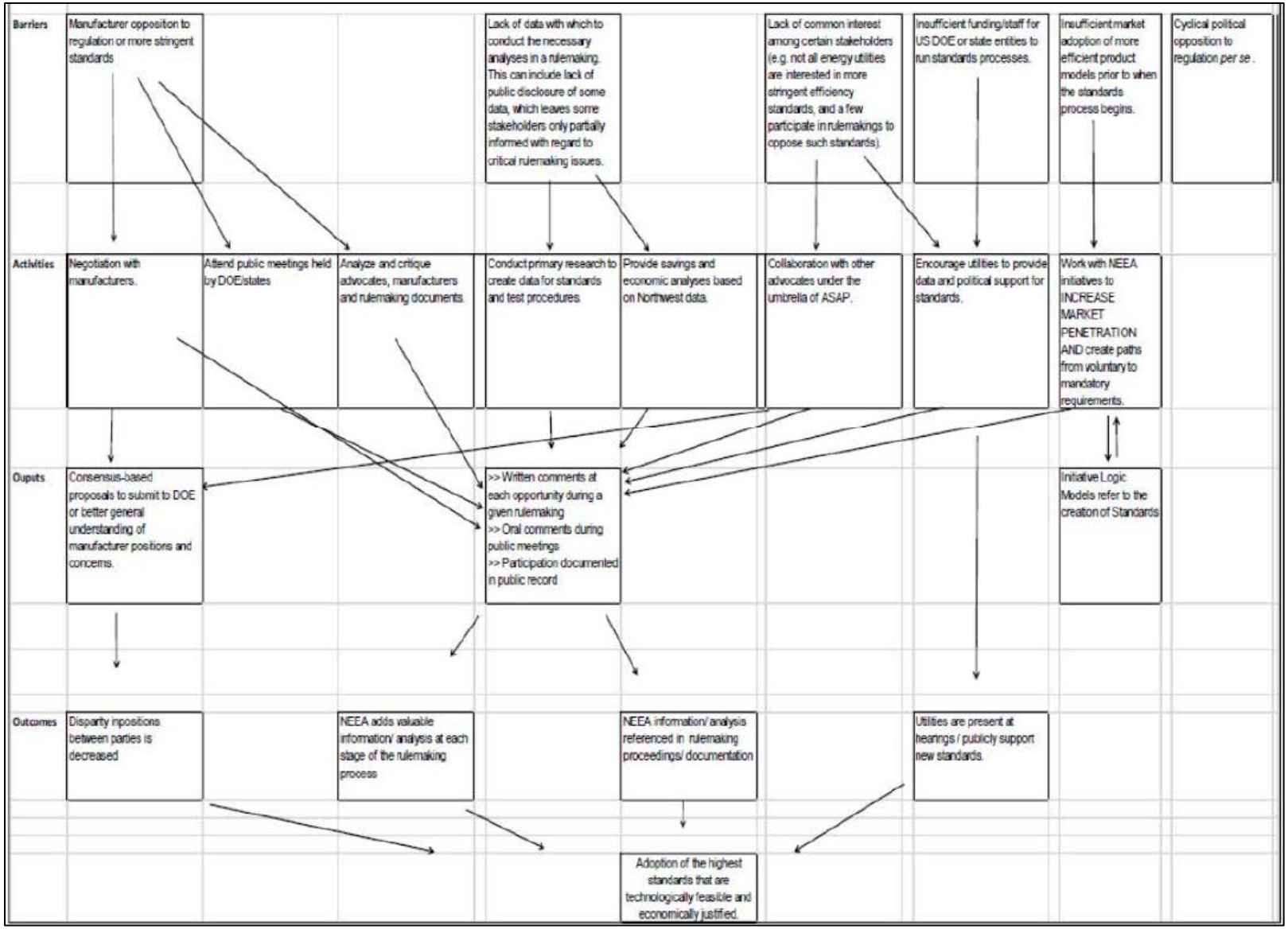
Figure 8 shows the logic model that NEEA developed for its standards development activities. NEEA adapts its activities to suit the specific needs for each particular standard.

There were three potential barriers that TRC found were not significant and did not include them in Figure 3. TRC describes these below, along with our rationale for identifying them as not significant for this standard.

- **Insufficient funding/staff for US DOE to run standards processes.** DOE enlisted an outside consultant, Navigant, to help conduct research, perform analyses, and develop recommendations for the proposed standard. Limitations in DOE staff or funding were not a significant barrier for this standard.

- **Insufficient market adoption of more efficient product models prior to standard development, and Cyclical political opposition to regulation per se.** For this standard, TRC considered these barriers as part of the barrier, “manufacturer opposition”.

Figure 8. NEEA Logic Model for Standards Rulemaking Process



6.2 Supporting Rationale for Energy Efficiency Organizations' Influence

6.2.1 Barriers

To identify barriers, TRC began with the barriers in the NEEA Standards Development Logic Model. Because this is the general logic model that applies to all of NEEA's standards development efforts, TRC revised this list of barriers based on the specific challenges of this standard. TRC identified two of the barriers in the NEEA logic model for standards rulemaking as significant – Manufacturer opposition, and Lack of data – and added a third barrier based on the specifics of this standard: Lack of accurate test standard.

Barrier 1: Manufacturer opposition to regulation or more stringent standard

Significance: High

Rationale and Findings: There was significant opposition among manufacturers and energy efficiency organizations regarding the proposed TSL. In the Notice of Proposed Rulemaking (NOPR), DOE proposed adoption of TSL 4. Energy efficiency organizations supported the adoption of TSL 4 since it represented the maximum energy savings with positive net present value. Furthermore, manufacturers reported that there were no pull-down units available in the market that met TSL 4. Manufacturers argued TSL 4 was not economically or technologically feasible. A few manufacturers expressed support for TSL 2, although the majority of manufacturers and trade organizations commented that TSL 4 was too stringent but did not argue for an alternative TSL.

In an interview, one energy efficiency organization reported that, shortly after DOE published the NOPR, ENERGY STAR released their version 3 standards for commercial refrigeration. In comparison to ENERGY STAR's proposed levels, the DOE was proposing efficiency levels in TSL 4 which was more stringent. As a result, ENERGY STAR's proposed rules provided further support for manufacturers to argue that DOE's TSL 4 levels were too aggressive. This resulted in a contentious disagreement from manufacturers on the proposed TSL.

In the final rule, DOE ultimately adopted TSL 3. Although, DOE adopted a less efficient TSL than originally proposed, one interviewee noted there was still criticism from manufacturers on the final CRE standard. As an example, an interviewee noted that AHRI and Zero Zone "filed a lawsuit" regarding the final rule, and a trade magazine confirms that AHRI and Zero Zone filed a petition with the U.S. Court of Appeals for the Seventh Circuit asking the DOE to review its March 28 final rule, because the rule required efficiency levels that did not exist yet for some product classes[11]. This further supports the significant manufacturer opposition that existed with the CRE standard.

[11] https://www.achrnews.com/articles/126894-ahri-and-zero-zone-challenge-doe-rulemaking?v=preview A later article notes that the court ruled in favor of the DOE: https://www.achrnews.com/articles/133136-appeals-court-denies-ahri-petition-regarding-commercial-refrigeration-standards?v=preview

Barrier 2: Lack of data availability and accuracy

Significance: Medium

Rationale and Findings: Manufacturers and energy efficiency organizations both questioned the accuracy of the baseline model and DOE's engineering analysis. This was an important area of discussion, but not as significant as the previous barrier regarding manufacturer opposition.

Regarding the baseline model both manufacturers and energy efficiency organizations commented on the accuracy of the baseline model. Manufacturers argued the baseline model remained the same as in the previous standards[12]. As a result, manufacturers believed savings was overestimated. Energy efficiency organizations also commented on the accuracy of the baseline for opposite reason. They urged DOE to update the baseline to be more in line with ENERGY STAR's product list and noted that many ENERGY STAR qualified products had ratings that were less efficient than the modeled baseline.

Barrier 3: Lack of Accurate Test Standard

Significance: Very Low

Rationale and Findings: There was significant discussion between both manufacturers and energy efficiency organizations regarding the test procedure, specifically related to the design options that were to be included in them. Energy efficiency organizations proposed including additional design options in the test procedure (anti-sweat controllers, high-efficiency expansion valves, triple pane doors). Manufacturers argued against adding these additional efficient design options during the standard development process and against the additional design options DOE originally proposed (night curtains, light occupancy sensors and controls).

TRC ranked this barrier as very low because while there was some discussion of the design options during the standard development process, there was an existing test procedure that DOE modified for this standard. The lack of accurate test procedure was much less significant compared with the arguments regarding TSL level, or the lack of data for developing analysis.

6.2.2 Activities

This section describes the activities that energy efficiency organizations pursued to overcome each barrier, the relative effectiveness of each activity for overcoming the barrier, and TRC's rationale for its estimate of each activity's effectiveness.

Activities to Address Barrier 1: Manufacturer Opposition to Regulation or More Stringent Standards

[12] The "previous standards" refer to the standards for reach-in refrigerators and freezers in the 2005 EPAct standards, and the standards for other equipment (e.g., self-contained equipment without doors, remote-condensing equipment) that DOE issued in 2009.

Barrier 1, Activity 1: Submitted written comment supporting TSL 4

Relative Effectiveness to Address Barrier: Low

Rationale and Findings: Energy efficiency organizations supported TSL 4, as proposed by DOE in the Notice of Proposed Rulemaking. Manufacturers strongly opposed TSL 4, citing it as not being technologically or economically feasible. A few manufacturers interviewed suggested they pushed for TSL 2, and a utility trade organization reported that the DOE struck a compromise between the energy efficiency organizations' and manufacturers' comments. In the final ruling, DOE adopted TSL 3. While the activities completed by energy efficiency organizations did not result in the adoption of a higher TSL, their efforts may have helped prevent the adoption of a lower TSL.

Activities to Address Barrier 2: Lack of data availability and accuracy

Barrier 2, Activity 1: Participated in an ASRAC Working Group to develop CRE certification requirements

Relative Effectiveness to Address Barrier: High

As described in the "Test Procedure for Commercial Refrigeration Equipment; Proposed Rule" (published October 28, 2013), federal regulation did not require certification for CRE at the time that DOE developed its proposed rule. On December 31, 2013, DOE published a final rule adopting amended regulations governing alternative energy determination methods (AEDMs), basic model definition, and the compliance dates for various equipment – including a certification date of December 31, 2014 for self-contained, closed solid, and closed transparent CRE and a certification date of July 1, 2015 for all other CRE[13], which necessitated the development of CRE certification requirements. The Appliance Standards and Rulemaking Federal Advisory Committee (ASRAC) formed a working group to negotiate rulemaking on certification for CRE, along with other equipment (including commercial HVAC and water heating equipment). Among the 22 members of the working group, four (including NEEA representative) were staff from energy efficiency organizations[14]. Staff from manufacturers and trade organizations comprised the remaining members of the working group.

ASRAC adopted the working group's proposed rules for model groupings and certifications provided in the August 30, 2013 working group report. Consequently, TRC found ranked this activity as "High" in its effectiveness for addressing the sub-barrier, "Lack of certification requirements".

TRC ranked the energy efficiency organizations' role in this activity as a "Major Contributor". Energy efficiency organizations represented only three or four members out of twenty to twenty-five" person

[13] Test Procedure for Commercial Refrigeration Equipment; Proposed Rule, p. 64298.

[14] Based on the initial members of the working group, as published on April 16, 2013: https://www.gpo.gov/fdsys/pkg/FR-2013-04-16/pdf/FR-2013-04-16.pdf. Based on meetings notes from the group, membership changed. But energy efficiency organizations continued to represent three to four members.

working group, and the final recommendations show that support among working group members was unanimous. However, interviewees from various stakeholder types (manufacturers, efficiency organizations, utility trade organizations) reported that the ASRAC negotiations process is contentious, with efficiency organizations recommending requirements that result in greater stringency (and therefore more reliable savings), and manufacturers generally recommending for the opposite. Thus, TRC ranked efficiency organizations as the "Major Contributor" in helping to develop requirements with greater stringency.

Barrier 2, Activity 2: Provided data (through previously published studies) that DOE used to develop engineering and cost analysis

Relative Effectiveness to Address Barrier: High

DOE required various data to develop its energy savings, cost analysis, market assessment, and other analysis. DOE relied on existing information from a variety of sources, including data from federal agencies, manufacturers and trade organizations, national laboratories, and energy efficiency organizations. TRC reviewed the Final Rule Technical Support Document and developed the following summary of DOE's use of studies from energy efficiency organizations[15]. DOE used:

- A Southern California Edison (SCE) field study[16] as one of two studies as inputs for its model to estimate the energy effect of night curtains.
- Data from CA IOU rebate programs and a California Energy Commission (CEC) database to develop market and technology assessment, which helped it identify existing regulatory and non-regulatory efficiency improvement initiatives, equipment classes, and trends in market and equipment characteristics.
- Data from CEC and IOUs to develop estimates for CRE lifetimes. Two of the thirteen references for effective useful life estimates came from energy efficiency organizations.
- Data from a CEC directory, as well as an ENERGY STAR directory, to develop market performance plots of energy use as a function of size for select self-contained equipment classes.
- Communications with staff from the SCE Refrigeration & Thermal Test Center (RTTC) to develop assumptions for one of the input models for its energy consumption model – specifically, the convective film coefficient inside case walls.

[15] TRC only reviewed the use of studies conducted or funded by energy efficiency organizations that were involved (e.g., provided comments on) the CRE standard.

[16] Southern California Edison Refrigeration Technology and Test Center. Effects of the Low Emissivity Shields on Performance and Power Use of a Refrigerated Display Case. 1997. Southern California Edison, Rancho Cucamonga, CA

- Data from CA IOU rebate programs to help develop two of five non-regulatory alternative scenarios. Federal regulation requires DOE to investigate if non-regulatory scenarios could provide energy savings that are more cost-effective than the proposed regulations. DOE investigated five non-regulatory scenarios (consumer rebates, consumer tax credits, manufacturer tax credits, voluntary energy efficiency targets, bulk government purchases), and data from energy efficiency organizations contributed to analysis for two of these:

  - Consumer rebates: DOE used data from 41 programs, and the California IOUs administered 3 of those programs

  - Consumer tax credits: As part of its analysis of consumer tax credits, DOE leveraged research conducted for SCE.

  DOE's analysis ultimately found that the proposed regulations led to more energy savings that had a higher Net Present Value (NPV) than all of the non-regulatory scenarios. This analysis enabled the DOE to move forward with the proposed regulations (i.e., not pursue one of the non-regulatory alternative scenarios).

- DOE used the CEC database - as well as various other databases, trade association membership directories, company websites, and market research tools – to identify small business manufacturers to interview as part of its analysis of impacts on small business manufacturers.

TRC ranked that the effectiveness of this activity as "High" for addressing the sub-barrier, "Lack of data for engineering and cost analysis". TRC ranked the role of energy efficiency organizations as "Minor", because DOE referenced data from other sources (federal agencies, manufacturers and trade organizations, national laboratories, journal articles) more often than data from efficiency organizations in the development of its analysis.

Barrier 2, Activity 3: Submitted written comment urging DOE to perform validation testing on theoretical engineering analysis

Relative Effectiveness to Address Barrier: Low

Rationale and Findings: Manufactures argued that DOE based its engineering analysis on theoretical results, not real-world conditions, and was therefore invalid. While energy efficiency organizations did not question the accuracy of DOE model, they were on a similar side as manufacturers arguing that DOE must perform validation testing to physically prove achievement of proposed efficiency levels. Given the argument from both sides, for the final rule, DOE procured CRE units currently on the market, gathered physical test data, and in some cases, conducted independent testing. This testing showed alignment between the original engineering analysis and physical tests, validating DOE's original model.

While energy efficiency organizations activities did cause DOE to perform physical tests which helped overcome manufacturer opposition, the results did not result in significant changes in the model that led to increased savings. Consequently, TRC ranked the effectiveness as "Low".

Barrier 2, Activity 4: Submitted written comment urging DOE to update baseline model

Relative Effectiveness to Address Barrier: Very Low

Rationale and Findings: DOE made minor adjustments to the baseline model. Energy efficiency organizations urged DOE to review the baseline model and compare against ENERGY STAR, but DOE found agreement between the performance results in their model and the ENERGY STAR's. As a result, energy efficiency organizations did not have a significant impact to result in capturing more savings. Because DOE did review the model, energy efficiency organizations did help DOE to defend its position against manufacturers' arguments, who argued the baseline model was overestimating savings. Because the comments enabled DOE to stand its ground but did not result in an analysis change, TRC ranked the effectiveness of this activity as "Very Low".

Barrier 2, Activity 5: Submitted comments that assumed LED efficacy assumptions were too conservative

Rationale and Findings: Energy efficiency organizations key contribution to the CRE standard development process was commenting on the DOE's conservative LED efficacy assumption used in their analysis. California Investor Owned Utilities (IOUs) commented the assumed LED efficacy (54 lumens per watt) was very conservative. Using the DesignLights Consortium online database, California IOUs provided data showing the simple average for all vertical refrigerated case lighting was 59 lumens per watt and the average for products added in 2013 was 66 lumens per watt. DOE directly referenced this data to adjust its analysis in response to the California IOUs comment. DOE cited this adjustment resulting in an approximately 20% increase in modeled lumen output for all LED fixtures modeled. TRC has allocated all savings from this activity to energy efficiency organizations as detailed in Section 4.2.1.

Note that TRC does not include this activity in Figure 7, because we were not able to calculate its impact directly based on lighting energy use (as a fraction of total CRE energy use) and the increase in lighting energy savings due to this comment.

Barrier 3, Activity 1: Provided minor comments on test procedure

As documented in the Test Procedure Final Rule, NEEA provided minor comments on the proposed test procedure. TRC summarizes these comments, and the final outcome, as follows:

- NEEA's support for DOE's proposal that equipment capable of operating in different equipment categories be required to comply with regulations for both. In the Test Procedure Final Rule, DOE maintained this proposal. Thus, NEEA's comments *may* have helped DOE stand its ground on this issue.

- NEEA recommended that DOE clarify its test procedure language so that "door" exclude night curtains. In the Test Procedure Final Rule, DOE added language to the definitions to clarify that "door" should exclude night curtains.

There were various issues in the test procedure besides the two described here. Furthermore, TRC views the outcomes (no change, and a clarification to a definition) as minor and which may have occurred in the absence of NEEA's comments. Consequently, TRC ranks this activity as "Very Low" in its effectiveness for overcoming this barrier.

6.2.3 Activities that Did Not Influence the CRE Standard

Besides the various activities that did influence the standard, the efficiency organizations conducted activities that did not influence it. TRC notes this is an expected outcome, since DOE generally accepts some, but not all, recommendations from each stakeholder during the development of an appliance standard. This section provides a brief description of some of those activities, and TRC's rationale for finding that the activity did not influence the standard.

Submitted written comment with refinements to test procedure to include efficient design options

In the proposed rule, DOE did add new design options (night curtains, lighting occupancy sensors and controls) in the test procedure that was updated from the previous version of the test procedure from 2006.

Many of the comments submitted by the joint energy efficiency organization (ASAP, NRDC, NEEA) and the California IOUs were to recommend additional refinements to the test procedure. These comments included recommendations to include the following efficient design options: high-efficiency expansion valves, anti-sweat heater controllers, and triple pane doors. The DOE included these options in the initial screening, but ultimately removed them from the analysis. From the docket:

- "DOE removed from consideration those technologies that cannot be considered to consistently affect or reduce CDEC during the tests across the range of equipment analyzed. These technologies include higher efficiency expansion valves, variable-speed condenser fans and condenser fan motor controllers, anti-sweat heater controllers, and liquid-suction heat exchangers (LSHXs)." (NOPR Technical Support Document p. 4-2)

- "Because they would have no impact on measured energy consumption under the DOE test procedure, DOE did not consider anti-sweat heater controllers in the engineering analysis." (Final Rule p. 17745)

- "DOE agrees with the CA IOUs that some equipment currently on the market for medium-temperature applications does feature triple-pane, low-e glass doors. However, this is not a standard design and DOE understands the concerns of manufacturers in applying this feature to the entirety of their product lines. Due to concerns over applicability and implementation of triple-pane, low-e doors in all medium-temperature products, DOE retained a double-pane design in its final rule engineering analysis simulation of improved glass door performance." (Final Rule p. 17751)

Since energy efficiency organizations' activities did not result in DOE adding new design options compared to the proposed rule, TRC rated the effectiveness as "None".

Submitted written comment supporting three-year compliance period

Energy efficiency organizations had no impact on the compliance period. In the final rule, DOE adopted a three-year compliance period, as DOE originally proposed. Beyond providing support, energy efficiency organizations did not make any significant contributions to help DOE stand their ground. Even though manufacturers opposed a three-year compliance period, there was not a contentious argument on this topic. Three years is a typical length of time generally used in the standard process, so comments by energy efficiency organizations were not significant.