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NEEA Residential Furnace Fan Standard Evaluation: Final Report

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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 Residential Furnace Fan (RFF) standard. The objectives of the study were to:

1. Qualitatively assess activities that NEEA conducted to help establish the RFF 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 RFF Standard: Overall, TRC found that NEEA played a *moderate* role in the development and adoption of this standard. However, the development of the test procedure, NEEA played a significant role.

This standard was the first federal standard to regulate residential furnace fans, and the DOE developed the test procedure concurrently with the standard. NEEA[1] (in partnership with Northwest Power and Conservation Council – NPCC) provided comments that significantly impacted the final test procedure, which affects the efficiency of products[2]. One energy efficiency organization interviewed noted that NEEA played a "big role in emphasizing the importance of capturing the complete air handler as opposed to just the fan and motor". The DOE also used past studies funded by NEEA (as well as studies funded by other organizations) when developing assumptions for External Static Pressure (ESP) assumptions, and NEEA provided comments stating that their Northwest field data aligned with the DOE's ESP assumptions. NEEA also partnered with four other energy efficiency organizations to submit joint comments regarding the DOE's revised test procedure, proposed TSL, and scope of the standard.

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 RFF standard.

[1] In the early stages of the standard's development, Adjuvant Consulting provided comments on behalf of NEEA. When referring to NEEA's comments, TRC includes all comments provided by NEEA and its consultants (including Adjuvant Consulting).

[2] The focus and stringency of test procedures that DOE accepts as part of the standard can affect the product's actual energy efficiency performance requirements. Much of the energy efficiency organizations' work focuses on ensuring the test procedures are designed to reflect the product's actual energy performance in the field.

Effect of all efficiency stakeholder efforts: Overall, TRC found that the efforts of all energy efficiency organizations led to approximately 15% of the total energy savings from the RFF standard.

TRC found that energy efficiency organizations influenced savings through the following efforts:

- Supported DOE's proposed trial standard level (TSL 4), citing the limited impact on manufacturers, positive benefits to consumers, and substantial energy savings. This helped enable DOE to adopt TSL 4 instead of potentially a lower TSL.

- Recommended changes to the DOE's originally proposed test procedure, including recommendations to regulate the air handler (not just the furnace fan), data to support the development of DOE's external static pressure (ESP) assumptions to better simulate field conditions, and data to support run-time hour assumptions for constant circulation mode assumptions.

- Broadened the reach of the standard by successfully arguing for the inclusion of modular blower fans in the standard's scope.

- Recommended additional testing that the DOE should conduct, to demonstrate that the majority of high-performing products met the DOE's proposed Furnace Efficiency Rating (FER).

As is the case with most standards, the efficiency organizations made other recommendations that the DOE did *not* accept. The following are examples of recommendations that the DOE did not accept for this standard:

- Shortening manufacturers compliance requirement from five years to three years, and

- Including fan housing design within the scope of the standard.

2 INTRODUCTION

2.1 Study Purpose

On July 3, 2014, the U.S. Department of Energy (DOE) published its final rule to adopt the "Energy Conservation Standards for Residential Furnace Fans" which took effect September 2, 2014, with a compliance date of July 3, 2019. This standard was the first for residential furnace fans. The DOE interpreted the federal statute to regulate electricity use of any electrically-powered devices used in a residential central HVAC systems for the purpose of circulating air through duct work. The DOE concurrently developed the test procedure with a notice and public meeting in June 2012, and a supplementary notice of proposed rulemaking (with a revised test procedure) in April 2013. DOE published the final rule for the standard on July 3, 2014. 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 RFF Standard, which TRC developed by comparing NEEA's activities for this standard with the NEEA Standards Development Logic Model (in Section 6.1 of the Appendix); 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.

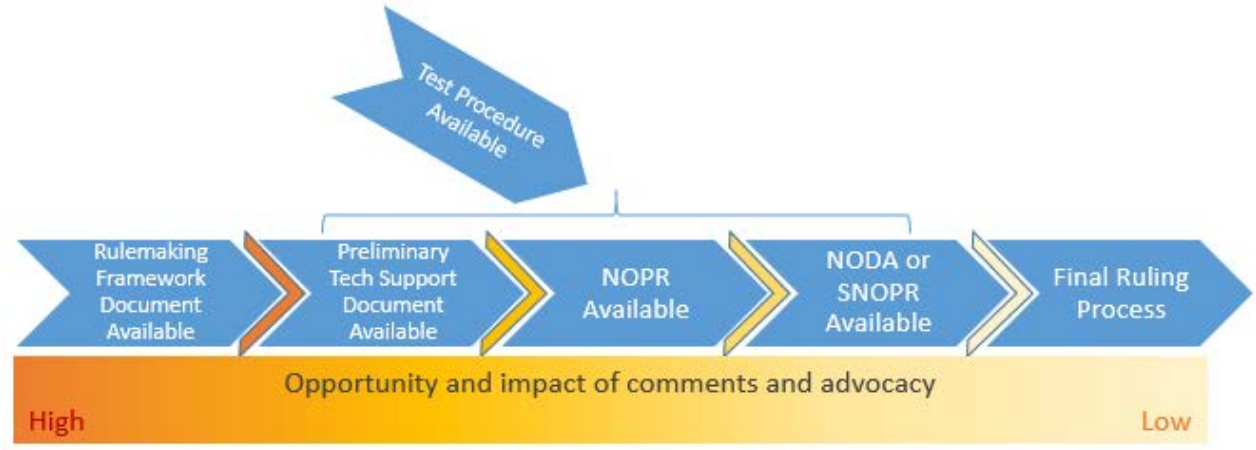
The DOE is the government agency responsible for developing and adopting national appliance energy standards. During the standard development process, the DOE seeks input from stakeholders, including comments regarding the feasibility of the proposed standard and its impact on consumers, manufacturers, 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) or Supplemental Notice of Proposed Rulemaking (SNOPR).

In addition, NEEA and other stakeholders often provide comments on the proposed test procedure, and these comments can influence energy savings. In the case of the RFF standard, energy efficiency organizations' comments helped ensure that set points better simulate field conditions, that procedures enabled energy efficiency design options to be included, and that the test procedure was not overly burdensome for manufacturers. Depending on the standard, the DOE can develop a new test procedure (as was done for the RFF), or revise an existing test procedure. In addition, the DOE may provide a final test procedure early in the process, or develop the test procedure concurrent to the standard (as occurred in the RFF).

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)
- DOE Supplemental NOPR (SNOPR)
- DOE Final Rule for the energy conservation standard and test standard
- DOE Preliminary and Final Technical Support Documents (TSDs)
- DOE Public meeting transcripts
- NEEA staff's notes from proceedings, meetings, and articles related to the topic

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

- The NEEA staff member 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 staff from Appliance Standard Awareness Program (ASAP), American Council for an Energy-Efficient Economy (ACEEE), and Earth Justice.
- Residential furnace fan manufacturers and industry representative groups in phone interviews. TRC collected feedback from two manufactures. Because of the small number of manufacturer respondents, this report does not provide the names of the manufacturers, for confidentiality.

Figure 2 summarizes the interview dispositions. TRC targeted seven interviews, but completed six. TRC made repeated attempts by phone and email to contact several manufacturers but was unable to obtain feedback from a third manufacturer. 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	1	1
Energy Efficiency Organizations	3-5	5	3
Manufacturers and Trade Organizations	3-5	8	2
(OPTIONAL - Pending need and NEEA approval) DOE staff or consultants	1-2 limited interviews	0	0
Total	**7-11**	**14**	**6**

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 interviewees 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 some individuals who played a key role because they no longer worked for an organization.

Despite these challenges, TRC believes that our quantitative and qualitative assessments are fairly accurate, because of the level of detail provided in the docket, and because many interviewees were able to recall details on the RFF standard.

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 RFF 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 resulting from activities during the development and rulemaking process. To develop the quantitative analysis, TRC used the following methodology:

1. Used the incremental savings between the trial standard level[1] (TSL) adopted: TSL 4, and the next TSL that DOE considered – TSL 3 – 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. As explained in Section 4.2.1, the information reviewed by TRC indicates that DOE would not have adopted a lower TSL (i.e., TSL 1 or 2), even in the absence of stakeholders. Consequently, TRC identified the incremental savings between TSL 3 and 4 as the best estimate of savings from the standard development process. In addition, data indicate that the efficiency organizations were not responsible for all of the savings from the standard development process (i.e., they were not responsible for all of the incremental savings between TSL 3 and 4). Consequently, TRC estimated the influence of the efficiency organizations on the process (as explained in Step 2).

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 efficiency organizations and estimated the influence of these activities in overcoming barriers to adoption. Efficiency organizations' activities included:

    a. Support for a higher TSL;

    b. Comments and supporting data for the DOE's test procedure, including comments supporting regulation of air handlers (not just furnace fans), comments and supporting data for ESP assumptions, and comments and supporting data for annual run-time hours for constant circulation mode;

[1] As part of the analysis process, DOE identifies different efficiency levels that it could potentially adopt, and estimates the energy savings, costs, and product availability implications of each level. Based on this analysis and stakeholder comments on the analysis, the DOE identifies Trial Standard Levels (TSLs) and proposes a specific TSL for adoption.

   c. Inclusion of modular blower fans in the standard's scope;
   d. Additional testing that the DOE should conduct, to demonstrate that the majority of high-performing products met the DOE's proposed Furnace Efficiency Rating (FER)
3. Multiplied the estimates from step 1 and step 2 to determine the impact of all 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

In the early stages of the standard development process, NEEA[1] submitted comments with the Northwest Power and Conservation Council (NPCC), which included several recommendations for the test procedure, including that DOE should regulate air handlers (as opposed to furnace fan). One energy efficiency organization interviewed noted that NEEA played a "big role in emphasizing the importance of capturing the complete air handler as opposed to just the fan and motor". The DOE also used two studies funded by NEEA (in conjunction with 25 studies from other organizations to develop ESP assumptions. NEEA submitted other comments, including comments regarding DOE's proposed efficiency metric, support for including at least three fan speeds in the test procedure, a recommendation that DOE set the compliance date as three (not five) years, and comments on the standard scope (i.e., to include furnace fans used in other residential space conditioning equipment).

As the standard development progressed, NEEA partnered with four other organizations (Appliance Standards Awareness Project - ASAP, American Council for an Energy Efficient Economy - ACEEE, National Consumer Law Center - NCLC, Natural Resources Defense Council - NRDC) to submit joint comments. By working jointly, this helped strengthen energy efficiency organizations' position collectively. The joint comments included support for TSL 4, support for inclusion of modular blowers in the scope, and a recommendation to adopt standards in the future to cover furnace fans in equipment that DOE excluded from the RFF.

Figure 3 summarizes the results of TRC's assessment of NEEA's efforts to affect the structure of the adopted standard. TRC developed this figure using the NEEA logic model (provided in Section 6.1) as an assessment framework. Based on our data collection, 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. Overall, TRC found that NEEA was successful at accomplishing the majority of its planned activities from the logic model.

[1] Adjuvant Consulting provided comments on behalf of NEEA in the early stages of the standard's development.

Figure 3. Assessment of NEEA's Activities on the RFF 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)	N	Y	Y	Y	Y	Y	Y
Rationale/ explanation (TRC)	TRC did not find evidence that NEEA negotiated with manufacturers during the RFF standard process.	NEEA attended and actively participated in all public DOE hearings.	NEEA submitted preliminary comments with NPCC, and later joint comments with four other energy efficiency organizations.	The DOE used two studies funded by NEEA (and 25 studies from other organizations) to develop External Static Pressure (ESP) assumptions for the standard.	NEEA/NPCC provided written comment and Northwest field data regarding annual operating hours for furnace fans.	NEEA submitted joint comments, and held on-going communication and meetings.	Through its utility partnership, NEEA collected Northwest specific field data on annual operating hours for furnace fans and on ESP assumptions.
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)	N/A	Y		Y	Y	Y	Y
Rationale/ explanation (TRC)	N/A, because NEEA did not complete negotiations with manufacturers.	NEEA provided comments in support of DOE and other efficiency organizations that influence the test procedure and TSL adopted		NEEA data supports DOE ESP assumptions for test procedure, which helps ensure that the test conditions mimic field conditions	NEEA research is contained in the docket prior to collaboration with other organizations.	DOE rulemaking documentation references joint comments. NEEA active during public stakeholder hearings.	NEEA collaborated with the California Investor Owned Utilities (IOUs), which submitted comments that generally aligned with NEEA's

4.2 Influence of All Efficiency Stakeholders

To estimate the percent of energy savings from energy efficiency organizations' comments, TRC:

1. Calculated incremental savings from TSL 4 and TSL 3 to represent savings from the development and rulemaking process,
2. Estimated the energy efficiency organizations' influence on the development and rulemaking process using an analysis framework described below, and
3. Multiplied results of step 1 by step 2 to calculate savings.

This section describes each of those steps.

4.2.1 Incremental Savings from TSL 4 and TSL 3

Because federal law requires DOE to regulate appliances, a substantial fraction of the savings from the RFF 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.

DOE originally proposed TSL 4 in its NOPR, and ultimately adopted TSL 4 in the final ruling. Energy efficiency organizations supported adoption of TSL 4, while manufacturers expressed opposition against TSL 4, claiming it was not economically or technologically feasible.

DOE did considerable investigations and found that a significant fraction of motors in the market already achieved TSL 3 performance. TRC finds that the DOE would only have adopted a TSL that would require a level of technology to achieve TSL 3. Consequently, TRC used the incremental difference between TSL 4 and TSL 3 to represent savings from the standard development process.

As shown in Figure 4, TRC calculated a 34% difference in energy savings from TSL 3 and TSL 4, based on the DOE savings analysis for each TSL.

Figure 4. Incremental Savings from TSL Adopted (TSL 4) and Next TSL (TSL 3)

TSL 3 Primary Energy Savings (Quads)	2.974
TSL 4 Primary Energy Savings (Quads)	3.994
Quad Savings (TSL 4 – TSL 3)	1.020
% Savings: (TSL 4 – TSL 3) / TSL 3	**34%**

Because the efficiency organizations were not responsible for all of the savings between TSL 3 and TSL 4, TRC multiplied this incremental savings (34%) by the overall influence of the efficiency organizations, as calculated in the next step.

4.2.2 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: 43%),
   ii. Lack of Data Availability and Accuracy (Medium: 29%[6]), and
   iii. Lack of Accurate Test Standard and Metric (Medium: 29%).

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 DOE's proposed TSL 4, while manufacturers argued that TSL 4 was not economically feasible. TRC found that this activity had a low significance in reducing the barrier, "Manufacturer Opposition to More Stringent Standard". (TRC provides rationale for this ranking in Figure 5, and more detailed rationale in section 6.2.) TRC estimated the significance of this activity as Low (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**. Using our example activity, "Support for TSL 4", because TRC rated this activity's significance as 20%, in addressing the barrier "Manufacturer Opposition to More Stringent Standard" which was rated as 43%, TRC estimated that the significance of this activity was 43% x 20% = 9%.

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 one of 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, and did not contribute significantly.

[6] This value is 28.5% for ii and iii, which TRC used for calculations. But TRC rounded these values to the nearest whole digit in the report so as not to imply greater certainty than appropriate.

Using our example activity ("Support for TSL 4"), efficiency organizations provided "All" support to the DOE, because other stakeholders (including many manufacturers) recommended a lower TSL. For this example activity, the final estimated significance for this energy efficiency activity is 43% x 20% x 100% = 9%.

e. **Estimated the total impact of efficiency organizations' activities.** TRC estimated the significance of each activity (using steps a through d) and then summed the significance of all activities.

Figure 5 presents results. TRC provides a supporting rationale for each input in this figure in the appendix (Section 6.2).

As an overview, the efficiency organizations played a particularly significant role in the development of the test procedure. This standard was the first federal standard to regulate residential furnace fans, and the DOE developed the test procedure concurrently with the standard. The efficiency organizations provided comments that significantly impacted the final test procedure, which affects the efficiency of products that are compliant with the standard. In addition, the efficiency organizations helped the DOE adopt the TSL it proposed, and maintain some portions of the standard scope. **Overall, TRC estimated the efficiency organizations' influence on the standard development process was 43%.**

Note that Figure 5 only presents results for activities that influenced the final rule (including the final test procedure). The efficiency organizations also provided other comments that – based on TRC's investigations –did not influence the RFF standard. Section 6.2.3 provides a brief description of these activities, and our rationale for finding that these had no impact. In addition, the efficiency organizations had provided comments in previous rulemakings - including comments on the test procedure for residential cooling and residential furnaces, and DOE incorporated aspects of those test procedures into the RFF test procedure. Consequently, the previous comments likely influenced the RFF test procedure, but TRC did not quantify this effect because it was indirect. Section 6.2.4 provides more detail.

Figure 5. Impact Assessment of Energy Efficiency Organizations' Activities

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 if applicable
	Sub-Barriers (Specific to standard)	Manufacturers argued TSL 4 not economically feasible. (A few opposition organization expressed support of TSL 1 or TSL 2.)	Lack of data for External static pressure (ESP) assumptions	Lack of data for constant circulation mode run-time assumptions	Standard and test procedure developed concurrently	Accuracy questioned for proposed FER for constant torque BPM motors with multistaging controls used in test procedure	Scope was debated regarding inclusion of modular blowers, and blower units in heat pumps (HPs) and central air conditioners (CACs)	
a: Estimate significance each barrier	**Significance**	**HIGH**	**MEDIUM**		**MEDIUM**			
	Significance (%)	**43%**	**29%**		**29%**			**57%**
b: Estimate significance of each activity		**Activities to Address Barr. 1**	**Activities to Address Barrier 2**		**Activities to Address Barrier 3**			
	Activities Conducted by All EE Organizations	EE organizations supported the selection of DOE's proposed trial standard level (TSL 4), citing the limited impact on furnace fan manufacturers, positive benefits to consumers, and substantial energy savings. EE organizations did not provide product cost data.	To develop ESP assumptions, DOE used 27 studies (1348 measurements), of which EE organizations (including NEEA) had funded 2 studies (representing 288 measurements – 21% of total). To counter manufacturer claims that ESP assumptions should be lower, NEEA stated their field measurements of ESP for the past 40 years are consistent with DOE's analysis.	Center for Energy and Environment (CEE) provided data use of constant circulation mode for furnace fans in MN. After DOE released NOPR using same assumptions for constant circulation (400 hrs/ year), NEEA and NPCC commented that 400 hr/year was too low, countering arguments from other stakeholders that 400 hrs/year was too high	DOE proposed AMCA 210 for test procedure in NOPR. Manufacturers, NEEA, and others argued DOE should regulate air handlers (not furnace fans). NEEA and others argued that ASHRAE 37 was more appropriate procedure than AMCA 210. Manufacturers, led by AHRI, proposed an alternative method NEEA, NPCC, and manufacturers argued that DOE should extend the comment period to reduce manufacturer opposition.	EE organizations recommended that DOE conduct additional testing of furnace fans with constant-torque BPM motors with multi-staging controls to verify the accuracy of the proposed FER standard level equations, and to ensure that the majority of products containing constant-torque BPM motors with multi-staging controls meet the standard.	EE organizations supported inclusion of modular blowers in the standard's scope. EE organizations urged DOE to "cover CAC/HP blower-coil units following the same logic that DOE used to justify covering modular blowers" (Final Rule, P. 38148). NEEA argued that DOE was only covering two-thirds of furnace fan products in this standard, by excluding fan in CACs, HPs, and other systems.	-
	Results – i.e., DOE response	DOE adopted TSL 4. DOE cited the higher net benefit to consumers compared to net cost for all considered product classes.	As noted above, DOE used studies that included work funded by efficiency organizations to develop ESP assumptions (average 0.65 in. w.c. for single-family households and 0.30 in. w.c. for mobile homes.), and maintained these ESP assumptions in final rule.	DOE used data from CEE and another entity to develop assumptions in NOPR regarding hours of use under constant circulation-mode (400 hours / yr). DOE maintained 400 hours/yr assumption in Final Rule.	In SNOPR, DOE agreed that furnace fans should be tested in situ (to capture impact of airflow path design), stating that was their original intent, but providing clarifying language; and DOE adopted modified AHRI test procedure. DOE extended comment period by 30 days.	DOE made no changes and noted they assessed efficiency level (EL-4) for "constant torque BPM motor and multistaging" and found 90% meet EL 4, so Final Rule efficiency levels are accurate and reflect performance of actual technologies.	DOE made no changes and covered those circulation fans used in furnaces and modular blowers. DOE did not include HP/CAC, citing, "The DOE test procedure for furnace fans is not currently equipped to address fans contained in central air conditioners, heat pumps, or other products" (Final Rule p. 38149)	-
	Effectiveness of activity for addressing barrier	**LOW**	**MEDIUM / HIGH**	**MEDIUM**	**MEDIUM**	**VERY LOW**	**VERY LOW**	-
	Significance for each barrier (%)	**20%**	**50%**	**40%**	**40%**	**10%**	**10%**	
c: Estimate significance across all barriers (a x b)	**Significance across all barriers (%)**	**9%**	**14%**	**11%**	**11%**	**3%**	**3%**	-

d: Estimate significance of each activity in comparison to all participants' activities.	**Efficiency Organizations' role (Primary, main, or minor)**	**All**	**All**	**All**	**Minor**	**Primary**	**All**	**-**
	Efficiency Organizations' Relative Role in Activity	**100%**	**100%**	**100%**	**30%**	**80%**	**100%**	**-**
e: Estimate Efficiency organizations' relative contribution (c x d)	**Significance of efficiency organization activities relative to all**	**9%**	**14%**	**11%**	**3%**	**2%**	**3%**	**43%**

4.2.3 Total Savings from Energy Efficiency Organizations

As noted in Section 4.2.1, TRC estimates a 34% incremental savings difference between TSL 3 and TSL 4. Figure 5 notes the total estimate of energy efficiency organizations relative contribution to the standard development process at 43%. To estimate savings from energy efficiency organizations, TRC multiplied the energy savings from activities supporting the standard development process (34%) by the estimate of energy efficiency organizations' influence in the standard development process (43%), to calculate that 15% of total energy savings from the activities shown in Figure 5. **Thus, TRC calculated that all energy efficiency organizations' comments and influence resulted in 15% of total savings from the standard.**

Because DOE calculated the 30 year savings from TSL 4 was 3.994 quads, TRC estimates that savings from all efficiency organizations is 15% x 3.994 quads = 0.6 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: NEEA and many of the other energy efficiency organizations submitted joint comments, which the docket references (in addition to comments by 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. However, TRC notes that:
  - NEEA led the joint comments with NPCC on the test procedure; these comments, along with comments from other energy efficiency organizations, had a significant impact on the final test procedure.
  - NEEA-funded studies contributed 18% of the ESP measurements that DOE used to develop its ESP assumptions
  - Almost all of the efficiency organizations' influence for assumptions regarding continuous-circulation mode operating hours was due to CEE's efforts collecting data on this topic.
- One energy efficiency organization interviewed believes DOE was heading in the right direction with this standard and reported their "focus to a large extent was to support

DOE's analysis and proposals to make sure they would end up in a good final standard, as well as trying to suggest where we could make improvements to the analysis."[1]

[1] A NEEA staff member disagreed with this assessment, and believed that the DOE's original direction needed considerable refinement.

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 significant role, particularly in the development of the test procedure. In addition, the efficiency organizations helped DOE maintain the originally proposed TSL 4.

Overall, TRC estimates that 15% of energy savings came from the energy efficiency organizations' role in the RFF standard development and rulemaking process.

6 APPENDICES

6.1 Current Logic Model

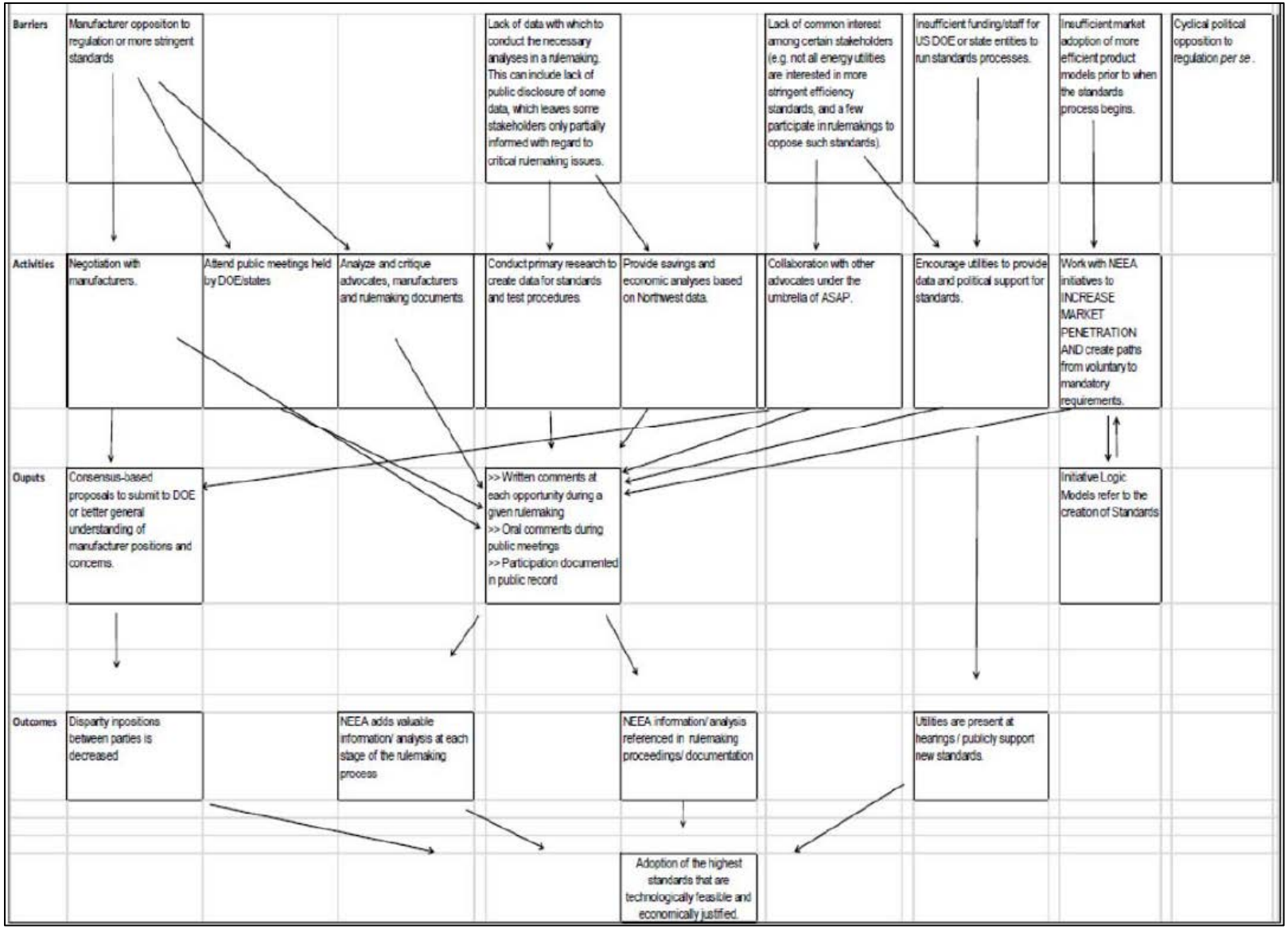
Figure 6 shows the logic model that NEEA developed for its standards development activities. NEEA adapts its activities to suit the specific needs for each particular standard.

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 barrier as part of the barrier, “manufacturer opposition”.

Figure 6. 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 applicable to this standard – Manufacturer opposition, and Lack of data – and added a third barrier based on the specifics of this standard: Lack of accurate test procedure and metric.

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. Manufacturers argued TSL 4 was not economically or technologically feasible. Some manufacturers expressed support for TSL 1 or TSL 2. To counter manufacturers' arguments, DOE had to conduct significant investigations into the costs, energy impacts, and product availability of each efficiency level it considered (as described in Section 4.2.1)

In the final rule, DOE ultimately adopted TSL 4, citing the higher net benefit to consumers compared to net cost for all considered product classes.

TRC ranked this barrier as "High", given the considerable discussion between DOE and stakeholders regarding efficiency level.

Barrier 2: Lack of data availability and accuracy

Significance: Medium

Rationale and Findings: The DOE faced significant challenges due to a lack of data, particularly for developing the test procedure. The gaps included a lack of field data for which to develop assumptions regarding ESP values to accurately reflect field conditions, and a lack of data for average run-time hours for furnace fans in constant-circulation mode. In the absence of data, manufacturers pushed for assumptions that would lead to lower energy savings – such as lower ESP assumptions.

TRC ranked this barrier as "Medium", because the data gaps were significant, but slightly less of a barrier compared with "Manufacturer opposition to regulation or more stringent standard".

Barrier 3: Lack of Accurate Test Procedure and Metric

Significance: Medium

Rationale and Findings: Because this was the first federal standard to regulate residential furnace fans, DOE did not have an existing test procedure for furnace fans. There was also significant discussion among the stakeholders regarding which standard in the market the DOE should use as a starting point (e.g., AMCA 210, ASHRAE 37, or a test procedure developed by AHRI). In addition, DOE developed the test procedure concurrently with the standard. Various stakeholders commented that this schedule resulted in a lack of opportunity to review the final test procedure.

TRC ranked this barrier as medium, because it was a significant obstacle to adoption. In order for DOE to progress with the standard setting process – including proposing a TSL for adoption – DOE needed to develop a test procedure (and test metric) that stakeholders felt was reasonably accurate. However, similar to the "Lack of Data", TRC viewed "Lack of accurate test procedure and Metric" as slightly less of a barrier compared with "Manufacturer opposition to regulation or more stringent standard".

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

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

Relative Effectiveness to Address Barrier: Low

Rationale and Findings: Energy efficiency organizations supported the selection of DOE's proposed trial standard level (TSL 4), citing the limited impact on furnace fan manufacturers, positive benefits to consumers, and substantial energy savings. DOE adopted TSL 4. DOE cited the higher net benefit to consumers compared to net cost for all considered product classes.

TRC noted energy efficiency organizations impact as "low" since DOE adopted TSL 4 in the final rule as originally proposed. In addition, the energy efficiency organizations provided general support, rather than data, for the proposed TSL. Energy efficiency did however help DOE maintain its position against manufacturer opposition.

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

Barrier 2, Activity 1: Conducted studies (prior to rulemaking) and submitted comments and supporting DOE's ESP assumptions.

Relative Effectiveness to Address Barrier: Medium / High

Rationale and Findings: As DOE states in the NOPR, "External static pressure [ESP] means the difference between the fan total pressure at the air outlet and the total pressure at the air inlet less velocity pressure at the air outlet of an HVAC product containing a furnace fan when operating and installed in accordance with the manufacturer's instructions." ESP is important because, as stated in the final rule, "The power

consumption (and overall efficiency) of a furnace fan depends on the speed at which the motor operates, the external static pressure difference across the fan, and the airflow through the fan."

As part of developing the test procedure, DOE needed to determine an appropriate distribution of ESP values. DOE used field data from various published studies to determine appropriate ESP values. As described in Appendix 7B of the TSD, DOE compiled 1,348 measurements from 27 studies, and three of these studies (comprising 288 measurements – or 21% of the total) were funded by energy efficiency organizations that later provided comment on the RFF standard. Specifically:

- Southern California Edison (SCE, another energy efficiency organization) funded one study that provided 40 measurements[8]:
- NEEA was the sole funder for one study that provided 148 measurements[9]
- NEEA and two other organizations funded one study that provided 100 measurements[10]

The remaining 24 studies (and 1,060 measurements) were primarily studies done for power companies, utilities (that were not the California IOUs), government agencies, or other organizations that did not provide efficiency advocacy to DOE for this standard.

Based on the studies, the DOE developed ESP assumptions: 0.5 in. w.c. for units with an internal evaporator coil, 0.65 in. w.c. for units designed to be paired with an evaporator coil, and 0.3 in. w.c. for units designed to be installed in a mobile home. These assumptions were significantly higher than the 0.2 - 0.3 in. w.c. assumptions recommended by manufacturers (Rheem, Morrison, and Mortex).

In addition, after DOE provided their ESP assumptions, NEEA stated that their field measurements of ESP for the past 40 years are consistent with DOE's analysis. This helped DOE maintain its proposed ESP values.

Because ESP has a significant impact on energy use, and the energy efficiency organizations provided approximately one-fifth of the measurements that DOE used to develop ESP values, TRC ranked this activity as Medium / High.

Barrier 2, Activity 2: Lack of data supporting constant-circulation mode assumptions

[8] Proctor, J. P., M. Blasnik and T.D. Downey, California Edison Coachella Valley Duct and HVAC Retrofit Efficiency Improvements Pilot Project, 1995. Southern California Edison Company. San Dimas, CA

[9] Baylon, D., S. Strand, B. Davis, D. Robison, and E. Kruse, Analysis of Heat Pump Installation Practices and Performance: Market Research Report, 2005. Northwest Energy Efficiency Alliance.

[10] Davis, B. a. D. B., Summary of SGC Manufactured Home Field Data (2001-02 Sitings), February 2004. Prepared for Northwest Energy Efficient Manufactured Homes (ODOE), Northwest Energy Efficiency Alliance, Idaho Department of Water Resources, Energy Division

Relative Effectiveness to Address Barrier: Medium

Rationale and Findings: The DOE developed a FER that weights the efficiency of the furnace fan in three modes: heating, cooling, and constant circulation[11], based on operating hours under each mode. As described below, using data that included results from an efficiency advocate (Center for Energy and the Environment - CEE), DOE estimated that on average, consumers operate furnace fans in constant-circulation mode 400 hours annually. DOE used this result to weight fan constant-circulation electrical energy consumption in the FER equation.

As described in section 7.5.3 of the RFF TSD, to develop the assumption of hours of operation under constant-circulation mode, DOE used data from a survey conducted in Minnesota by CEE, and a survey conducted in Wisconsin by an entity that was not an efficiency advocate. Because the studies collected data in northern states, DOE did not use these data directly. DOE developed regional fractions that took into account information from manufacturer product literature and regional climate conditions. For example, because furnace fan literature states that constant circulation fan operation is not recommended for humid climates DOE assumed that the fraction of systems using constant circulation in the South Hot Humid region would be 10 percent of what was reported in the Wisconsin and Minnesota studies.

In addition, after DOE released its NOPR that provided the assumption of 400 hours per year for constant-circulation mode, NEEA and NPCC commented that 400 hr/year was too low, countering arguments from other stakeholders that 400 hrs/year was too high.

In its Final Rule, DOE stated that "excluding this mode from the rating metric would underestimate the potential efficiency improvements of technology options, such as BPM motors, that could reduce fan electrical consumption while performing this function." Because DOE used data from an efficiency advocate to develop constant circulation run-time hour assumptions, and this mode has a significant impact on electrical consumption, TRC ranked this activity as Medium.

Activities to Address Barrier 3: Lack of Accurate Test Standard and Metric

Barrier 3, Activity 1: Recommended that DOE regulated air handlers (not furnace fans), use ASHRAE 37 (instead of AMCA 210), and extend comment period

Relative Effectiveness to Address Barrier: Medium

Rationale and Findings: DOE originally proposed Air Movement and Control Association (AMCA) Standard 210 as the test procedure in the NOPR. Manufacturers, NEEA, and others argued that AMCA was an inappropriate test procedure, and that DOE should regulate air handlers (not furnace fans). For example, as stated in the SNOPR, NEEA (represented by Adjuvant Consulting) stated that "testing air handlers is

[11] The DOE defines constant circulation mode as "Constant circulation is the mode in which the furnace fan circulates air continuously but the HVAC product does not condition (heat or cool) the air" (RFF TSD p. 3-31).

more difficult than DOE's proposal depicts because of the necessity to specify appurtenances and other issues like cabinet leakage".

In response, DOE stated in the SNOPR that it "agrees with interested parties that furnace fans should be tested in a laboratory and as factory-installed in the HVAC product with which it is integrated (i.e., in-situ) to account for the impacts of airflow path design on furnace fan performance. In the NOPR, DOE included language in the proposed regulatory text that specified that furnace fans be tested in-situ... DOE recognizes that the preamble language of the NOPR may not have been clear in this regard." TRC's interpretation is that DOE had always intended to require that furnace fans be tested in-situ, and provided clarifying language to this effect in the final test procedure.

In addition, NEEA and others argued that ASHRAE 37 was a more appropriate procedure than AMCA 210. Manufacturers, led by AHRI, proposed an alternative method. In the SNOPR, DOE abandoned AMCA 210 and adopted the AHRI test method with modifications.

NEEA and the Northwest Power & Conservation Council (NPCC) provided comments that there is a need for product testing using the final test procedure. Energy efficiency organizations and manufacturers both argued to extend the comment period to reduce manufacturer opposition and allow testing. DOE extended the NOPR comment period for 30 days for to allow more time for stakeholders to review the finalized test procedure.

Because DOE reported it had always intended that furnace fans be tested in-situ, and the 30-day comment period extension was a minor outcome, TRC believes that the comments that had the largest impact were those that encouraged DOE to adopt an alternative test procedure (instead of AMCA 210). TRC ranks this activity as Medium. However, both manufacturers and energy efficiency organizations steered DOE away from AMCA 210, and the DOE ultimately followed manufacturers' recommendation (with modifications) to adopt the AHRI method. Consequently, TRC views the energy efficiency organizations as playing a Minor role, with manufacturers serving as the Primary contributor to this activity.

Barrier 3, Activity 2: Submitted written comment on accuracy of proposed FER for constant torque brushless permanent magnet motors with multi-staging controls.

Relative Effectiveness to Address Barrier: Very Low

Rationale and Findings: Several energy efficiency organization (ASAP, ASE, NCLC, NRDC, CA IOUs) submitted joint comments recommending that DOE conduct additional testing of furnace fans with constant-torque brushless permanent magnet (BPM) motors with multi-staging controls to verify the accuracy of the proposed FER standard level equations, and to ensure that the majority of products containing constant-torque BPM motors with multi-staging controls met the standard.

DOE made no changes in their proposed FER equations for this equipment. However, DOE noted they assessed efficiency level (EL-4) for constant torque BPM motor and multi-staging and found that 90% of products met EL 4, indicating that the final rule efficiency levels are accurate and reflect performance of actual technologies. This likely reduced manufacturer opposition to this portion of the test procedure. Although the DOE's FER equations did not change, DOE's increased its technical support for analysis for this equipment (conducted in response to the efficiency organizations' comment). Because this helped DOE

maintain its position on this issue, TRC rated this influence as positive but slight, and ranked this activity as "very low". Note that the results of the additional analysis may have more broadly helped DOE maintain its position to adopt TSL 4; however, TRC already accounts for this activity in Barrier 1, Activity 1, so we do not account for it here (to avoid double-counting savings).

Also, TRC identified the energy efficiency organizations' role as "Primary", because manufacturers made comments on this topic, which may have also influenced the DOE to conduct additional testing.

Barrier 3, Activity 3: Supported inclusion of modular blowers, and recommended inclusion of blower units in heat pumps (HPs) and central air conditioners (CACs)

Relative Effectiveness to Address Barrier: Very Low

Rationale and Findings: Energy efficiency organizations submitted joint comment expressing support for the inclusion of modular blowers in the scope of coverage. Manufacturers argued against their inclusion.

As described in the docket, "efficiency advocates expressed concern at DOE's exclusion of packaged and split-system CAC products because advocates believe current standards for these products do not maximize the technologically feasible and economically justified energy savings for the circulation fans integrated in these products. ASAP and Adjuvant [NEEA] stated that the metric used for CAC products does not accurately represent field conditions and requested that they be added to the scope" (Final Rule p. 38145). NEEA argued the DOE was only covering two-thirds of furnace fan products by excluding split system heat pump and air conditioning systems.

In the final rule, DOE made no change to the scope based on these comments. "The DOE test procedure for furnace fans is not currently equipped to address fans contained in central air conditioners, heat pumps, or other products, as would be required for the adoption of standards under 42 U.S.C. 6295(o)(3). Consequently, DOE is not considering standard setting for other products beyond the current scope of the rulemaking at this time" (Final Rule p. 38149).

Although energy efficiency organizations did not succeed in including fans in heat pumps and central air conditioners in the scope, TRC rated energy efficiency organizations' effectiveness to address this barrier as positive but slight – rating the effectiveness as "very low" because their support only resulted in modular blowers remaining as part of the standard. This support helped DOE maintain its position despite manufacturer arguments for excluding modular blowers. Based on DOE savings analysis, modular blower fans product classes comprise 6% of total savings from the standard. Because this is a small contribution to total savings, and the efficiency organizations only helped DOE maintain its position (rather than expanding the scope), TRC ranked this activity as "very low".

Note that TRC grouped this activity under the barrier "Lack of Accurate Test Procedure and Metric" because DOE's rationale for excluding fans in HPs and CAC was that the test procedure was not equipped to cover that equipment.

6.2.3 Activities that Did Not Influence the RFF 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.

Recommended three year compliance period

DOE proposed a five year compliance data in the Notice of Proposed Rulemaking. Energy efficiency organizations supported a three year compliance date, stating that the technologies assumed to be required to meet TSL 4 are well-established in the market and commercially available. DOE adopted a five year compliance date in the final rule. DOE acknowledged that complying with the standard would require research and development by manufacturers, so DOE extended compliance period accordingly. TRC rated the energy efficiency organizations' activities as "none", because the DOE maintained its original compliance data of five years.

Commented that definition of residential furnace fan should be "whole system"

Energy efficiency organizations argued the ruling should not have component level regulations. The California Investor Owned Utilities (CA IOUs) suggested that the DOE should define furnace fan as "a unit consisting of a fan motor, its controls, an impeller, shroud, and cabinet that houses all of the heat exchange material for the furnace" (Final Rule p. 38145). In the final rule, DOE made no change in its definition. DOE interpreted its statutory mandate by defining "furnace fan" to include "any electrically-powered device used in residential HVAC products to circulate air through duct work" (Final Rule p. 38145). Although TRC found that this particular comment did not have an impact, TRC did identify influence from comments provided by NEEA and other efficiency organizations that the RFF should regulate air handlers (rather than furnace fans), as described in Barrier 3 Activity 1.

Recommended that fan housing design be included as a design option

The Appliance Standards Awareness Project (ASAP) cited a 2003 General Electric study that quantified energy savings produced by modifying fan housing as justification for its inclusion as a design option. The American Council for an Energy-Efficient Economy (ACEEE) cited a Lawrence Berkeley National Laboratory (LBNL) study that linked changes in efficiency to modifying the clearance between fan housing and an air handler cabinet wall.

The RFF final rule and TSD shows that DOE included fan housing design in the initial screening analysis, in part because of comments from energy efficiency organizations. However, DOE ultimately did not include fan housing design as a technology assumption. From RFF TSD Section 4.2: "DOE investigated housing design modifications during its teardown analysis. DOE found that housing designs did not vary dramatically between baseline and higher efficiency models or across manufacturers. In addition, DOE found no quantitative data correlating specific housing design modifications with efficiency improvements. Manufacturers also estimated that housing improvements would have very little effect on fan efficiency during manufacturer interviews. Additionally, many of the housing design modifications listed by manufacturers would increase HVAC product size. Any increase in product size would cause adverse

impacts on practicability to install and consumer utility because the furnace fan market is predominantly a replacement market." Consequently, as stated in RFF TSD section 4.2, "DOE eliminated the following technology options for residential furnace fans from further consideration: housing design modifications and airflow path design." Since DOE did not include housing design modifications in its final energy analysis, TRC concludes the comments made from the energy efficiency organizations on this topic ultimately made no impact on energy savings.

6.2.4 Activities for Previous Standards that Indirectly Affected the RFF Standard

NEEA and other energy efficiency organizations provided support for previous standards that influenced the test procedure for the RFF standard.

Specifically, the RFF TSD references the DOE test procedure for cooling, and the DOE test procedure for residential furnace standards, both of which the energy efficiency organizations (including NEEA) influenced through comments. The RFF TSD states that, "To align the proposed furnace fan test procedure with the DOE test procedure for residential furnaces, DOE incorporated by reference specific provisions from American National Standards Institute (ANSI)/ American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) 103 previously incorporated by reference in its furnace test procedure…The specific provisions that DOE proposed to incorporate include definitions, test setup and equipment, and procedures for measuring combustion efficiency." Because NEEA and other energy efficiency organizations provided comments on the residential furnace test procedure, these comments indirectly affected the RFF test procedure.

Although comments from NEEA and other energy efficiency organizations on previous test procedures influenced the RFF test procedure, the effect of these comments is indirect. Consequently, TRC views the savings from comments made on previous standards to be outside of the scope of savings that we can credit to energy efficiency organizations for the RFF standard. (As a side note, to estimate savings from comments made on previous test procedures, TRC would need to evaluate the influence that the energy efficiency organizations had on the specific elements pulled from those procedures - i.e., definitions, test set up and equipment, and procedures for measuring combustion efficiency, which would be akin to conducting another evaluation.) While the energy efficiency organizations' comments on previous standards likely contributed to savings in the RFF, TRC did not quantify their impact on the RFF because these influences were indirect.