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## Air Compressors Standard Evaluation

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# Executive Summary

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The Northwest Energy Efficiency Alliance (NEEA) contracted with Michaels Energy (the evaluation team) to conduct an independent evaluation to:

1. Assess NEEA and its partner organizations' influence on the federal standards, for commercial and industrial air compressors, documented in Docket EERE-2013-BT-STD-0040.
2. Estimate the proportion of total energy savings from the standards that resulted from NEEA and its partners' influence.

The NEEA Codes and Standards team supports standards development for various product classes. The NEEA Codes and Standards team tracks their efforts throughout the standards development process and identifies which standards have the highest potential for energy savings. Independent contractors conduct evaluations to assess NEEA and its partners' efforts and their overall influence on the adoption of the standards.

This analysis pertains to the Notice of Proposed Rulemaking (NOPR) published on May 19, 2016,<sup>1</sup> through which the U.S. Department of Energy (DOE) proposed new energy conservation standards for air compressors. The Final Rule, published in the Federal Register on January 10, 2020, adopted the first energy conservation standards that applies to certain rotary air compressors manufactured in, or imported into, the U.S.<sup>2</sup> Compliance with the standards is required on and after January 10, 2025.

The evaluation team identified the following efficiency organizations as NEEA partners:<sup>3</sup>

- Appliance Standards Awareness Project (ASAP)
- Alliance to Save Energy (ASE)
- American Council for an Energy Efficient Economy (ACEEE)
- Natural Resources Defense Council (NRDC)
- Northeast Energy Efficiency Partnership (NEEP)
- Northwest Power & Conservation Council (NWPPCC)
- Edison Electric Institute (EEI)

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<sup>1</sup> 81 FR 38398

<sup>2</sup> 85 FR 1378

<sup>3</sup> For the purpose of this evaluation, we define a NEEA partner as an organization that meets the following criteria:

- |  |     |   |
|--|-----|---|
| 1) Having a shared goal to influence the adoption of the standards | and | 2) Had direct and intentional communication with NEEA about the standards (emails, meetings, documented conversations, etc.).                                 |
|  |     | or  |
|  |     | 3) Had taken specific actions with NEEA to influence the standards (submitted joint comments, commissioned a study, spoke at meetings, press releases, etc.). |

To evaluate NEEA and its partners' influence on the standards, Michaels Energy reviewed DOE's analyses and comments submitted by interested parties to the air compressor standards rulemaking (Docket EERE-2013-BT-STD-0040) and the rulemaking to establish air compressor test procedure (Docket EERE-2014-BT-TP-0054). The evaluation team also interviewed interested parties who participated in the rulemaking process; however, this aspect of the evaluation was constrained by the lengthy time lapse between the close of the NOPR (December 2016) and this evaluation and respondents' lack of recall.

In addition, the evaluation team identified two manufacturers and a prominent trade organization that NEEA engaged with throughout the test procedure and standards rulemakings. While not partners, per se, because they supported different positions on some aspects of DOE's proposed standards, they shared a common goal to adopt standards and had direct and intentional engagement with NEEA staff regarding the rulemaking.

The evaluation team identified three barriers to the adoption of the most stringent standard:

**Manufacturer opposition to regulation or more stringent standards** centered on the perceived burden of the standards imposed on small original equipment manufacturers (OEMs) that faced steep redesign costs, limited capital access, and higher borrowing rates compared to larger competitors. Concerns about technological approaches and capacity thresholds creating unfair advantages at the low and high ends of the capacity (horsepower) range had fueled broader industry resistance. Some interested parties sought exemptions for packagers, citing minimal control over efficiency. In its comments submitted to the docket, the Compressed Air Gas Institute (CAGI) argued for excluding reciprocating compressors altogether due to low sales volumes, limited cost-effective savings opportunities, and the potential for market fragmentation.

**Lack of data to conduct the necessary analysis** for the rulemaking also emerged as a significant barrier. While ASAP and NEEA pointed to shipment data showing heavy energy use by reciprocating compressors, DOE found that the absence of detailed performance and market data for this equipment class prevented it from justifying new standards economically. CAGI's comments in the docket stated that compiling the requested information for compressors above 200 hp would have required substantial time and resources and might still have missed models from non-member manufacturers, leaving DOE's dataset incomplete. Because of the lack of reliable data, especially for under-15 hp units for which testing was rare and inconsistent, DOE excluded reciprocating (engine-driven) compressors and declined to base its regulation on the European Union's (EUs) Ecodesign Lot 31 approach that included reciprocating compressors, due to insufficient publicly available information.<sup>4</sup>

**Lack of common interest among stakeholders** posed only a minor barrier during the air compressor rulemaking, largely because it was proactively addressed early in the rulemaking process by NEEA staff. Recognizing the potential for misalignment across industry and advocacy

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<sup>4</sup> According to the Final TSD (p.3-32), the EU Ecodesign and Energy Labelling directive established a framework under which manufacturers of energy-using products are obligated to reduce the energy consumption and other negative environmental impacts. This directive grouped products into "lots," and compressors are included in Lot 31. The regulation had not been adopted at the time of the U.S. federal standards rulemaking.

groups, NEEA took deliberate steps to facilitate early coordination and build consensus, as participants were aligned in getting the standards correct to the best of their abilities. NEEA staff noted that the rulemaking process ran smoothly because parties agreed on key issues. Efficient organizations, including NEEA, ACEEE, NRDC, NEEP, and ASE, joined together to submit unified comments on equipment classes, substitution risks, and global regulatory alignment. This collaborative spirit minimized conflict, reduced the need for DOE intervention, and helped ensure the standard's successful development.

The evaluation team identified the following activities by NEEA and its partners to influence the test procedure and standards:

- Negotiated and collaborated with manufacturers
- Attended and made oral comments in all public meetings
- Examined DOE's analysis and documents for the test procedure and standards rulemakings and submitted written comments
- Provided Northwest-specific data for DOE's analysis

The evaluation team concludes that these activities were somewhat effective in addressing manufacturer opposition and influencing the outcome of the adopted standards. DOE adopted some but not all of NEEA and its partners' recommendations and ultimately adopted TSL 2 instead of TSL 3. Further, NEEA and its partners' efforts did not directly address some of the key points of the lack of data availability to expand the scope of the standards and did not provide data or research to substantiate the adoption of TSL 3.

**The evaluation team estimates that the total share of savings influenced by NEEA and its partners' activities associated with the adoption of the air compressor standards is 12%.**

# 1 Introduction

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## 1.1 Purpose of Study

NEEA's Codes and Standards team supports the development and adoption of efficiency standards and test procedures by advocating for the most stringent, technologically feasible, and economically justified standards to maximize energy savings.

This report presents the independent evaluation of NEEA and its partners' efforts to influence the inaugural federal minimum energy efficiency standards and test procedure for commercial and industrial (C&I) air compressors. This evaluation pertains to the Notice of Proposed Rulemaking (NOPR) published on May 19, 2015.<sup>5</sup> The Final Rule (published in the Federal Register on January 10, 2020) adopted standards for lubricated rotary air compressors between 10 hp and 200 hp, which are used almost exclusively in industrial facilities.<sup>6</sup> Other types of compressors, such as reciprocating, centrifugal compressors, and lubricant-free compressors were excluded from the standards.

This study assessed the influence of NEEA and its partner organizations on the adopted test procedure and standards and estimated the share of savings influenced by their efforts. The evaluation team investigated the challenges and barriers to adopting the most stringent, technologically feasible, and economically justified standards and conducted two assessments:

1. A qualitative assessment of NEEA and its partners' influence on the standards using NEEA's Standards Logic Model as a framework, and
2. A quantitative determination of the proportion of total energy savings from the standards that resulted from NEEA and its partners' influence.

This report summarizes the evaluation team's assessment, including 1) the barriers to the most stringent, technologically feasible, and economically justified standards,<sup>7</sup> 2) the effectiveness of the activities of NEEA and its partners during the rulemaking in overcoming the identified barriers, and 3) the role of NEEA and its partners in each identified activity relative to other stakeholders.

## 1.2 Federal Standards Procedural History

This section summarizes the history of the air compressor test procedure and energy conservation standards rulemakings (Figure 1). While the focus of this study is the influence of activities pertaining to the energy conservation standards (Docket EERE-2013-BT-STD-0040), the evaluation team expanded the scope to include the test procedure rulemaking (Docket EERE-2014-BT-TP-0054). Including the test procedure rulemaking was important for the following reasons:

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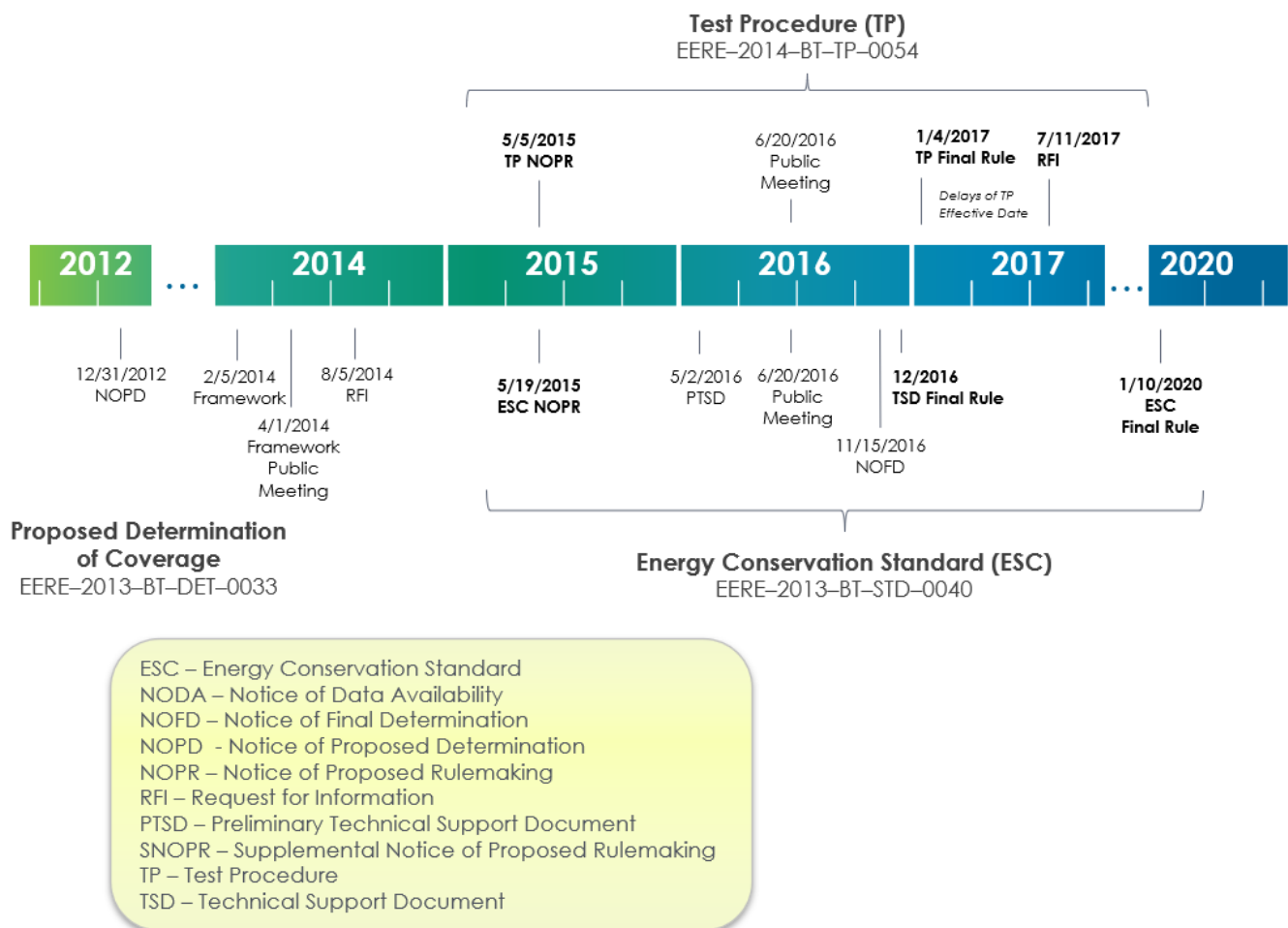
<sup>5</sup> 81 FR 31680

<sup>6</sup> 85 FR 1504

<sup>7</sup> It is important to note that barriers to the adoption of standards are distinctly different from market barriers that market transformation programs are intended to address. The NEEA Standards Logic Model represents the rationale of activities and the intended outcomes of NEEA's investment in influencing codes and standards and serves as the framework for evaluation.

1. Test procedure rulemakings, in general, define the products and product classes to be covered and address many technical issues and questions regarding the measurement of energy use that are fundamental (and required) for establishing energy conservation standards. Including the test procedure in the analysis ensured the evaluation was comprehensive and considered all of NEEA and its partners' involvement.
2. The first adopted test procedure and standards will serve as the starting point for future amendments and therefore could have considerable influence on savings from subsequent standards.
3. As shown in Figure 1, the test procedure and energy conservation standards rulemakings overlapped, which is atypical of DOE's process to develop federal energy conservation standards. DOE's typical process is to adopt a test procedure prior to issuing a NOPR for energy conservation standards. In the Final Rule, DOE explains "DOE believed this action was appropriate in this specific instance because DOE was proposing a commonly used industry test procedure methodology with few modifications."<sup>8</sup>

Figure 1. Air Compressor Test Procedure and Federal Standards Procedural History



<sup>8</sup> 85 FR 1510



## Federal Energy Conservation Standards Rulemaking

**Notice of Proposed Determination (NOPD, 12/31/2012):**<sup>9</sup> DOE issued the proposed NOPD to classify air compressors as consumer products covered under the Energy Policy and Conservation Act of 1975 (EPCA).<sup>10</sup> This is the first milestone in the process to develop energy conservation standards for a new covered product. The NOPD presented DOE's proposed proposal to establish the scope of products that would be subject to the standards.

**Notice of Final Determination (NOFD, 11/15/2016):**<sup>11</sup> DOE issued the NOFD that determined that air compressors met the criteria to be a covered product under EPCA. This NOFD finalized the definition of a compressor as:

*"a machine or apparatus that converts different types of energy into the potential energy of gas pressure for displacement and compression of gaseous media to any higher pressure values above atmospheric pressure and has a pressure ratio at full-load operating pressure greater than 1.3."*<sup>12</sup>

**Framework (2/5/2014):**<sup>13</sup> DOE published the Framework that outlined potential standard and test procedure for air compressors. DOE held a public meeting on April 1, 2014, to discuss and solicit comment on the Framework.

**Preliminary Technical Support Document (PTSD, 5/2016):**<sup>14</sup> The PTSD presents the methodology and results of DOE's preliminary technical analysis and the potential efficiency levels to consider for the air compressor standards. DOE solicited comments on the PTSD from interested parties through written comments and from a public meeting held on June 20, 2016.

**Notice of Proposed Rulemaking (NOPR) for Energy Conservation Standards (5/19/2016):**<sup>15</sup> DOE issued the NOPR that proposed new standards for certain air compressors. DOE solicited input from interested parties through written comments and from a public meeting held on June 20, 2016.

**TSD Final Rule (12/2016):**<sup>16</sup> After receiving comments and collecting additional information, DOE revised its analysis to establish the standards. This is the final TSD upon which the adopted standards are based. This TSD documents DOE's ruling to adopt TSL 2 as the standards.

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<sup>9</sup> 77 FR 76972

<sup>10</sup> 42 U.S.C. 6291–6309

<sup>11</sup> 81 FR 79991

<sup>12</sup> 81 FR 79998

<sup>13</sup> 79 FR 6839

<sup>14</sup> U.S. Department of Energy (2015, May). *Technical Support Document: Energy Efficiency Program for Consumer Products and Commercial and Industrial Equipment: Air Compressors*.

<sup>15</sup> 81 FR 31680

<sup>16</sup> U.S. Department of Energy (2016, December). *Technical Support Document: Energy Efficiency Program for Consumer Products and Commercial and Industrial Equipment: Air Compressors*.

**Energy Conservation Standards Final Rule (1/10/2020):**<sup>17</sup> This Final Rule, published in the Federal Register, established the energy conservation standards for certain commercial and industrial air compressors. The compliance date of the published standards is January 10, 2025.

The duration of time between the TSD Final Rule and the Energy Conservation Standards Final Rule is worth highlighting. The Energy Conservation Standards Final Rule was published as the result of legal action against DOE for its failure to publish the adopted standards in the Federal Register after the 45-day error correction period after finalizing the standards in December 2016. After the error correction period expired in early 2017 and DOE failed to publish the standards, a coalition led by the Natural Resources Defense Council (NRDC) issued a 60-day “Notice of Intent to Sue.” DOE did not heed the notice, and the coalition filed a suit against DOE on June 13, 2017. A separate lawsuit was also filed by a coalition of 11 states, led by the Attorneys General for California and New York. The Energy Conservation Standards Final Rule was published in the Federal Register five years after the TSD Final Rule in response to a court order.<sup>18</sup>

## Federal Test Procedure Rulemaking

**NOPR for Test Procedure (5/5/2016):**<sup>19</sup> DOE issued the NOPR through which it proposed test procedure for air compressors. DOE held a public meeting on June 20, 2016, to present the proposed test procedure and solicit comments.

**Final Rule for Test Procedure (1/4/2017):**<sup>20</sup> This Final Rule adopted the new air compressor test procedure. This Final Rule established package isentropic efficiency as the applicable energy metric for compressors.

After publishing this Final Rule, however, several parties protested and identified areas in need of clarification relating to the economic burden and costs of implementing the test procedure, among other things. DOE postponed the effective date through multiple rulings,<sup>21</sup> and on July 22, 2017, DOE issued a Request for Information (RFI) to solicit additional data and information regarding the compressor test procedure. DOE also delayed enforcement of the test procedure until December 30, 2017.<sup>22</sup>

## Summary of the Adopted Federal Standards

The Final TSD presents DOE's technical analyses and results supporting the adopted federal air compressor standards. The standards are based upon the package isentropic efficiency metric, which represents “the ratio of the theoretical isentropic power required for a compression process to the actual power required for the same process.”<sup>23</sup>

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<sup>17</sup> 85 FR 1504

<sup>18</sup> 85 FR 1378

<sup>19</sup> 81 FR 27219

<sup>20</sup> 82 FR 1052

<sup>21</sup> 82 FR 8985, 82 FR 14426

<sup>22</sup> 82 FR 31890

<sup>23</sup> U.S. Department of Energy (2016, December). *Technical Support Document: Energy Efficiency Program for Consumer Products and Commercial and Industrial Equipment: Air Compressors*.

The TSD designated four equipment classes and technology options for increasing air compressor efficiency that DOE included in its engineering analysis to define efficiency levels (ELs) considered for the standards (Table 1).

Table 1. Air Compressor Equipment Classes

Compressor Type	Lubrication Type	Cooling Method	Driver Type	Motor Phase	Class Designation
Rotary	Lubricated	Air-cooled	Fixed speed	Three-phase	RP_FS_L_AC
		Liquid-cooled			RP_FS_L_WC
		Air-cooled	Variable speed		RP_VS_L_AC
		Liquid-cooled			RP_VS_L_WC

Source: U.S. Department of Energy (2016, December). *Technical Support Document: Energy Efficiency Program for Consumer Products and Commercial and Industrial Equipment: Air Compressors*. Table 3.4.1.

For each equipment class, DOE assessed energy efficiency improvements resulting from a package redesign. DOE's analysis defined six incremental ELs for each equipment class according to a d-value, defined as:

*"a percentage improvement from the regression curve to theoretical 100 percent isentropic efficiency. A d-value of 100 would generate an efficiency level at 100 percent isentropic efficiency for all full-load actual volume flow rates. Alternatively, a d-value of 50 would generate a regulation curve that falls halfway between the regression curve and 100 percent isentropic efficiency for all full-load actual volume flow rates. This d-value represents the improvement of a product, expressed as the reduction of losses going from average (the regression curve) to 100 percent efficiency (theoretical)."*<sup>24</sup>

For each equipment class, DOE established "max-tech" (EL 6) and d-value of zero (EL 3), and two levels between baseline and EL3 and two levels between EL 3 and EL 6. Max-tech is the EL of the "maximum technologically feasible options that provides the maximum improvement in energy efficiency."<sup>25</sup> According to the TSD, air compressors "are considered mature products with the highest levels of attainable efficiency already present in the marketplace. As such, the max-tech configuration represents the highest efficiency equipment commonly available in the market."<sup>26</sup>

For all equipment classes, EL 3 corresponds to a d-value of zero and represents the mean efficiency available in the market. The numerical values for ELs 1, 2, 4, and 5 vary by equipment class.

In its Final Rule, DOE adopted TSL 2, which corresponds to EL 2 for each project class.

<sup>24</sup> Ibid. P. 5-19.

<sup>25</sup> Ibid. P. 5-20.

<sup>26</sup> Ibid. P. 5-20.

## 1.3 NEEA Partners

For this evaluation, the evaluation team defines a NEEA partner as an organization that meets the following criteria:

- |   |     |  |
|---|-----|--|
| 1) Had a shared goal to influence the standards | and | 2) Had direct and intentional communication with NEEA about the standards (emails, meetings, documented conversations, etc.).                            |
|   | or  | 3) Took specific actions with NEEA to influence the standards (submitted joint comments, commissioned a study, spoke at meetings, press releases, etc.). |

The evaluation team identified the following efficiency organizations as NEEA partners in the test procedure and energy conservation standards rulemakings:

- |         |         |
|---------|---------|
| • ASAP  | • NEEP  |
| • ASE   | • NWPCC |
| • ACEEE | • EEI   |
| • NRDC  |         |

In addition, NEEA and its partners engaged with two manufacturers and a prominent industry trade organization throughout the test procedure and standards rulemakings. While not partners, per se, because they supported different positions on some aspects of DOE's proposed standards, they shared a common goal to adopt the standards, and all had direct and intentional engagement with NEEA staff regarding the rulemaking. In-depth interview respondents emphasized the importance of these relationships during this rulemaking and to support future standards rulemakings.

## 1.4 Recent Developments

Since the Final Rule adopting the federal standards was published in January 2020, there have been recent procedural developments that could impact the test procedure and energy conservation standards of commercial and industrial air compressors.

In May 2022, DOE initiated a rulemaking (EERE-2022-BT-TP-0019) with an RFI to consider amending the test procedure for air compressors;<sup>27</sup> DOE issued a NOPR in February 2023.<sup>28</sup> A Final Rule to amend the test procedure was published on January 17, 2025. DOE subsequently published a rule delaying the effective date of the test procedure amendment.

Most significantly, however, on May 12, 2025, DOE issued a proposal for the withdrawal of the determination of air compressors as a covered equipment.<sup>29</sup> DOE held a public webinar on May 29, 2025, and is not expected to issue a ruling until after this evaluation report is published.

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<sup>27</sup> 87 FR 27025

<sup>28</sup> 88 FR 9199

<sup>29</sup> 90 FR 20849

## 1.5 State Standards

In general, once federal standards are established for a product, states cannot set their own standards for that product.<sup>30</sup> In the absence of federal standards for air compressors due to DOE delaying publishing the standards in 2017 and subsequent litigation (see 1.2 above), several states moved forward to establish energy conservation standards for air compressors. California, Colorado, Vermont, and Washington adopted the federal standards that were established in December 2016 Final Rule but not published to the Federal Register. By doing so, these states increased the minimum efficiency standards for air compressors during the period when the federal standard was delayed. The Washington State standards, in particular, apply to all compressors manufactured on or after January 1, 2022 through January 9, 2025.<sup>31</sup> The Washington state standards also require that manufacturers follow the federal test procedure effective on July 3, 2017.

Although out of scope of this evaluation, the influence of NEEA and its partners' efforts on the adopted federal standards, as described in this report, can be construed as influence on the Washington state standard, because the Washington State standard referenced the federal standard and test procedure.

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<sup>30</sup> 10 CFR §430.33

<sup>31</sup> WAC 194-24-185

## 2 Methodology

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This section describes the methodology used to evaluate NEEA and its partners' influence on the commercial and industrial air compressor federal standards. The data collection approach and its limitations are described first, followed by the methodologies for the qualitative and quantitative assessments.

### 2.1 Data Collection Approach

To estimate NEEA and its partners' share of savings associated with adopting the air compressor standards, the evaluation team reviewed documentation and comments on the docket and interviewed a sample of stakeholders who participated in the rulemaking process.

#### Document Review

The evaluation team reviewed the following documents associated with adopting the standards:

- Test procedure Final Rule
- TSD Final Rule
- Air Compressor Standards Final Rule
- Transcripts of public meetings for the test procedure and the standards rulemakings
- Written comments by interested parties submitted to the dockets for the test procedure and the standards rulemakings, as well as documents associated with the NOPD and Framework
- Other publicly available information relating to the standards
- Documentation provided by NEEA that is not publicly available

For each document reviewed, the evaluation team aimed to answer three key research questions: 1) Who were the main players, and what were their roles? 2) What were the challenges to developing and adopting the standards? 3) What activities did the organizations undertake to overcome these challenges?

The document review helped to identify major barriers to adopting the standards and activities conducted by NEEA and its partners to overcome these barriers. The information learned from the document review also informed the in-depth interviews.

#### In-depth Interviews

To understand perspectives of interested parties of the rulemakings, the evaluation team developed a purposive (that is, non-probability) interview sample based on the participation reflected in the dockets, primarily manufacturer associations and energy-efficiency organizations engaged in the standards rulemaking process. The sample was compiled from various sources, including the document review, public meeting attendee lists and transcripts, and recommendations from NEEA staff.

The sample included 57 individuals representing 40 companies and organizations. The 57 individuals in the sample were assigned a high, medium, or low priority based on their involvement in the rulemaking process and other documents provided by NEEA. Individuals in the high-priority group were contacted first. After a maximum of five unsuccessful outreach attempts, the evaluation team removed the individual from the sample.

As summarized in Table 2, the evaluation team completed interviews with five individuals from five different organizations. Table 3 summarizes the interviews according to the evaluation team's priority level assignment.

**Table 2. Completed In-depth Interviews**

Category	Count in Sample	Completed Interviews
Efficiency or environmental organization	19	4
Industry trade organization	7	0
Manufacturer, distributor, supply chain	18	0
Utility or other	13	1
<b>Total Individuals</b>	<b>57</b>	<b>5</b>
<b>Total Organizations</b>	<b>40</b>	<b>5</b>

**Table 3. Completed In-depth Interviews, by Priority**

Priority	Count in Sample	Completed Interviews
High	23	4
Medium	15	1
Low	19	0
<b>Total Individuals</b>	<b>57</b>	<b>5</b>

The in-depth interview guide included structured and unstructured questions to gather qualitative insights and quantitative ratings of barriers and NEEA activities identified in the document review. In-depth interviews enabled the evaluation team to explore topics raised by the respondent, gather contextual information, and ask clarifying questions.

## 2.2 Limitations

As with any evaluation, it is important to acknowledge the study limitations that might affect its results. The limitations associated with the in-depth interviews were the primary driver for the evaluation team to rely almost completely on the analysis of rulemaking documents for this evaluation.

**Interview sample.** It is important to acknowledge that nearly a decade has passed between when the air compressor standards were finalized (2016) and this evaluation effort (2025). This limited the evaluation team's ability to recruit respondents for in-depth interviews because many of the individuals have since retired or changed their employment and their current contact information could not be located.

Another factor is the lack of diversity of types of organizations represented in the completed interview sample. Representatives of manufacturers and industry trade associations would have provided an important perspective on the identification of barriers and the effectiveness of activities by NEEA and its partners. Because manufacturers and industry trade associations are not included in the completed interviews for this evaluation (because of nonresponse/refusal to participate, they have since retired or changed their employment, and/or their current contact information could not be located), that perspective is not reflected in the analysis.

Similarly, the interview sample is dominated by representatives of energy efficiency organizations that were NEEA partners, specifically. While their perspective is highly valuable, their recollections may not be representative of others who participated in the rulemakings.

**Interview respondent recall.** During the interviews, some respondents could not recall details to identify specific barriers and key issues raised through the test procedure or standards rulemakings, nor could they provide ratings of significance of barriers or the effectiveness of NEEA and its partners' activities.<sup>32</sup>

The information learned from the in-depth interviews provided valuable context for this evaluation. However, due to respondent lack of recall, the evaluation team relied almost completely on the document review for the quantitative analysis and share of savings computation. To minimize any researcher bias in the assessment of barrier significance or activity effectiveness, the evaluation approach included a validation process through which the qualitative and quantitative analyses were reviewed by a team member who was familiar with the Final Rule but not involved in the analysis.

## 2.3 Methodology to Assess NEEA and Partners' Influence

To determine NEEA and its partners' influence on the standards, the evaluation team used the NEEA Standards Initiative Logic Model (Appendix A) as a framework.

Through the document review, the evaluation team identified barriers in the logic model that were present in the air compressor standards development process. Additionally, the evaluation team identified activities undertaken by NEEA and its partners, then aligned each activity to one or more of the identified barriers. Finally, the evaluation team determined the extent to which those activities resulted in the outputs and outcomes shown in the logic model.

This qualitative assessment was primarily based on the detailed review of documents in the dockets. Due to a lack of recall of the interview respondents, information provided during in-depth interviews provided contextual information rather than specific details that supported the analysis.

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<sup>32</sup> To assist with recall, the evaluation team provided some respondents with comments they co-signed that were submitted to the docket prior to the scheduled interview.



## 2.4 Methodology to Estimate Share of Energy Savings from NEEA and Partners' Efforts

To quantitatively estimate the share of savings influenced by NEEA and its partners' activities, the evaluation team followed the framework developed by NEEA and its stakeholders, which has been used for past standards evaluations. This framework involves identifying barriers to the adoption of the most stringent, technologically feasible, and economically justified standards, then developing a quantitative estimate of the percentage of savings from the standards that each barrier represents; this is referred to as the barrier significance. Adjustment factors that account for the relative significance and effectiveness of activities in reducing each barrier and the role of NEEA and its partners in those activities are then applied to the barrier significance percentage to compute the share of savings influenced by NEEA and its partners.

The key inputs created through the framework to calculate the share of savings are:

- a. Significance of the Barrier
- b. Effectiveness and Significance of Activity in Addressing the Barrier
- c. Effectiveness of Activity Relative to All Relevant Barriers ( $= a \times b$ )
- d. NEEA and its Partners' Role in the Activity
- e. Relative Savings Influenced by the Activity ( $= c \times d$ )

Where:

$$a \times b = c \text{ and } c \times d = e$$

The steps the evaluation team took to develop these inputs and compute the share of savings are summarized below.

### Identify Barriers and Rate the Significance of Each Barrier

Through the document analysis, the evaluation team identified all barriers to adoption of the most stringent achievable standards, including the barriers not addressed by NEEA and its partners. All identified barriers aligned with the NEEA Standards Initiative Logic Model. Because most interview respondents could not comment on specific issues or opposition due to lack of recall, the evaluation team identified barriers as a result of the detailed document review. The list of barriers was validated by an evaluation team member who was familiar with the Final Rule but not involved in the analysis.

Based on the document analysis, the evaluation team then rated the significance of each barrier as “high,” “medium,” or “low” and a corresponding percentage to represent the significance of the energy savings associated with each barrier. The sum of the percentages of all barriers equals 100%.

Because ratings for barriers were not provided by interview respondents due to lack of recall, the evaluation team considered the following factors to rate the significance of each identified barrier:

- Issue or opposition was mentioned by an interview respondent, in a statement made in a public meeting or in written comments submitted to the docket
- Issue or opposition was raised by more than one interested party
- An interested party requested additional data or analysis to support or refute an issue or opposition
- DOE requested or required additional data or analysis to support or refute an issue or opposition
- An interested party requested extension of the comment period to further investigate an issue or opposition.

The ratings and percentages of barrier significance were assigned by the evaluation team member who conducted the document review and were validated by an evaluation team member who reviewed the Final Rule but who did not participate in the analysis process.

## Identify Activities and Rate the Relative Significance of Each Activity for Each Barrier

Using information gathered from the interviews and the document review, the evaluation team identified the activities that NEEA and its partners undertook to overcome the identified barriers. The evaluation team then assigned a percentage to each activity to represent its significance relative to other activities associated with the same barrier. If there was only one activity, the percentage of significance of the activity would be set equal to the significance percentage of the barrier. If there was more than one activity associated with the same barrier, the evaluation assigned a percentage to each activity such that the sum of the percentages of all activities for the same barrier equals the percent significance of the barrier.

## Rate the Effectiveness of All Activities

The evaluation team used the document analysis and professional judgment to rate the effectiveness of each activity on addressing the barriers, using the rubric in Table 4.

Table 4. Activity Effectiveness Designations

Activity Effectiveness	Percent Assigned	Description
High	60%	Achieved the desired outcome(s).
Medium	40%	Achieved some of the desired outcomes, but not all.
Low	20%	Achieved little of the desired outcome(s) or achieved outcomes with little impact on energy savings.
Not effective	0%	Did not achieve any of the desired outcomes during this rulemaking.

The evaluation team determined if the action resulted in the desired outcome in the Final TSD and the Final Rule. Evidence of activity effectiveness was determined as a result of the analysis of rulemaking documents and other documentation provided by NEEA. The evaluation team considered the following factors to rate the significance of each identified activity:

- NEEA and its partners' position on a particular aspect of the analysis for the standards was reflected in Final TSD or the Final Rule (that is, DOE adopted what NEEA and its partners advocated for or supported)
- NEEA or its partners were cited in Final Rule
- The evaluation team identified evidence of non-public engagement (strategy emails, meetings, etc. that were not submitted to the docket)

The assigned percentages are consistently used for each rating across standards evaluations conducted for NEEA, with exceptions made for activities that may have had a much larger or much smaller influence on overcoming the intended barrier. Rationale is provided if the percentages deviate from Table 4.

## Rate the Role of NEEA and its Partners in Each Activity

The evaluation team used the document analysis and professional judgment to determine the role of NEEA and its partners in each activity, following the rubric in Table 5. The assigned percentages are consistently used for each role across standards evaluations conducted for NEEA, with exceptions made only if other interested parties played a much greater or smaller role in the activity to influence the standards. The rationale is provided if the percentages assigned in the analysis deviated from Table 5.

Table 5. Role of NEEA and its Partner's Designations

Role of NEEA and Partners	Percent Assigned	Description
Primary	50%	NEEA and its partners either led the effort themselves or led an effort to support the standards.
Major	30%	NEEA and its partners did not lead but contributed significantly to an activity.
Minor	15%	NEEA and its partners contributed, but not significantly, to an activity.

## Compute the Share of Savings from NEEA and Partners' Activities

The evaluation team computed the share of savings as a result of each activity by multiplying the barrier significance of each activity by the effectiveness of each activity and the relative role of NEEA and partners. This calculation estimated the savings from each activity as a percentage of total savings from the standards. The sum of these percentages equals the share of total savings (as a percentage) influenced by NEEA and its partners' activities.

The significance of each barrier as well as the number of barriers and activities strongly impacts the resultant share of savings percentage. Lower-rated barriers and/or fewer barriers or activities will lead to lower activity effectiveness relative to all barriers, and the relative savings influenced by the activity scores. For example, a barrier rated with a 10% significance, high-rated effectiveness (60%), and a primary role (50%) for the activity will account for less of the total share of savings compared to a barrier with a 20% significance with the same effectiveness and role percentages. The significance of the barrier is the key driver of the share of energy savings influenced by the activity.

# 3 Results

## 3.1 Qualitative Assessment of NEEA and Partners' Influence

This section presents the results of the qualitative assessment conducted by the evaluation team following the approach described in Section 2.

Table 6 through Table 9 present the qualitative assessment of NEEA and its partners' influence on the air compressor standards using NEEA's Standards Initiative Logic Model as a framework. NEEA and its partners exerted their most significant influence by analyzing DOE's proposed test procedure and standards documents and participating in DOE's public meetings for both rulemakings.

This analysis demonstrates that NEEA and its partners played a pivotal, but moderately impactful, role in shaping the air compressor standards by strategically engaging in DOE's rulemaking process, addressing critical data gaps, and collaborating with national efficiency advocates. Representatives of NEEA and its partners actively participated in public meetings, negotiated and collaborated with manufacturers, and submitted technical comments that aligned with broader advocacy coalitions, helping to reduce stakeholder conflict and influence the structure of the test procedure and standards.

NEEA and NWPCC's contributions of Northwest-specific data, particularly on operating hours, helped inform DOE's analysis. At the same time, its advocacy for including reciprocating compressors and supporting TSL 3 reflected a strong commitment to maximizing energy savings. Although not all recommendations were adopted, NEEA and its partners' involvement significantly enhanced the technical rigor and ambition of the final standards.

Table 6. Qualitative Analysis of NEEA and its Partners' Influence - **Activities**

Box # in Logic Model	Activity Description (From the NEEA Standards Logic Model)	Did NEEA and partners have a role in the activity?	Findings
1	Negotiate with manufacturers	Yes	NEEA and its partners engaged with representatives of some manufacturers and a prominent industry trade organization to discuss the test procedure and standards rulemaking. Manufacturers and energy efficiency organizations were aligned on compressor capacity ranges and harmonization with EU Ecodesign Lot 31 regulations.
2	Attend public meetings held by DOE	Yes	NEEA and its partners attended and actively participated in public meetings held by DOE.

Box # in Logic Model	Activity Description (From the NEEA Standards Logic Model)	Did NEEA and partners have a role in the activity?	Findings
3	Analyze and comment on advocate and manufacturer comments and rulemaking documents	Yes	NEEA and its partners analyzed and commented on DOE's proposed TSD and NOPR regarding the topics of equipment classes, energy savings, compressor capacity, harmonization with the EU Ecodesign Lot 31 regulations, lack of market data, pressure ratios, and compressor performance.
4	Conduct primary research to create data for standards	No	No findings.
5	Provide savings and economic analyses based on Northwest data	Yes	NEEA and NWPCC provided DOE with the requested data on operating hours of air compressors and consumption data from the Northwest Industrial Motor Database. <sup>33</sup>
6	Collaborate with other advocates	Yes	NEEA and its partners collaborated with the California investor-owned utilities (IOUs), EEI, and some manufacturers to propose separate equipment classes for air and liquid cooling methods.
7	Encourage utilities to provide data and support for standards	No	No findings.
8	Work with NEEA initiatives to increase market penetration and create paths from voluntary to mandatory requirements	No	No findings.

Table 7. Qualitative Analysis of NEEA and its Partners' Influence - **Outputs**

Box # in Logic Model	Output Description	Did NEEA and its partners provide any outputs?	Findings
9	Consensus-based proposals to submit to DOE or better general understanding of manufacturer positions and concern	No	A consensus proposal was not developed or submitted to DOE during this rulemaking.

<sup>33</sup> Strategic Energy Group (2008, January). Northwest Industrial Database Summary.

Box # in Logic Model	Output Description	Did NEEA and its partners provide any outputs?	Findings
10	Written comments and each opportunity during a rulemaking Participation and oral comments during public meetings	Yes	NEEA and its partners commented on DOE's proposed TSD and NOPR.
11	Initiative logic models refer to the creation of standards	No	No findings.

Table 8. Qualitative Analysis of NEEA and its Partners' Influence - **Outcomes**

Box # in Logic Model	Outcome Description	Is there evidence that NEEA and its partners influenced these outcomes?	Findings
12	Disparity in positions between parties is decreased	Partial	Even though a consensus proposal was not developed, NEEA and its partners were in communication with some manufacturers and met with a prominent trade organization to discuss the proposed test procedure and standards. Manufacturers and energy efficiency organizations were aligned on compressor capacity ranges.
13	NEEA and its partners add valuable information or analysis at each stage of the rulemaking process	Yes	<p>NEEA and its partners' analysis of DOE's proposed TSD and countered manufacturer opposition.</p> <p>NEEA commented that the shipments data for reciprocating compressors led them to believe that a large amount of energy consumption is attributed to reciprocating compressors.</p> <p>In response to the 2012 NOPD, NEEA commented that performance testing at horsepower levels below 15 was rare and that corresponding data is unreliable.</p> <p>NEEA and its partners advocated to increase the pressure ratio of compressors from 1.1 to 1.3.</p> <p>Designating separate equipment classes for air and liquid cooling methods significantly shaped the standard; achieving this was a collaborative effort between ASAP, the California IOUs, EEL, and some manufacturers.</p> <p>NEEA and NWPC provided DOE with requested data on operating hours for air compressors.</p>

Box # in Logic Model	Outcome Description	Is there evidence that NEEA and its partners influenced these outcomes?	Findings
			NEEA and NWPCC provided reciprocating air compressor consumption data from the Northwest Industrial Motor Database for Air Compressors. <sup>34</sup>
14	NEEA and its partners' information or analysis is referenced in rulemaking documentation	Yes	<p>NEEA and its partners advocated for TSL 3. The Final TSD adopted TSL 2. Manufacturers advocated for TSL 1, or exclusion from the Final Rule.</p> <p>NEEA advocated for alignment with EU Ecodesign Lot 31 standards, which were similar to TSL 3.</p> <p>As a result of NEEA's comments on reciprocating compressors, DOE performed the reciprocating compressor analyses based on a limited dataset. DOE had limited data characterizing reciprocating compressor performance, manufacturer selling price, and shipments in the U.S. market.</p>
15	Utilities are present at hearings or publicly support new standards	No	While representatives of the California IOUs participated in the standards rulemaking, the evaluation team did not find evidence to consider the California IOUs as partners with NEEA for the standards.

Table 9. Qualitative Analysis of NEEA and its Partners' Influence - **Impact**

Box # in Logic Model	Impact Description	Is there evidence that NEEA and partners impacted the adoption of the standard?	Findings
16	Adoption of the highest standards that are technologically feasible and economically justified	Partial	<p>DOE accepted some, but not all, of the recommendations set forth by NEEA and its partners in oral and written comments submitted to the Energy Conservation Standards rulemaking docket.</p> <p>NEEA and its partners recommended that DOE adopt TSL 3 for the standards, but DOE adopted TSL 2 in its Final TSD and in the Final Rule.</p>

<sup>34</sup> Ibid.

### 3.2 Share of Energy Savings from NEEA and Partners' Efforts

This section presents the quantitative analysis of the significance of barriers to adopting the most stringent, technologically feasible and economically justified standards, the effectiveness of the activities in which NEEA and its partners participated, and their respective roles in each activity.

Table 10 presents the share of savings influenced by NEEA and its partners' activities during the rulemakings for the air compressor test procedure and standards. **The evaluation team estimates that the total share of savings influenced by NEEA and its partners' activities is 12%.**



Table 10. Estimated Share of Savings

Share of Savings Inputs		Barriers								
		Manufacturer Opposition			Lack of Data		Lack of common interest among stakeholders	Insufficient funding/staff DOE	Insufficient market adoption of more efficient options	Cyclical political opposition
a	Relative significance for energy savings	Medium			High		Low	None	None	None
	Significance of barrier (%)	32.0%			48.0%		20.0%	N/A	N/A	N/A
	Significance of activity relative to the barrier (%)	8.0%	4.0%	20.0%	32.0%	16.0%	20.0%	N/A	N/A	N/A
b	Activity	A1. Negotiations with manufacturers	A2. Attended public meetings held by DOE	A3. Analyze and critique advocates, manufacturers, and rulemaking documents	A4. Analyze and critique advocates, manufacturers, and rulemaking documents	A5. Provide savings and economic analyses based on Northwest data	A6. Collaborated with other advocates under the umbrella of ASAP	N/A	N/A	N/A
	Outcome	Disparity impositions between parties is decreased	Utilities are present at hearings/ publically support new standards	NEEA adds valuable information/ analysis at each state of the rulemaking process	NEEA adds valuable information/ analysis at each state of the rulemaking process	NEEA adds valuable information/ analysis at each state of the rulemaking process	NEEA information/analysis referenced in the rulemaking proceedings/ documentation	N/A	N/A	N/A
	Effectiveness of activity in addressing barrier	Med	Med	Med	Low	Med	Med	N/A	N/A	N/A
	Effectiveness of activity in addressing barrier (%)	40.0%	40.0%	40.0%	20.0%	40.0%	40.0%	N/A	N/A	N/A
c	Effectiveness of activity relative to ALL barriers (a x b) (%)	3.2%	1.6%	8.0%	6.4%	6.4%	8.0%	N/A	N/A	N/A
d	NEEA and its partners' role compared to other stakeholders	Major	Primary	Primary	Major	Major	Major	N/A	N/A	N/A
	NEEA and its partners' relative role in activity (%)	30.0%	50.0%	50.0%	30.0%	30.0%	30.0%	N/A	N/A	N/A
e	Relative savings influenced by the activity (c x d) (%)	1.0%	0.8%	4.0%	1.9%	1.9%	2.4%	N/A	N/A	N/A
										12.0%

## Barrier 1: Manufacturer opposition to regulation or more stringent standards

In this rulemaking, manufacturer opposition to regulation was driven by the perceived disproportionate burden new standards place on small OEMs that face significant redesign costs, higher borrowing rates, and limited capital access compared to larger competitors. DOE found that one small OEM accounted for most noncompliant models, highlighting performance gaps and a lack of familiarity with regulatory processes among compressor manufacturers. Additionally, small manufacturers expressed concern that complex testing requirements and outdated procedures would add unnecessary burden to their already constrained operations.

Significance of Barrier:  
**Medium (32.0%)**

Manufacturers also expressed concern that using a technological approach and certain capacity thresholds in DOE's standards created unfair regulatory advantages, particularly for compressors on the low and high ends of the regulated range. Some manufacturers also opposed regulation for air compressor packagers, arguing they have minimal influence over energy efficiency and should be exempt.

CAGI submitted comments to the docket opposing the regulation of reciprocating air compressors, citing limited potential for cost-effective efficiency improvements and low sales volumes. CAGI argued that the fragmented nature of this market makes crafting and enforcing standards overly complex and burdensome. Given the minimal energy savings opportunity, CAGI recommended excluding reciprocating compressors from the standards entirely.

### Activity 1-1: Negotiations with manufacturers

NEEA, together with its energy efficiency organization partners, engaged manufacturers and consulted with a prominent trade organization to refine the test procedure and standards. The discussions showed consensus between manufacturers and efficiency organizations regarding compressor capacity ranges, harmonization with the EU, and categorizing compressor types by cooling source. Evidence of NEEA's negotiations with manufacturers is present in the Final Rule, as air and liquid-cooled air compressors are one of two primary categories of air compressor equipment types.

Effectiveness of Activity: **Medium**  
NEEA & Partners Role: **Major**  
Share of Savings: **1.0%**

### Activity 1-2: Attended public meetings held by DOE

During DOE's public meetings for the test procedure and the proposed standards rulemakings, NEEA staff participated actively, providing input on data collection efforts with Lawrence Berkeley National Laboratory (LBNL), addressing distribution-related concerns and explaining how the proposed standards compare to EU policies. Additionally, NEEA staff emphasized the usefulness of compressor labels in facilitating utility incentives.

Effectiveness of Activity: **Medium**  
NEEA & Partners Role: **Primary**  
Share of Savings: **0.8%**

### Activity 1-3: Analyze and critique advocates, manufacturers, and rulemaking documents

In its written comments, NEEA pressed DOE to independently investigate the power draw of optional components, such as dryers, that manufacturers wanted excluded from the standards, arguing these parts meaningfully affect compressor efficiency. NEEA and NWPCC noted that failing to set standards for reciprocating compressors in the 20 hp to 100 hp range risks customers substituting to reciprocating compressors due to the higher-cost rotary models subject to regulation.

NEEA and its partners supported adopting TSL 3 for its greater energy savings, higher consumer net present value (NPV), and lower carbon footprint compared with TSL 2.

Effectiveness of Activity: **Medium**  
NEEA & Partners Role: **Primary**  
Share of Savings: **4.0%**

### Barrier 2: Lack of data with which to conduct the necessary analysis in a rulemaking

The evaluation team concludes lack of data for DOE's analysis was a significant barrier to adopting a higher TSL for the standards.

Significance of Barrier:  
**High (48.0%)**

- ASAP and NEEA commented that the shipments data provided by stakeholders for DOE's analysis indicated significant energy use from reciprocating compressors,<sup>35</sup> but DOE stated that a lack of detailed performance and market data prevents setting economically justified standards.
- Comments submitted by a trade organization emphasized that the data DOE requested on compressors above 200 hp would require substantial time and resources to compile and may not be available from non-member manufacturers, further limiting the completeness of the DOE analysis dataset.
- DOE concluded that reciprocating compressors should be excluded from this rulemaking due to limited data availability under Annex D of ISO 1217:2009, their distinct utility profiles, and existing U.S. Environmental Protection Agency (EPA) regulations.
- One manufacturer's comments suggested that DOE use standards based on the EU's Lot 31 regulation. DOE declined to do so, however, due to the absence of published or publicly available regulatory information.
- NEEA noted that performance testing for compressors under 15 hp is rare and that the available data for this segment is unreliable, making analysis difficult.

### Activity 2-1: Analyze and critique advocates, manufacturers, and rulemaking documents

In their oral comments in the standards rulemaking, NEEA and ASAP noted that the shipments data used in DOE's analysis suggested reciprocating compressors account for a substantial share of energy use. ASAP argued that excluding reciprocating compressors from the standard would represent a missed opportunity to reduce compressor-related energy consumption significantly. Additionally, in response to the 2012 NOPD, NEEA noted that

Effectiveness of Activity: **Low**  
NEEA & Partners Role: **Major**  
Share of Savings: **1.9%**

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<sup>35</sup> For the NOPR analysis, DOE received confidential shipments data from stakeholders.

performance testing for compressors below 15 hp was uncommon, making the available data unreliable. Although NEEA consistently provided technical expertise and valuable analysis throughout the rulemaking process, DOE excluded reciprocating compressors from the standards.

- ASAP and NEEA highlighted limited data availability for reciprocating compressors, cautioning that this gap may hinder effective standard-setting.
- NEEA noted that compressors under 15 hp are rarely performance-tested, resulting in unreliable data.

## Activity 2-2: Provide savings and economic analyses based on Northwest data

NEEA and NWPCC supplied DOE with key regional datasets, including operating hours data and reciprocating air compressor consumption figures from the Northwest Industrial Motor Database.<sup>36</sup> These contributions supported savings and economic analyses based on Northwest-specific conditions. As a result, DOE incorporated the operating hours data into its final analysis. However, the reciprocating compressor data was not reflected in the Final Rule, indicating a lower level of impact.

Effectiveness of Activity: **Medium**  
NEEA & Partners Role: **Major**  
Share of Savings: **1.9%**

## Barrier 3: Lack of common interest among certain stakeholders

NEEA commented that the rulemaking process functioned effectively because stakeholders became aligned mainly on key issues. This barrier is considered to be of low significance, as early coordination and consensus among participants during the rulemaking process minimized conflict and reduced the need for DOE to intervene through a negotiated rulemaking process.

Significance of Barrier:  
**Low (20.0%)**

## Activity 3-1: Collaborated with other advocates under the umbrella of ASAP

During the standards rulemaking process, NEEA actively collaborated with its partner efficiency organizations, including ASAP, ACEEE, NRDC, NEEP, and ASE. This coalition consistently submitted aligned comments to DOE across multiple topics, from establishing equipment classes by cooling method to advocating for standards that reduce substitution risk and support global regulatory alignment. These joint efforts underscore NEEA's role in coordinated engagement, particularly under the broader umbrella of ASAP-led engagement.

Effectiveness of Activity: **Medium**  
NEEA & Partners Role: **Major**  
Share of Savings: **2.4%**

- NEEA joined ASAP and other efficiency partners in supporting TSL 3, citing its benefits for energy savings, consumer NPV, and reduced CO<sub>2</sub> emissions.
- NEEA and NWPCC aligned with ASAP's recommendation to regulate large reciprocating compressors, specifically endorsing standards for the 20 hp to 100 hp range to address substitution risk.

<sup>36</sup> Strategic Energy Group (2008, January). Northwest Industrial Database Summary.

- NEEA contributed to joint comments, noting the lack of data for lubricant-free compressors; NEEA supported their inclusion in the standards to build a foundation for future analysis.
- Alongside ASAP and other organizations, NEEA emphasized the value of aligning DOE standards with the EU Lot 31 regulations to minimize global compliance burdens for manufacturers.

This coordination reflects a strategic alliance of efficiency organizations, with NEEA consistently aligning its technical recommendations and policy goals with ASAP's coalition.

## Barrier 4: Insufficient funding/staff for DOE to run the standards rulemaking process

There was no evidence of this barrier, and this barrier is excluded from the share of savings analysis.

## Barrier 5: Insufficient market adoption of more efficient product models prior to the standard rulemaking process

There was no evidence of this barrier, and this barrier is excluded from the share of savings analysis.

## Barrier 6: Cyclical political opposition to regulation

There was no evidence that cyclical political opposition to regulation was a barrier to adopting the standards. As such, this barrier is excluded from the share of savings analysis. The evaluation team acknowledges, however, that political opposition delayed the effective date of the standards by three years.

As mentioned in Section 1.2 and shown in Figure 1, the length of time between the TSD Final Rule (December 2016) and when the standards Final Rule was published in the Federal Register (January 2020) is not typical for DOE's federal standards development process. After DOE published the TSD Final Rule, the mandatory 45-day correction period extended into early 2017, which coincided with the transition from the Obama administration to the Trump administration. However, under the new Trump administration, DOE did not publish the Final Rule, preventing the standards from being enacted. Two separate lawsuits – one led by NRDC and one by California and New York – were filed against DOE for not publishing the standards.<sup>37</sup> After several years of litigation, DOE published the Final Rule in the Federal Register in response to a court order.

The adopted standards in the Final Rule published on January 10, 2020 was unchanged from the standards adopted in the Final TSD in December 2016. The evaluation team, therefore, concludes that cyclical political opposition due to the transition to the Trump administration was not a barrier to stringency of the standards because it occurred after the standards rulemaking was complete and did not change the final adopted standards.

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<sup>37</sup> Even though the evaluation team considered NRDC to be a NEEA partner during the standards rulemaking process, NEEA does not participate in any legal procedures *after* the standards rulemaking is closed, as was the case for the air compressor standards.

## 4 Savings Duration

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Currently, NEEA assumes the savings resulting from its work on standards to be ten years long. This duration of savings assumes that the market would have independently arrived at the same efficiency specified in the standards ten years after the standards compliance date. In 2019, a third-party analysis was conducted for NEEA's internal use. This review did not identify any compelling evidence supporting using a different savings duration. Likewise, no evidence was found in the present research to suggest that a different duration of savings should be used for the air compressor standards. The evaluation team supports ten years as a reasonable duration for the savings from these standards.

## 5 Future Energy Savings

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Insofar as the rulemakings covered by this evaluation adopted the first test procedure and standards for air compressors, NEEA and its partners have a significant opportunity to influence future standards.

There is an opportunity for future standards to cover a broader range of compressors, such as reciprocating compressors in the 20 hp to 100 hp range, should DOE issue a NOPR to amend the energy conservation standards. NEEA can leverage the growing body of research and available data on commercial and industrial air compressor types and configurations that have grown significantly since the federal standards rulemaking. Additional opportunities to leverage primary market data include (but are not limited to) NEEA's most recent Commercial Building Stock Assessment (CBSA) and upcoming Motor Systems Stock Assessment (MSSA), ongoing engagement with key industry organizations, such as CAGI and the Compressed Air Challenge.

Interview respondents emphasized that the value and influence of NEEA in the standards development process is by providing market data and field research that substantiates DOE's analysis or is incorporated in DOE's analysis to support adoption of the highest TSL. Doing so for future standards amendments could influence future air compressor baseline efficiency as a result of the standards, and therefore savings.

## 6 Conclusion and Recommendations

### 6.1 Conclusions

The qualitative analysis reveals that NEEA played a leading role in shaping the air compressor standards by engaging in the DOE rulemaking process. NEEA and its partners actively participated in public meetings, negotiated with manufacturers, and provided in-depth analysis of DOE's proposed test procedure and TSD, regarding equipment classes, and energy savings scenarios, in particular. NEEA's alignment with manufacturers and industry representatives on compressor capacity ranges and the EU Lot 31 framework helped reduce conflict and facilitate informed decision-making. These coordinated actions improved clarity and strengthened the argument for more stringent standards, though DOE ultimately adopted a less stringent TSL than what NEEA and its partners supported.

NEEA and NWPCC reduced one of the most significant barriers in the rulemaking process, the lack of reliable data, by providing region-specific consumption and compressor operating hours data. While DOE incorporated the data into its final analysis, NEEA's efforts to supply reciprocating compressor data were less influential, highlighting the challenge of overcoming entrenched data gaps in less-studied equipment categories.

NEEA's collaboration with its partner organizations amplified its influence on the rulemaking outcome. Through joint comments with ASAP, ACEEE, NRDC, NEEP, and others, NEEA supported more stringent standards (TSL 3) and advocated for including reciprocating compressors within the scope. These coordinated efforts ensured consistent policy messaging and pushed DOE to consider broader market impacts and global harmonization. Although TSL 2 was ultimately adopted, the widespread coalition support for TSL 3 positions NEEA and its partners to have a strong influence on a future amendment.

Table 11 summarizes activities completed by NEEA and its partners to overcome the identified barriers, along with the evaluation team's assessment of the effectiveness. **The total share of savings from the air compressor standards due to NEEA and its partners' activities is 12%.**

Table 11. Summary of Activities to Address Barriers

Barrier	Activity	Share of Savings Influenced by Activity
<b>B1 Manufacturer opposition to regulation or more stringent standards</b>	A1. Negotiations with manufacturers	1.0%
	A2. Attended public meetings held by DOE	0.8%
	A3. Analyze and critique advocates, manufacturers, and rulemaking documents	4.0%



Barrier	Activity	Share of Savings Influenced by Activity
<b>B2 Lack of data with which to conduct the necessary analysis in a rulemaking.</b>	A3. Analyze and critique advocates, manufacturers, and rulemaking documents	1.9%
	A5. Provide savings and economic analyses based on Northwest data	1.9%
<b>B3 Lack of common interest among certain stakeholders</b>	A6. Collaborated with other advocates under the umbrella of ASAP	2.4%
<b>Total Share of Savings</b>		<b>12.0%</b>

## 6.2 Recommendations

The evaluation team offers four recommendations for NEEA to consider:

**State Standards for Air Compressors.** If DOE proceeds with rescinding the coverage determination, then DOE would lack the authority to require test procedures, compliance, reporting, and enforcement of federal energy conservation standards for air compressors. The withdrawal of the federal standards would create an opportunity for standards at the state level. The evaluation team recommends that NEEA and its partners pivot efforts to extend the effective date of and potentially amend the air compressor standards in Washington and to engage with its partners and key stakeholders to influence the adoption of the standards in other Northwest states. Without federal standards, adopting and aligning state standards could create regional influence, with manufacturers and packagers continuing to supply air compressor models and components that align with the Northwest market.

**Address Data Gaps and Limitations.** The most significant barrier identified in this evaluation is the lack of data to justify a higher TSL or standards incorporating a wider range of equipment classes, such as reciprocating air compressors. NEEA's detailed critique of the proposed rule and call for improved analysis of underrepresented equipment classes, including the under-15 hp compressors and lubricant-free models, can help shape future data collection priorities and reinforces the importance of regional input in national standards development. Robust data will strengthen DOE analyses and accelerate adoption of broader, more stringent standards.

**Considerations for Incorporating the Cumulative Influence of NEEA and its Partners.** The NEEA Standards Logic Model represents a single standards development cycle, and the current framework does not reflect the *cumulative* impact of NEEA and its partners' influence through multiple test procedures and standards rulemakings. Evaluations of the influence of NEEA and its partners on future air compressor standards amendments, at a minimum, should reference and incorporate the findings of this evaluation to qualitatively characterize the persistence of barriers and the longevity of NEEA and partner engagement over time.

Aside from the air compressor standards specifically, the evaluation team recommends that NEEA consider if the Standards Logic Model should and can be modified to reflect the longer-term cumulative influence across multiple standards revisions rather than a single rulemaking. This may better align with the long-term rationale of NEEA and its partners' efforts.

**Contemporaneous Documentation of Activities and Engagement.** DOE's standards rulemakings are typically completed within three years. To ensure the evaluation accurately accounts for all activities conducted by NEEA and its partners, including engagement with manufacturers and industry associations, the evaluation team recommends that NEEA Codes and Standards staff maintain contemporaneous notes to be available as documentation for the evaluation. The evaluation team understands that NEEA has adopted a process for NEEA staff to document their efforts and encourages NEEA to continue that practice. Doing so will be particularly valuable to reflect engagement with manufacturers and trade associations, as they have declined to participate in this and other similar standards evaluations.

## Appendix A | NEEA Standards Logic Model

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## NEEA STANDARDS LOGIC MODEL

