Appliance Standards Awareness Project
American Council for an Energy-Efficient Economy
Natural Resources Defense Council

August 2, 2019

Mr. Jeremy Dommu
U.S. Department of Energy
Office of Energy Efficiency and Renewable Energy
Building Technologies Program, EE-5B
1000 Independence Avenue SW
Washington, DC 20585-0121

RE: Docket number EERE-2019-BT-STD-0018; Energy Conservation Standards for Distribution Transformers; Request for Information

Dear Mr. Dommu:

This document constitutes the comments of the American Council for an Energy-Efficient Economy (ACEEE), the Appliance Standards Awareness Project (ASAP), and the Natural Resources Defense Council (NRDC) with respect to the Department of Energy's Request for Information (RFI) to determine whether to amend the current energy conservation standards for distribution transformers. Our organizations were involved in the development of the original energy conservation standards legislation for transformers and the subsequent standards rulemaking docket (EERE-2010-BT-STD-0048), including the negotiated rulemaking. We appreciate the opportunity to provide input as DOE considers revisions to these standards.

In the 2013 rulemaking for distribution transformers energy conservation standards DOE found that additional energy, economic and environmental savings were cost-effective and technologically achievable but were not selected due to conditions in the electrical steel market. As DOE now considers whether to amend standards for distribution transformers, it is imperative that the agency include in its determination the facts that the additional savings from higher standard levels identified in the 2013 rulemaking are still available today; and that the market for necessary materials and the technologies involved have both matured since 2013 in ways that address DOE's prior concerns. In order to set standards for distribution transformers at the maximum level of energy efficiency that is technologically feasible and economically justified as required by statute,[1] DOE must thoroughly re-evaluate the Trial Standards Levels (TSLs) from the 2013 rulemaking, and also consider new TSLs based on up-to-date information gathered by DOE and its contractors and through the public rulemaking process.

[1] The Energy Policy and Conservation Act of 1975, (42 U.S.C. 6316(a); 42 U.S.C. 6295(o)(2)(A))

Large additional energy savings from distribution transformer energy conservation standards are technologically feasible and cost-effective.

Tables 1-3 show the significant economic, energy and environmental savings that DOE identified for distribution transformers beyond the savings achieved by the standards set in the 2013 final rule.

Table 1[2]

Liquid Immersed Transformers	Chosen Level TSL 1	Cost-effective Level TSL 6	Additional Potential Savings
Electricity (quads)	0.92	4.09	3.17
CO_2 (mil metric tons)	82.2	321.8	239.6
NPV Benefit (bil $2011, 3% discount rate)	3.12	10.27	7.15

Excerpted from Table V.38 – Summary of Analytical Results for Liquid-Immersed Distribution Transformers: National Impacts

Table 2[2]

Low-Voltage Dry-Type Transformers	Chosen Level TSL 2	Cost-effective Level TSL 5	Additional Potential Savings
Electricity (quads)	2.43	4.48	2.05
CO_2 (mil metric tons)	161.6	297.6	136.0
NPV Benefit (bil $2011, 3% discount rate)	9.04	11.80	2.76

Excerpted from Table V.41 – Summary of Analytical Results for Liquid-Immersed Distribution Transformers: National Impacts

Table 3[2]

Medium-Voltage Dry-Type Transformers	Chosen Level TSL 2	Cost-effective Level TSL 4	Additional Potential Savings
Electricity (quads)	0.29	0.53	0.24
CO_2 (mil metric tons)	20.9	40.7	19.8
NPV Benefit (bil $2011, 3% discount rate)	0.79	1.12	0.33

Excerpted from Table V.44 – Summary of Analytical Results for Liquid-Immersed Distribution Transformers: National Impacts

*The "Cost-effective Levels" in each table are the most stringent TSLs that provided positive net present values at both 3% and 7% discount rates in DOE's 2013 analysis.

In the 2013 final rule, DOE reviewed seven trial standard levels (TSL) for liquid-immersed distribution transformers and found that TSL1 through TSL6 would all create positive net present values at two discount rates. DOE found that TSL6 would generate the largest energy savings, but DOE adopted TSL1 for liquid-immersed distribution transformers. DOE reviewed six TSLs for low-voltage dry-type distribution transformers (LVDT) and found that TSL1 through TSL5 all offered positive net present values at two discount rates. DOE found that TSL5 would generate the largest energy savings for LVDT, yet DOE adopted TSL 2. Finally, DOE reviewed five TSLs for medium-voltage dry-type distribution

[2] 2013-04-18 Energy Conservation Program: Energy Conservation Standards for Distribution Transformers; Final Rule. 78FR23335 Section 8.C.1-3

transformers (MVDT) and found that TSL 1 through TSL 4 would all create positive net present values at two discount rates. DOE found that TSL4 offering the largest energy savings, yet the agency also adopted TSL 2 for MVDT. In the 2013 final rule, DOE made it clear that concerns about potential disruptions in the electrical steel market from more stringent energy efficiency levels was a key element in the agency's choice of TSLs for standards setting.

DOE should perform a comprehensive review of the availability and price of distribution transformer core steel

DOE's life-cycle cost analysis for the 2013 standards final rule was based on the range of transformer core steels and related technologies available at the time, including amorphous core steel. DOE assumed amorphous steel was the most cost-effective (but not the only) technology capable of attaining higher TSLs. In the RFI, DOE requests comments on Table 11.6, which lists technology options that were considered during the 2013 rulemaking, and specifically requests information on changes to these options including *"information as to whether steel grades and fabrication techniques have been updated or improved since the April 2013 standards rule."*[3] Since 2013 there have been significant changes in both the market for electrical steel and in the development of alternative technologies which may address DOE's concerns and allow the agency to make cost-effective amendments to the standards.

The 2013 rulemaking changed the US market for distribution transformers. The price and availability of amorphous steel, and grain-oriented electrical steel, have also been affected by advances in metallurgy, changing global demand, and prevailing economic conditions. For example, during the 2013 rulemaking DOE noted research by Hydro-Québec into lower-cost production methods for amorphous steel but DOE did not attempt to model this technology in its engineering analysis because Hydro-Québec's approach was too new and commercial cost data were not yet available. Since then, Hydro-Québec has patented the AMORPHLEX technology and low-cost TRANSFLEX distribution transformers based on AMORPHLEX [4] are now available. In another example, in 2018 AK Steel introduced TRAN-COR X[5] grain-oriented electrical steel, increasing options available to manufacturers. DOE must investigate these and other changes in the international and US steel market and the finished transformer market in order to understand the technological pathways and costs of improved transformer efficiency.

DOE should perform a comprehensive review of the status of solid-state distribution transformer technologies.

In addition to developments in the electrical steels market, alternative technologies such as wide-band-gap, solid-state transformers are much more advanced now than they were in 2013. Solid-state

[3] 2019-06-18 Energy Conservation Program: Energy Conservation Standards for Distribution Transformers; Request for information. EERE-2019-BT-STD-0018-0001

[4] http://www.hydroquebec.com/innovation/en/amorphlex-transflex.html. See attached Hydro-Québec document „US-DOE's Efficiency Standard can be used to achieve massive penetration of AMORPHLEX in the US market through TRANSFLEX" attached.

[5] *https://www.aksteel.com/sites/default/files/2018-07/trancorx201807.pdf*

transformers are beginning to enter the market[6] and offer both higher energy efficiency and a range of additional features that can increase the overall energy efficiency of the distribution grid. PowerAmerica is a DOE-funded collaborative community led by NC State University that creates, showcases, and deploys new power electronic capabilities including solid-state distribution transformers. The future cost and availability of solid-state distribution transformers will be significantly influenced by the expanding sales of electric vehicles, which use similar solid-state power technology. DOE should consider the impact of changing technology and markets for components and materials shared by solid-state distribution transformers and electric vehicles on the future price and availability of solid-state distribution transformers.

DOE should update the test procedure for distribution transformers, and account for resulting changes in transformer design in the agency's analysis of the need to amend standards.

In the 2013 rulemaking, DOE's economic analysis used loading distributions that reflected the agency's understanding of the United States electrical grid.[7] The co-signers to these comments also submitted comments on docket number EERE-2017-BT-TP-0055; Test Procedure for Distribution Transformers; Notice of proposed rulemaking and request for comment (84 FR 20704) calling upon DOE to proactively gather and analyze data on distribution transformer loading that has become available through the widespread adoption of Advanced Meter Infrastructure (AMI) technology.

As shown by the IEEE Distribution Transformers Subcommittee,[8] AMI data can be used to estimate actual average Per-Unit Load (PUL) rating points. The Subcommittee's analysis of AMI data from four utilities suggests that DOE's use of a 50% PUL rating point for the distribution transformer test procedure is not representative of real-world conditions. Testing at lower, more realistic PUL rating points would encourage distribution transformer manufacturers to change their product designs. Differently optimized distribution transformers will require (for example) different amounts of core steel and have different costs and benefits in DOE's lifecycle cost analysis.

Conclusion

DOE must perform a thorough, new analysis of potential energy efficiency requirements for liquid-immersed, low-voltage dry type, and medium-voltage dry type distribution transformers to determine whether to amend energy conservation standards. If DOE fails to perform such an analysis the agency will fall short of its obligation to set standards at the maximum level of energy efficiency that is technologically feasible and economically justified, as required by statute.[9]

[6] https://powerpulse.net/100kw-solid-state-transformer-aims-to-drive-transition-from-ac-to-dc-power-grids/
[7] 2013-04-18 Energy Conservation Program: Energy Conservation Standards for Distribution Transformers; Final Rule. 78FR23335. Section III.A.6
[8] https://www.transformerscommittee.org/subcommittees/distributiontransfsc/
[9] The Energy Policy and Conservation Act of 1975, (42 U.S.C. 6316(a); 42 U.S.C. 6295(o)(2)(A))

Thank you for considering these comments.

Sincerely,

Chris Granda
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Steve Nadel
Executive Director
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Joseph Vukovich
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Attachments:

US-DOE's Efficiency Standard can be used to achieve massive penetration of AMORPHLEX in the US market through TRANSFLEX