Setting Standards for Excellence

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VIA EMAIL TO: DistributionTransformers@energystar.gov

Ms. Verena Radulovic
US Environmental Protection Agency
ENERGY STAR Program, Product Labeling
Ariel Rios Building 6202J
1200 Pennsylvania Avenue
NW Washington, DC 20460

NEMA Comments on ENERGY STAR Distribution Transformers Draft 2 Specification

Dear Ms. Radulovic,

As the leading trade association representing the manufacturers of electrical and medical imaging equipment, the National Electrical Manufacturers Association (NEMA) provides the attached comments on the EPA's proposed Specification and Program for ENERGY STAR Distribution Transformers. These comments are submitted on behalf of NEMA Transformer Section Member companies.

NEMA, founded in 1926 and headquartered in Arlington, Virginia, represents nearly 400 electrical and medical imaging manufacturers. Our combined industries account for more than 350,000 American jobs and more than 6,500 facilities across the U.S. Domestic production exceeds $117 billion per year.

Please find our detailed comments attached. Our Member companies count on your careful consideration and we look forward to an outcome that meets their expectations.

If you have any questions on these comments, please contact Alex Boesenberg of NEMA at 703-841-3268 or alex.boesenberg@nema.org.

Sincerely,

Kyle Pitsor

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Vice President, Government Relations

NEMA Comments on ENERGY STAR

Distribution Transformers Draft 2 Specification

Preamble:

Importantly, NEMA prefaces these comments by stating that NEMA and its Members are committed advocates for energy efficiency at multiple levels in the electricity supply chain. We are also advocates for promoting and incentivizing the installation and use of energy efficient products, technologies and systems, including those products that are more efficient than required by minimum governmental standards. To that end, our industry has supported the ENERGY STAR program for a number of electrical products where it makes sense to do so. However, after careful consideration of marginal benefits and what we see as very significant burdens associated with an ENERGY STAR program for distribution transformers, we cannot support such a program and request that EPA discontinue consideration of its proposal immediately.

Distribution transformer manufacturers routinely consult with and speak about energy efficiency with their customers as part of the product specification and ordering process. As the EPA knows, the most recent DOE minimum energy conservation standards for distribution transformers went into effect January, 2016. Conversations among our members and their customers demonstrate that the transformer customers are now experiencing "sticker shock" with respect to those distribution transformers that meet the new minimum federal requirements. They are significantly more expensive than what the utility industry customer expected. While there is some upselling of more efficient transformers in special cases, it is minimal because those slightly more efficient transformers cost significantly more than the distribution transformers that meet minimum federal standards. Our members who manufacture and sell distribution transformers cannot support an ENERGY STAR program that would meet such significant resistance from their customers. Nor can our members support an ENERGY STAR program that will *not* materially move the needle for energy savings, because we simply do not see significant national support for such a program among the industry's customers. The interest among the industry's customer base to date for such a program is very small, and we do not see that changing. And finally, there is the burden for manufacturers in whatever conformity assessment program that comes with every ENERGY STAR program that will be significantly more expensive than any other ENERGY STAR program because of the nature of distribution transformers.

NEMA notes that the EPA has made significant changes to the previous draft specification in attempt to accommodate stakeholder concerns and comments. We further reiterate, however, our continued opposition to the proposed new program, given the near total lack of demand or interest for such a program by the two groups of stakeholders whom it would impact: the manufacturers of liquid fill transformers and their customers in the utility industry. The costs and burdens of the program's proposed requirements are not well-assessed, and in our experience and estimations these additional costs will not be balanced by corresponding energy savings. ENERGY STAR programs generally do and must enjoy substantially more support before they are worthy of implementation. Such isnot the case here.

Our comments below will address individual issues presented by the EPA's current proposal for an ENERGY STAR distribution transformer program. Notwithstanding our strong opposition of an ENERGY STAR program for distribution transformers, we ask that you read carefully our individual comments because they form the basis for and amplify our very serious concerns regarding the lack of justification for this idea.

Key Concerns:

1. We must restate most strongly our previously expressed concern that **EPA's consultant for this proposal is also a consultant for a raw material supplier (an amorphous material supplier) who will become the primary financial beneficiary of the proposed program.** This is a clear ethical and legal conflict of interest and EPA has done nothing to steer away from the conflict. We insist on legal review of this arrangement and the proposal by the EPA General Counsel. Since it has been an Administration concern and policy about lobbyists participating in Federal Advisory Committees, it would stand to reason that the Administration should be even be more concerned about this arrangement especially with respect to EPA's ensuing proposal.

2. The EPA continues to ignore the firm statements of the transformer manufacturing industry and their utility customers who assert low to no interest in pursuing this program. Regardless of whether there may be limited interest from a few entities for an ENERGY STAR program for distribution transformers, there is no indication or evidence that there will be an incremental increase in sales at levels sufficient to afford return on the significant investment that certification and verification of ENERGY STAR Distribution Transformers represents. The proposal appears to be mostly burden, with virtually nothing in the way of benefit to the public or the impacted parties the program proposes to regulate. Without a clearly identified demand for ENERGY STAR products in this category, any investment into establishing it represents wasted investment of time and resources for everyone involved. See item 15 below.

3. EPA has failed to demonstrate the financial viability of this program as part of the foundational documents, especially given the firm statements of lack of interest from so many affected sectors. It is not enough to have one or two proponents for a proposed nationwide program, when so many stakeholders, including those primarily impacted, are vehemently non-supportive. The EPA's energy/cost savings analysis fails to consider all the factors which influence the purchase of capital equipment. See item 14 below and Appendix A.

4. The EPA has not considered thoroughly the actual realities of distribution transformer performance and loading in the field. Furthermore, the proposed load factors favor low load levels not truly representative of field conditions, which in turn biases raw material selection to amorphous core transformers. See items 1 through 4 below. This again calls into question the consultant relationship mentioned above.

5. The EPA's analysis fails to accurately illustrate the numerous interactions of materials, design, cost and field performance with respect to declaring a design feasible or claiming energy savings will result from use of said design. The EPA's supporting analysis for the Draft 2 specification is at best partial, and at worst misleading. See items 5, 6, 7, and 8 below.

Comments to Specification and Program

1. Proposed Load Factor Selections: EPA proposes to establish ENERGY STAR criteria in three groups of transformer load factors: <30%, 30-40%, and >40%. Per the narrative for

the Draft 2 specification these load factors purportedly encompass the average load on transformers for the rural residential customer (15%), average nationwide load factor (35%) and for the heavy industrial customer (≥50%). We note that, of the EPA's three proposed efficiency qualification ratings/ranges, two of the three factors focus on load levels below the 50% DOE load point. By contrast, in the 2013 DOE Final Rule, DOE found that 'higher-capacity three phase liquid-immersed and medium voltage dry-type transformers were loaded at 20 to 66 percent, and smaller capacity single-phase medium-voltage liquid-immersed transformers were loaded at 20 to 60 percent." 78 FR 23336, 23372 (April 18, 2013)[1]. NEMA questions, with considerable skepticism, the veracity of any claim of an "average load of 15% for the rural residential customer." This figure is outside of the DOE's range for both three-phase and single-phase transformers and EPA has not cited any market facts that would justify such a peculiar load factor. One explanation for proposing this kind of deviation is that the extremely low loading figure favors the selection of amorphous core transformers, the product supported by the client of EPA's analytical consultant on this ENERGY STAR proposal. If true, this is clear evidence that EPA has permitted undue influence of special interests who favor amorphous metal which is the only practical material available (at times in limited quantities) to gain higher efficiencies at low load levels.

2. Proposed Load Factor "Ranges": With respect to the proposed load levels for the program, we are confused that EPA has suggested *ranges* of efficiency rather than a *specific* numerical percentage. DOE in contrast settled on a single numerical loading percentage because it facilitated comparison and compliance. For its ENERGY STAR program, EPA asks consumers to "Find product models that have earned the ENERGY STAR and *compare* features, savings and more to optimize your purchase."[2] It is unclear how EPA's proposed program for distribution transformers with its range of load factors will fit the ENERGY STAR paradigm and enable a buyer to compare "features, savings and optimize purchase." The only explanation for this deviation from the EPA's ENERGY STAR paradigm is the aforementioned conflict of interest that underlies this proposal. Using ranges instead of fixed integers will result in confusion in any list of products and an inability to readily perform comparisons since the expressed performance information may not have been measured at the same load points. This approach may be intended to grant greater flexibility to participants in the proposed program, but in application it will only increases burden and confusion on the part of manufacturers AND customers. The DOE's arrival at the 50% load factor for the Federal minimum standard was the result of long and careful analysis of current and projected load levels in the U.S. market. As noted in item 1 above, a review of the 3 EPA's proposed Load Factors leads to the conclusion that the Load Factors chosen are not indicative of the market.

3. Bias in selecting load factor ranges: We believe that the 3 tiers of load Factors chosen by EPA for ENERGY STAR are too biased toward non-representative low Load Factors. The fact that they are unusual and non-representative is indicative of bias and irrelevance with respect to true energy savings. We note that the 2013 DOE Final Rule, see 78 FR at 23375, estimated load growth on liquid filled distribution transformer to be 1% per year. Therefore over their expected life, transformers loaded at 30% (for a relatively new residential development) at the beginning would be at 60% by end of life as the customer base served by these transformers grows. This is a significant part of the reason for DOE's analytical conclusion to use 50% load factor for lifetime energy

[1] https://www.regulations.gov/docket?D=EERE-2010-BT-STD-0048
[2] https://www.energystar.gov/productfinder/

calculations. The EPA has not offered any new data, or even a feasible reinterpretation of existing data, to support the proposed low load factors. DOE analysis suggests low loading is a temporal phenomenon in most market circumstances, yet EPA has assumed it is a maintained norm for their calculations. Given that many users do not even know their true load factor where any particular transformer will be performing once in use, we believe the proposal of 3 different Load Factors in the specification is too detailed for practical use. Furthermore, the weighting towards lower load factors, where amorphous metal is more popular, to us displays clear evidence of EPA allowing itself to be over-influenced by special interests.

4. More on Load Factor: The only load factor that makes sense in practical terms is 50%, because it allows for fair comparison of existing standards versus elevated standards and because the DOE's analysis noted above arrived at 50% as a good representation of typical loading in the field. In contrast to EPA's proposed analysis which would assert that energy and financial savings are readily available at lower load factors, the DOE rulemaking analysis clearly demonstrated that the current Federal standards are the most technically feasible and economically viable nationwide, thus there is no room for a higher efficiency program from E* unless it successfully targets a very narrow band of loading, price and materials. That is, if the EPA program specifically targets low load factors and expensive amorphous core designs. However, such narrow focus and analytical dependence is not a wise choice for a national incentive program.

5. Design Analysis: The EPA's claim that various transformer design lines and construction types can meet the proposed efficiency levels for the various kVA levels are not grounded in commercial reality and ignore important physical facts. In its analysis, EPA neglected to examine design feasibility in terms of cost or physical characteristics (i.e. size and weight). For example: EPA analysis would assert that a pole-mounted transformer is capable of being made more efficient with a variety of core types. This claim ignores the fact that these design options can result in a transformer of such size that it cannot safely be mounted on an existing pole. The U.S. Department of Energy studied and understood that this was a significant issue before deciding upon an economically justifiable energy conservation standard under the Energy Policy and Conservation Act for liquid filled distribution transformers. (See 78 FR 23336, 23374): "For pole-mounted transformers, represented by design lines (DL) 2 and 3, the increased weight may lead to situations where the pole needs to be replaced to support the additional weight of the transformer. This in turn leads to an increase in the installation cost." Size and weight impacts are present in other designs, such as pad-mounted transformers, as well. The EPA did not sufficiently examine cost impacts of their proposal's claimed-compliant design lines. We speak to the costs of higher efficiency in more detail in items 6, 11, 12, 13, 14 and in Appendix A.

6. Design Efficiency versus Weight: To further expand the issue of design versus weight, we refer the EPA to the previous DOE rulemaking (78 FR at 23374), where the DOE effectively states that their analysis gave rise to an assumption that if the transformer weight for the more efficient transformer over the base line exceeded 15%, then pole change out would occur. It is important to note that the baseline being referred to in this reference is the 2010 DOE minimum efficiency standard. In implementing the new 2016 DOE transformer standards, NEMA manufacturers inform us that they have already received complaints about pole transformer weight (i.e. for 2016-compliant designs). The proposed ENERGY STAR levels would cause even more problems. We see no evidence in the supplied information from EPA that the additional costs and considerations for size and weight for pole and pad mounted transformers have been incorporated into EPAs analysis in any way. Similarly, the EPA analysis does not

include consideration of the fact that larger and heavier units will result in less units per truckload, increasing transportation costs. These examples illustrate the significant oversight and evidence the many errors in analysis that impact the viability of the proposed program and drive the conclusion that this ENERGY STAR proposal is poorly conceived *and* evidence that conflict of interest is at the root of the proposal.

7. Materials Choices in Practice: The EPA's reassurances that multiple design lines and construction methods for Distribution Transformers *might* meet the proposed performance levels of Specification Draft 2 ignore real-world material availability constraints and competitive practices. We remind the EPA that amorphous metal, a key ingredient in high-efficiency lightly-loaded transformers, is available from only two global sources. The second source is relatively new to the utility-grade market, and the original source has nearly all the market. As such, this treads closely on sole-source availability, which EPA like any government agency is obliged to stay away from. We note in several footnoted links below that there are periodic gaps in availability of high-performance grain oriented steels[3]. As a result, a performance specification which heeds these aforementioned challenges cannot push too high into the efficiency of one design line or another. In the presentation from the August 11th webinar on pages 31/32, EPA would appear to claim that multiple core materials are able to comply with the proposed efficiency levels. However, by ignoring material availability and costs as well as physical constraints noted in our preceding comments the EPA analysis dismisses very significant factors and as a result portrays hand-picked data from larger, more complicated data sets to create the appearance of feasibility. This failure to fully express and illustrate numerous design factors could be perceived as intent to deceive the casual observer away from the truth that amorphous metal is the only practical low-load-factor efficiency option.

8. Total Ownership Cost (TOC): The EPA's latest analysis into technical feasibility and TOC are noticeably insufficient in terms of actual cost of ownership, particularly with respect to purchase price of products with exotic materials. It is not sufficient to cite DOE analysis that a particular efficiency level is achievable without balancing this with the at-times prohibitive cost of those designs and corresponding higher purchase price. A proper TOC approach factors in all these considerations and is firmly dependent on knowing one's current and projected transformer load levels. EPA's approach is too circumspect and shallow to yield realistic and truthful assessments. Because of its missing factors, the EPA's proposed TOC calculation is at best inaccurate and at worst misleading. A very detailed and accurate full TOC analysis is essential to justify purchase of higher, more expensive transformers. EPA's approach is too over-simplified to be useful. The demonstrated lack of participation in the previous ENERGY STAR Transformers program, which was deeply rooted in TOC, evidences the low consumer demand for more expensive high-efficiency products.

[3] Three examples: http://www.prnewswire.com/news-releases/us-grain-oriented-electrical-steel-industry-encouraged-by-commerce-departments-affirmative-preliminary-determinations-in-antidumping-investigations-258012431.html
https://agmetalminer.com/2015/08/11/if-only-free-markets-prevailed-for-grain-oriented-electrical-steel/
https://agmetalminer.com/2016/08/10/trade-cases-continue-to-drive-grain-oriented-electrical-steel-markets/

9. Product SKUs/Model Numbers: In reviewing the EPA's proposed approach to efficiency and design of our products, it seems clear that EPA has assumed manufacturers offer products by catalog number or model number, meaning one can order a particular model at any time and reorder that same one. This is not common practice. As we have stated before, transformers are ordered in terms of performance features, efficiency being one feature, and as a result model numbers can and do change over the course of a year, even for a transformer built to the same or very similar specifications as a predecessor. For example: one NEMA member gives every production run of a specific design a different model number. This is another illustration of how custom, made-to-order products do not fit the EPA's ENERGY STAR program mold. If EPA disagrees, they must provide clear illustrations and examples as to how their program administration practices will accommodate the needs of custom-made products.

10. There Are No Catalogs: The EPA's typical approach of having a significant percentage of any manufacturer's model numbers represented in the ENERGY STAR program fails to consider that distribution transformers are typically built-to-order to meet a given customer's requirements; they are not stocked in warehouses. The EPA fails to recognize that *tens of thousands* of potential designs exist within a manufacturer's models. Since manufacturers have literally tens of thousands of basic models it would never be feasible in terms of data management and certification costs to list tens of thousands of designs in an EPA database for potential customers to select from. The certification costs for this many models, even the top 25% or less, would be cost-prohibitive and again not consistent with the made-to-order nature of the distribution transformer market's supply and demand practices. The EPA's typical menu-driven, qualified products list approach does not suit custom built, made-to-order products.

11. 3rd Party Certification and Custom-Made Products: On the August 11th webinar the EPA and its consultants seemed to be beginning to understand, for the first time, the staggering costs associated with qualifying thousands or tens of thousands of designs to the program through the expensive 3rd Party Certification Program. On the call, NEMA members asked aloud whether EPA would allow for an Alternative Efficiency Determination Method, or AEDM, to be certified instead and the AEDM's resulting modeling results qualified by association without further individual review and submission. Given industry's stated strong opposition to witness testing and a lack of existing third party test facilities for transformers, the EPA would have to address this issue clearly and fairly if EPA continues to consider this proposed program. During the August 11th webinar industry indicated that the typical 3rd party program models would not work, and the EPA must demonstrate effective and non-burdensome administrative processes before the Agency can claim this program is feasible. The EPA must recognize that without clear identification and analysis of how the 3rd Party Certification program would manage transformer certification and verifications processes, the proposed program is infeasible.

12. Testing Burden: EPA's dismissal of industry concerns over the application of the 3rd Party program to this product class belies a perceived conclusion at EPA that physical testing of products which weigh thousands of pounds and are only made to order is a trivial undertaking. This is not the case. There are few labs in the world, outside manufacturer's own labs, with a robust capability or experience in testing distribution transformers. Similarly, the cost of witness testing travel of CB employees or the cost of shipping physical samples to outside labs would be in the thousands of dollars per unit. Even if manufacturers are allowed to certify and use their AEDM's to submit products, physical testing is still required to substantiate an AEDM. This consideration also does not factor in EPA's requirements for verification testing and how they could be satisfied.

NEMA and its members await EPA's clear, detailed explanation as to how a viable 3rd party certification and verification concept could be established which would minimize burden on manufacturers and minimize resulting impacts on product cost.

13. Two Transformers Per Listing: The EPA's proposed approach which would require an ENERGY STAR product to be some fixed percentage better than a base model does not factor in the complexity or cost of transformer design with respect to first calculating a DOE-compliant model and then having to see if they can design a more efficient version of the same model which qualifies for the given design line in the EPA Specification. Transformers are not designed until they are ordered. As we have stated since the beginning, distribution transformers are custom, unique products, thus there is no such thing as "upgrading" a basic model; rather one must design an entirely *different* model. This means there is no "baseline" catalog or accompanying test data for "baseline" products. This is the fallacy in EPA's approach. Even if a manufacturer were to design a model and call it a base model, that product must be tested to verify its efficiency to compare that to the "upgraded" model. This means manufacturers seeking to sell an ENERGY STAR Transformer will have to design two or more transformers for every potential submission or bid. In practice this could effectively double the amount of administrative costs and submission processing time for each ENERGY STAR listing.

14. Comparing EPA and DOE Design Savings: The EPA analysis into potential compliance with the proposed efficiency levels does not include feasibility analysis in terms of what two competing efficiency requirements (EPA-voluntary vs. DOE-mandatory) might experience in terms of design cost or technical feasibility. Unlike typical ENERGY STAR products whose higher efficiency levels are associated with no change in performance and with identical patterns of use, distribution transformer efficiency is not in direct proportion with potential energy savings, due to the variety of loading factors in the field and during the course of any given daily or seasonal electricity demand. Energy savings for lightly loaded (ex. 30%) ENERGY STAR transformers can only be realized if several conditions exist and are maintained throughout the life of the product: 1) the final application must in fact experience 30% (maintained, low) loading, 2) the related efficiency maximization at 30% loading must not preclude compliance with DOE Federal minimum energy conservation standards at 50% loading, and 3) the resulting high-efficiency "hybrid" transformer must be practical and cost-effective to design, build, test and procure. The EPA analysis does not examine the interplay of the above mentioned three key factors, and manufacturer experience informs us that these factors are often incompatible. Importantly, transformer loading is not static over time and tends to rise as much as 1% per year as noted in item 5 above. Example 1: For example: a transformer that is certified as more efficient at 30% load than a sibling is ONLY guaranteed more efficient at that load level. Any energy savings off that optimization point cannot be guaranteed, and in fact the product's efficiency may be worse depending on circumstances. Slide 30 from the August 11th webinar graphically illustrates that it is possible for a proposed ENERGY STAR design to be less efficient under field conditions than a DOE-compliant design. The distinct potential for performance variation of distribution transformers in the field defies any approach to manage it from afar. As a result, EPA cannot claim tangible energy savings; they can only claim that savings *might* occur under *perfect* conditions. An ENERGY STAR program for distribution transformers has the hallmarks of a Las Vegas crap shoot when it comes to establishing energy savings, and this fact undermines and diminishes the value of the ENERGY STAR mark.

15. Accurately Assessing and Portraying Demand: For any energy conservation standard applicable to distribution transformers, it is critical that the correct transformer be

matched with the right field conditions, or the claimed energy savings will never be realized. The EPA evidenced during the August 11th webinar that they have no firm plan for how the specification will be applied and how qualification and selection of ENERGY STAR Distribution Transformers will take place. Because the EPA has chosen to deviate from the DOE's efficiency levels and test procedures, *i.e.* deviate from the 50% load factor, the EPA must structure a program which ensures that efficiency savings are actually realized. The current proposal's analysis does not guarantee energy savings in any way, it only projects potential savings if 50% or 100% of sales are captured by ENERYG STAR Distribution Transformers, without showing how those transformers would be qualified or selected.

In expansion of this concept, we note that the EPA has published no analysis indicating the actual market demand for ENERGY STAR Distribution Transformers. Two of the three national utility representatives participating in this proceeding previously indicated little interest in the proposed program, while the third stakeholder customer group indicated a desire to be able to use Federal funds for ENERGY STAR products when available. In messages to NEMA, these stakeholders all continue to voice skepticism in the proposed program and specification. The EPA has not addressed market demand concerns adequately to date, and they are arguably the most critical. Without a clearly identified demand for ENERGY STAR products in this category, any investment into establishing it represents wasted investment of time and resources for everyone involved.

We refer the EPA to Table 8.3.10 of the 2013 DOE rulemaking Technical Support document[4]. This table shows that public utilities, the consumer group most likely to be in a position to receive funds to purchase the proposed ENERGY STAR transformers, own 26% or less of the market for individual design lines 1-5. This means the EPA's estimate of 100% or even 50% of the market going to ENERGY STAR products is wholly inaccurate. The EPA must clearly quantify the interested market demand, not just assume some potential demand level, through polling of potential customers of the program to demonstrate that sufficient demand exists to justify the significant costs and investments which will be first borne by industry and then passed along to customers. It follows that EPA should research and recalculate the savings estimates for more likely and reasonable percentages such as 10% or 20% at the absolute maximum, according to evidence gained by said research.

16. Transformer Consumers are Intelligent: Purchasers of distribution transformers are educated, sophisticated and informed consumers. As NEMA indicated at the outset of these comments, our members discuss energy efficiency with their customers all the time. These customers are already deeply familiar with the practice of total ownership cost in purchasing decisions, and those who are able or allowed to apply TOC to their purchasing processes already use it. They do not need an ENERGY STAR product to make their TOC decisions actionable. EPA has consistently described ENERGY STAR "as a voluntary labeling program designed *to identify and promote energy-efficient products*,"[5] and the ENERGY STAR mark has helped consumers easily identify for decades the more efficient products in a product category that they would not so easily identify without the mark. But that would not be true for distribution transformer customers; they already know about the more efficient transformers. They do not need to be "identified." It cannot be defensibly claimed that the creation of an ENERGY STAR

[4] https://www.regulations.gov/docket?D=EERE-2010-BT-STD-0048
[5] https://www.energystar.gov/about/history

program for distribution transformers will change consumer habits or procurement constraints and practices at individual utilities. In contrast, as noted in preceding comments about cost, the added costs of certification and testing to the proposed program WILL raise purchase price without guaranteed balance from energy savings, which will further discourage consumer purchases.

17. In conclusion: the EPA continues to misunderstand the complex nature of the manufacturer-to-customer relationship for these products, the varying availability of their construction materials, the physical and financial constraints of specific designs and the customized nature of distribution transformers. The EPA has not adequately illustrated how the proposed program is anything but a sales pitch for amorphous metal core materials. The EPA has not conclusively addressed manufacturer concerns as to how the 3rd Party Certification program can be applied to these products in a way that minimizes burden or production and delivery delays for their customers.

    NEMA reiterates our member's unanimous opposition to the program as proposed, owing to inadequate investigation and analysis into demand, cost, technical versus physical feasibility and the lack of clear detail in how this program would be successfully and reasonably administered.

Appendix A

Cost Effective Energy Savings:

Our review of EPA's analysis of the savings and cost of improved efficiencies, at various Load Factors, suggests that the cost side is not well documented or explained. We cannot determine the costs (price) associated with improved efficiencies in the EPA model shown during the webinar. EPA must show the cost (in the DOE model this is referred to as price, or at least the price increase) used to determine these benefits. The EPA's slides from August 11th seem to show very low cost differentials but our review of available data does not corroborate EPA's claims.

Our study of existing designs for improved efficiency to meet the proposed Energy Star requirements suggests that:

If one wanted to continue to use silicon steel cores (a stated EPA goal), to meet the EPA target for efficiency for Load Factors of 40% or greater, the transformers would cost 35 – 45% more. The low end is for Design Line 2 and the higher end is for Design Line 1. We have only looked at these two Design Lines due to time constraints.

Using the data shown in the EPA Draft 2, Version 1.0 document for Design Line 2, we have constructed a more complete version of the Cost Effective Savings and included an estimate of price and used the EPA formula of A = $7/watt, B = $2.75/watt.

We then constructed the following models using the designs from the Energy Star presentation on August 11, 2016 and used the owning formulas from that presentation.

Chart A shows design compared at an owning formula of A = $7, B = $2.75. This would be an owning formula we would consider on the high side; however the A/B ratio is quite typical of 2.5:1. As you can see from the following model, there is no economic justification/savings for any of the designs shown by DOE. For the Minimum Cost Design shown below, we used price information from the DOE analysis (see footnote 3). Our analysis concludes that the only claimed savings would come from operating at a much lower Load Factor, but if the Load Factor is lowered then the A/B ratio is wrong.

Chart A

	Core Loss (W)	50% Winding Loss 55C (W)	100% Winding Loss @ 85C (W)	Cost of Losses A=$7, B=$2.75	Difference vs min cost Design	Est Breakeven price	$ Difference	% Difference
Min Cost Design	66	66	286	$1,248.50		$1,512.00		
Design 1	44	89	384	$1,364.00	$115.50	$1,396.50	($115.50)	-7.6%
Design 2	52	81	349	$1,323.75	$75.25	$1,436.75	($75.25)	-5.0%
Design 3	47	84	363	$1,327.25	$78.75	$1,433.25	($78.75)	-5.2%
Design 4	52	82	355	$1,340.25	$91.75	$1,420.25	($91.75)	-6.1%
Design 5	51	81	351	$1,322.25	$73.75	$1,438.25	($73.75)	-4.9%
Design 6	44	84	370	$1,325.50	$77.00	$1,435.00	($77.00)	-5.1%
Design 7	43	89	393	$1,381.75	$133.25	$1,378.75	($133.25)	-8.8%
Design 8	44	88	389	$1,377.75	$129.25	$1,382.75	($129.25)	-8.5%

Next, using data from the EPA's briefs on this subject, we make the same comparison using the owning formula of A = $6, B = $0.75. This owning formula has an A/B ratio of 8, which would be more typical of a very low Load Factor utility. See chart B below.

Chart B

	Core Loss (W)	50% Winding Loss 55C (W)	100% Winding Loss @ 85C (W)	Cost of Losses A=$6, B=$.75	Difference vs min cost Design	Est Breakeven price	$ Difference	% Difference
Min Cost Design	66	66	286	$610.50		$1,512.00		
Design 1	44	89	384	$552.00	($58.50)	$1,570.50	$58.50	3.9%
Design 2	52	81	349	$573.75	($36.75)	$1,548.75	$36.75	2.4%
Design 3	47	84	363	$554.25	($56.25)	$1,568.25	$56.25	3.7%
Design 4	52	82	355	$578.25	($32.25)	$1,544.25	$32.25	2.1%
Design 5	51	81	351	$569.25	($41.25)	$1,553.25	$41.25	2.7%
Design 6	44	84	370	$541.50	($69.00)	$1,581.00	$69.00	4.6%
Design 7	43	89	393	$552.75	($57.75)	$1,569.75	$57.75	3.8%
Design 8	44	88	389	$555.75	($54.75)	$1,566.75	$54.75	3.6%

Chart B suggests that the price increase for the improved, higher efficiency designs need to be less than 5% to justify changing to the proposed ENERGY STAR compliant designs. Our data, as explained previously indicates that price would go up significantly more than 5% --- in the range of 35-40% more. There does not appear to be any economic advantage to the EPA's proposed designs and efficiencies.

We have not explored using amorphous core transformers as part of this analysis, just as EPA did not explore that option. However, the data suggests that the efficiency increased proposed by DOE would not be economically justified by a Cost of Losses approach using owning values typically used by utilities. In fact, most of the savings come from the use of a lower Load Factor and that Load Factor is not the average used by the industry. **We believe that if EPA wants to make Load Factor part of the program, there needs to be a means by which the Load Factor used by the customer can be verified, since the deemed energy savings of the program are almost entirely attributable to the Load Factor.**