March 27, 2023

Submitted via [www.regulations.gov](http://www.regulations.gov)

**RE: Energy Conservation Program: Energy Conservation Standards for Distribution Transformers [EERE-2019-BT-STD-0018]**

To Whom It May Concern:

The National Rural Electric Cooperative Association (NRECA) respectfully submits the following comments to the U.S. Department of Energy (DOE) in response to its notice of proposed rulemaking (NOPR) on Energy Conservation Standards for Distribution Transformers (EERE-2019-BT-STD-0018).

NRECA is the national trade association representing nearly 900 local electric cooperatives and other rural electric utilities. America’s electric cooperatives are owned by the people that they serve and comprise a unique sector of the electric industry. From growing regions to remote farming communities, electric cooperatives power 1 in 8 Americans and serve as engines of economic development for 42 million Americans across 56 percent of the nation’s landscape.

Electric cooperatives operate at cost and without a profit incentive. NRECA’s member cooperatives include 62 generation and transmission (G&T) cooperatives and 831 distribution cooperatives. The G&Ts generate and transmit power to distribution cooperatives that provide it to the end of line co-op consumer-members. Collectively, cooperative G&Ts generate and transmit power to nearly 80 percent of the distribution cooperatives in the nation. The remaining distribution cooperatives receive power directly from other generation sources within the electric utility sector. Both distribution and G&T cooperatives share an obligation to serve their members by providing safe, reliable, and affordable electric service.

Electric cooperatives have a long history of supporting energy efficiency and are committed to finding cost-effective solutions that help their consumer-members save money. Given that cooperatives are cost-based any new costs borne by the cooperative must ultimately be passed to the end-of-the-line consumer. As such, cooperatives actively seek out ways to save energy and pass those savings on to their consumer-members as part of their commitment to affordable and reliable electric service.

Our members are some of the primary consumers of distribution transformers and thus we have a vital stake in the outcome of this rulemaking. If this proposal is implemented as currently contemplated, it would have serious consequences to NRECA members’ ability to provide affordable, reliable electric service to millions of Americans. We urge the agency to reconsider the NOPR as currently drafted, and to issue a final rule that maintains the current standard. Contrary to DOE’s assertions, the NOPR does not meet the Energy Policy and Conservation Act’s (EPCA) requirements that the standard be both technologically feasible and economically justified. DOE’s NOPR relies on flawed assumptions and ignores the real-world challenges facing the distribution transformer market today not just for electric cooperatives but all electric utilities, as explained in further detail below. In preparation for our comments in this docket, NRECA engaged Power System Engineering (PSE), a full service electrical and mechanical consulting firm for utilities and other entities with a wealth of experience with electric cooperatives and we enclose PSE’s memo here as further evidence to our concerns expressed below. PSE states: “we support and echo many of NRECA’s concerns about this proposal as currently written and its potential consequences on the ability of U.S. electric cooperatives to continue to provide affordable, reliable electric service to their members.”

We urge DOE to keep the existing standard in place, as permitted by statute, and instead focus on other means for incentivizing amorphous steel core transformers that could allow for potential expansion in the manufacturer market without jeopardizing electric reliability. DOE’s top priority should be finding ways to support domestic distribution transformer manufacturers to increase production immediately and to sustain that output over the long term as electrification of the U.S. economy grows.

**Now is the wrong time for this proposal. The current distribution transformer supply chain serving the utility sector is struggling to meet demand.**

The current manufacturing base serving electric utilities is struggling to meet demand and DOE’s NOPR exacerbates this ongoing crisis. Electric cooperatives are facing unprecedented challenges securing equipment and material to provide reliable electric service to their consumer-members. All segments of the utility sector have been sounding the alarm for more than a year about the supply chain constraints around multiple types of equipment they require to keep the lights on, with distribution transformers being the most acute challenge. It now takes more than a year on average for utilities to receive distribution transformers, compared with 60 days just a couple of years ago. Some domestic transformer manufacturers have stopped taking orders altogether. We expect the backlog to continue to increase absent U.S. government support as utilities invest in grid resilience and modernization projects and federal and state policies drive more electrification.

Given the precarious situation that electric utilities face today in procuring distribution transformers, the NOPR sends the wrong message and exact opposite signal that existing steel producers and transformer manufacturers need right now to further invest in the production capability we need to dig us out of the current hole we are in and be able to meet the increasing demand for electrification that comes with electric vehicle charging, heat pumps and other carbon reduction initiatives. One of the potential solutions identified in the last several months to address current supply chain constraints to distribution transformer manufacturers is to send a clear signal to the steel producers – for example through subsidies or purchase commitments – that there is and will remain a strong and growing demand for grain oriented electrical steel (GOES). However, DOE’s NOPR does the exact opposite and instead pushes the transformer market to move almost entirely away from GOES. Contrary to DOE’s assertions, this proposal will not expand the market for distribution transformers because most of the current production using traditional GOES will not be able to meet the new energy conservation standard.

**DOE’s NOPR injects harmful uncertainty into the distribution transformer market, upending potential progress in increasing production, just when utilities need manufacturers to be 100% focused on increasing output.**

Since under DOE’s proposal most current production will need to shift to using amorphous steel, distribution transformer manufacturers are being forced to consider how they will adjust and retool their production, including sourcing their material – taking critical attention away from increasing today’s output. Simply put, this proposal is already doing damage to alleviating the ongoing supply chain crisis.

Further, the NOPR is already creating immediate implications in steel production. There is only one domestic producer of GOES and this proposal risks putting the domestic electrical steel market in a precarious state. With the uncertainty caused by the NOPR itself and its implications that GOES will become irrelevant in the market once DOE finalizes the proposal, it is a natural result that this existing producer, and others considering investment in GOES, will pause any decisions on increasing GOES production – and this is all playing out when the industry needs more GOES today.

Rather than helping to diversify supply, the NOPR is counterproductive as it would deter further domestic investment in GOES production because only amorphous steel cores would be able to meet the new energy conservation standard proposed by DOE. Ultimately, DOE’s NOPR will not foster competition and is instead likely to create a new monopoly supplier while simultaneously driving the existing GOES supplier out of the market. This is likely to create a ripple effect of ceasing further investment in the domestic production of GOES for distribution transformers under consideration or announced by other steel producers.

**DOE’s assumptions about the availability of amorphous steel are incorrect and underestimate the ability of the material to be available at a level to meet the utility sector’s needs in the envisioned timeframe.**

We have serious concerns about whether the only domestic producer of amorphous steel today would even be able to meet electric utilities’ demand for distribution transformers. The only amorphous steel producer’s output today is a mere fraction of what would be required as input to distribution transformer manufacturing to adequately meet the electric utilities’ demand, raising serious implications for electric reliability and affordability. As currently drafted, the NOPR relies on a single supplier in the market to ramp up output to meet the demand in just three years. We already have a steel availability issue today. DOE’s NOPR compounds this existing problem as the proposed standard would require 60% more GOES or 30% more amorphous steel per transformer. When the focus should be squarely on increasing current production of distribution transformers, it is clear that the DOE NOPR does more harm than good. Even if the lone domestic producer of amorphous steel ribbon may be able to ramp up if this rule is finalized, we have serious concerns as to whether there will be sufficient capacity in the companies that use the ribbon to turn it into wound core.

In addition, the Department of Commerce found that amorphous steel is “more labor intensive to form into cores” and “it is more economical in countries with low labor costs.”[[1]](#footnote-1) The United States’ labor market, characterized by higher prevailing wages, is very different than the labor markets of countries, such as China and India, where most amorphous steel cores are widely produced today. Moreover, the labor shortages plaguing many U.S. industries today – including distribution transformer manufacturers– make it very unlikely that domestic production of amorphous steel cores will ramp up to the level that DOE assumes in the NOPR. The Department of Commerce also found that the current lone domestic supplier “has lost 50 percent of its employees due to its inability to compete with imports from China that have flooded the world market.” We have serious doubts about the ability of one supplier to increase output in the timeline envisioned in this proposal. If this NOPR is finalized as drafted, and the sole supplier cannot meet the demand, manufacturers will be forced to source their material from international sources (particularly China) representing a significant national security risk to the United States.

Further, it is our understanding that most of this amorphous steel producer’s steel inputs (?) are foreign-sourced, representing an additional national security risk. Relying on foreign sources for steel inputs (?) required to support critical infrastructure should be a serious consideration for DOE as it considers whether to finalize this rule as contemplated. Moreover, with the Build America Buy America Act (BABA) becoming law with passage of the Infrastructure Investment and Jobs Act (IIJA) the steel being used by this amorphous steel producer would likely not meet the requirements of BABA.

This move will also be detrimental to bringing back domestic manufacturing capacity for large power transformers (LPTs) used for electric utility transmission services. LPTs use GOES and cannot use amorphous steel cores, and it has already been identified as another national security risk that the U.S. receives nearly all LPTs and their components from overseas.

**The superiority of amorphous steel to grain oriented electrical steel is overstated in DOE’s proposal.**

We acknowledge that amorphous steel core transformers are technologically feasible in that they are in production and use both in the United States and more widely in other countries today. However, we believe DOE has not adequately accounted for some serious operational concerns that come with using amorphous steel cores as compared with traditional GOES cores. More work is needed to address these concerns and gain a better understanding of their potential impacts to the reliable operation of the distribution grid.

The relative energy efficiency benefits of amorphous steel core transformers cannot be realized consistently and broadly due to operating conditions that vary across electric utilities. DOE’s analysis in the NOPR relies on the energy savings from improved no load losses achieved with amorphous steel core transformers. However, DOE’s analysis does not accurately reflect the loading on today’s transformers as well as the increased loading expected in the future due to greater electrification. DOE’s assumption that utilities are loading their transformers at 30% today vastly underrepresents the loading that NRECA members report from their systems. Our members strive to maximize the loading that is both safe and maximizes usage of the asset to the extent possible. For cooperatives, it is more likely that the loading on our members’ distribution transformers today on average is closer to 80%. Therefore, DOE is also undercounting the expected loading on distribution transformers due to future growth in electrification at 50% as that is well below what is already the case today.

Again, DOE’s analysis in the NOPR relies on energy savings achieved through improved no load losses. However, we urge DOE to consider that amorphous steel core transformers experience improved no load losses at the expense of high load losses. Our members’ experience shows that amorphous steel core transformers sustain higher full load losses, which is more likely to be the operating condition of transformers with further electrification and EV charging occurring overnight, thus reducing the amount of time that transformers are carrying no or very low load. Adding more copper and core material can compensate for these losses at full load, but the transformer will ultimately be larger, making them more difficult to handle and more expensive for cooperatives. In addition, DOE should better account for the additional greenhouse gas emissions it will take in terms of materials to support the bigger footprint of amorphous steel core transformers, ranging from the copper in the windings to the steel for the tanks to the oils, paints, and insulating papers used on the transformers, and everything in between. Using more material to produce these transformers means more emissions and DOE should accurately reflect that in the Department’s analysis.

Moreover, we have serious concerns about the material itself. Past research and experience has demonstrated to our members that amorphous steel cores are brittle and can fragment easily. Our members have seen these cores damaged during construction and during faults such as lightning strikes. When these units are damaged, it is nearly impossible to repair them. Ultimately this results in more material and operational costs to electric cooperatives that must replace damaged equipment. Our members also cite concerns regarding the potential for ferroresonance, which can result in transformer damage and create other problems during restoration of power in an outage. While there may be advances in the technology to address these concerns, more operational experience is needed prior to mandating a shift to amorphous steel core transformers. DOE should consider how to support pilot programs with utilities to gain more operating experience and provide opportunities for utilities to participate in research at the national labs to address these concerns. Finally, we urge DOE to consider more long-term research as to whether the amorphous steel cores maintain their improved no load losses over time.

**Forcing the industry to move to amorphous steel core transformers will require several changes to utility operations and impose significant burden in terms of cost and redesign of other equipment.**

Electric cooperatives will face significant challenges that the DOE NOPR fails to adequately account for, and if DOE incorporates all of these potential issues, its analysis would show that the standard proposed in the NOPR is not economically justified. The increased weight and size of amorphous steel core transformers, in addition to other factors, means that significant changes to utility operations need to be addressed, all of which represent increased costs:[[2]](#footnote-2)

* Significant increase in wood pole class and heights as well as the frequency at which pole replacements are required.[[3]](#footnote-3) Overstressed poles may lead to failures sooner than anticipated. For utilities with low customer densities such as many electric cooperatives this would be very costly as additional costs are collected from fewer consumer-members.
* Higher rated equipment required to set higher class poles.[[4]](#footnote-4)
* Bigger trucks and an increase in specialty lifting services would be required, particularly in remote and hard-to-access locations.[[5]](#footnote-5) May also require larger forklifts to accommodate these transformers in storage.
* Oversized/heavier pad-mount units could cause cracks in foundations.
* New processes would need to be developed for design to determine the best locations for using amorphous steel core transformers and new inventory processes to store, track and manage this new type of transformer.
* Louder noise from the transformer leading to potential consumer-member complaints.
* Additional storage space required for larger transformers.
* Existing trucks cannot carry as many of these larger transformers, therefore greater fuel use (and emissions) from additional required trips to transport, leading to overall higher transportation costs.[[6]](#footnote-6)
* Equipment purchases needed to facilitate movement, transportation, and installation.
* Problems where existing transformers have a defined vault and limited ingress/egress space available.
* Poor overload capacity which could result in more damage to transformers or failures[[7]](#footnote-7)
* Amorphous steel cores require more winding, resulting in the need for bigger conductor and thicker trip secondaries than currently in use.

Electric cooperatives with experience utilizing amorphous steel core transformers in the field report that they more often led to broken wood poles, replacement transformers had long lead times, and to switch out amorphous transformers with new equipment required two trucks. Perhaps most concerning is that the ability of amorphous steel core transformers to withstand short circuit faults is low.[[8]](#footnote-8) This is due to the rectangular shape of amorphous steel cores versus the traditional circular core shape because electromagnetic forces are no longer distributed evenly. This will lead to more outage time and damaged transformers for cooperatives, which will ultimately be very costly to their consumer-members at the end of the line.

Again, we expect more pole replacements will be needed. However, DOE’s analysis assumes like-for-like pole replacements which is misguided. Rather, we expect that more transformer replacements will be necessary to allow for greater capacity transformers due to electrification, thus requiring larger poles.[[9]](#footnote-9) In some cases, where a pole’s design will not allow for heavier transformers, the cooperative will be forced to convert to pad-mounted transformers. This type of swapping that will be necessary is not included in DOE’s analysis including the higher installation costs that utilities will face.

Many electric cooperatives are Rural Utilities Service (RUS) borrowers and thus use RUS Bulletin 1724D-107, “Guide for Economic Evaluation of Distribution Transformers,” to calculate the cost of owning a transformer over its useful life using the total owning cost (TOC) method. Historically, cooperatives have widely used the TOC method to evaluate transformer purchases. In more recent years, first cost has been used by more utilities largely because of the current DOE energy conservation standard. Given today’s supply chain challenges, the information provided by NRECA’s members shows availability of transformers is the primary concern, not the cost, and therefore DOE’s estimation of the utilities using TOC are not representative of real-world experience.

As PSE notes, many electric cooperatives are RUS borrowers and thus must follow Buy American regulations that may prohibit them from using products with foreign-sourced steel as we expect amorphous steel to be for the foreseeable future.[[10]](#footnote-10) This will likely be a problem on an industry-wide basis given the passage of the Build America Buy America Act that is applicable to all infrastructure spending going forward.

DOE requests specific comment regarding some assumptions in their analysis pertaining to utilities serving low customer populations. It will vary across cooperatives, but our data suggests that 15 kVA transformers are used more commonly in areas with densities of 6 customers per mile, as compared to DOE’s assumption in the NOPR of 25 kVA transformer units.

**A proposal of this magnitude requires more time and analysis to avoid unintended consequences.**

We raise several significant concerns throughout our comments that each warrant more consideration and more accurate accounting by DOE in its analysis. We feel strongly that DOE needs to take more time to gather data from the steel producers, transformer manufacturers, and electric utilities to better reflect the real-world conditions that will impact its analysis of the standard as proposed in the NOPR.

This proposal could potentially impact the market for other products and equipment also critical to the utility sector. For example, PSE notes that “lead times for distribution voltage regulators – which include internal autotransformers and are a critical piece of cooperatives’ ability to maintain adequate voltage levels on their systems – are even longer than distribution transformers, reaching up to two years. This is not likely to improve if electrical steelmakers are forced to shift to amorphous core steel production to meet distribution transformer demand.”[[11]](#footnote-11)

**Conclusion**

It is critical that DOE reconsider implementing a new energy conservation standard for distribution transformers as laid out in the NOPR given the unprecedented challenges electric cooperatives and other electric utilities are facing in receiving this critical equipment today. The proposal will exacerbate current supply chain constraints while achieving minimal energy savings. Based on today’s energy conservation standard, distribution transformers are already above 98% efficient with most over 99%, meaning this proposal is focused on small incremental improvements while ignoring many of the potential risks and costs associated with mandating amorphous steel core transformers by 2027. DOE’s top priority should be finding ways to support domestic distribution transformer manufacturers to increase production immediately and to sustain that output over the long term as electrification of the U.S. economy grows.

NRECA urges DOE to keep the existing standard in place, as permitted by statute, and instead focus on other means for incentivizing amorphous steel core transformers that could allow for potential expansion in the manufacturer market without jeopardizing electric reliability. We welcome more dialogue with DOE that would provide insight into what would could alleviate electric cooperatives’ substantial concerns from an operational perspective about being required to move to amorphous steel core transformers, such as the increased size and weight. Investments being driven by the Infrastructure Investment and Jobs Act, Inflation Reduction Act, other electrification initiatives and increased spending on resilience all demonstrate that demand for distribution transformers is growing and will remain elevated for the foreseeable future. We need to be expanding the market for transformers rather than constricting it by driving traditional GOES distribution transformers out of the market as DOE’s NOPR would do.

Thank you for considering our comments and we look forward to further discussion with DOE about how to move forward in a way that would not adversely impact our members’ ability to provide affordable, reliable power to their consumer-members. Please contact Stephanie Crawford at stephanie.crawford@nreca.coop or 571-623-4049 if you have any questions about our comments.

Sincerely,

Stephanie Crawford

Regulatory Affairs Director

National Rural Electric Cooperative Association

Enclosure:

1. March 13, 2023 Memo from Power Systems Engineering (PSE) to NRECA RE: Support for NRECA Comments on DoE Transformer Efficiency NOPR [Energy Conservation Standards for Distribution Transformers, EERE-2019-BT-STD-0018]
1. See the U.S. Department of Commerce’s “The Effect of Imports of Transformers and Transformer Components on the National Security” (October 15, 2020) at: <https://www.bis.doc.gov/index.php/documents/section-232-investigations/2790-redacted-goes-report-20210723-ab-redacted/file> [↑](#footnote-ref-1)
2. See PSE memo, page 2: PSE highlights that the potential cost increases from moving to amorphous steel core transformers could account for an increase in total Construction Work Plan costs by 3% based on their experience with cooperatives. PSE notes “At a glance, this may not seem like a big change but represents a significant cost increase for many small rural cooperatives who serve primarily residential and small commercial members and whose revenue and rates are limited by the demographics of their service territories, since all of these costs will ultimately fall to the member-owners.” [↑](#footnote-ref-2)
3. See PSE memo, page 3 [↑](#footnote-ref-3)
4. See PSE memo, page 4 [↑](#footnote-ref-4)
5. See PSE memo page 4 [↑](#footnote-ref-5)
6. See PSE memo, page 4 [↑](#footnote-ref-6)
7. See PSE memo, page 5” “While cooperatives certainly don’t size transformer installations with the intent of overloading them, there are many reasons (outside of the utility’s control) why a distribution transformer might become loaded to capacity or overloaded. In these situations, it is critical that the transformer be able to handle the overload without damage or failure. This will become significantly more important as high demand loads like EV chargers and electric heat systems become widespread, and if cooperatives are unable to purchase replacement transformers within a reasonable timeframe, system reliability could be impacted.” [↑](#footnote-ref-7)
8. See PSE memo, page 5: “Amorphous cores will be able to handle fewer fault events and will be more susceptible to catastrophic damage due to fault exposure.” [↑](#footnote-ref-8)
9. See PSE memo page 2, For an EV project, “the demand from these chargers represents a huge increase to the total system demand, and as a result the cooperative intends to convert part of their system from 12.47 kV distribution voltage to 24.9 kV.” See also, Page 3: “DOE has stated that its analysis suggests that the heavier transformer designs needed for compliance with the proposed rules will not require larger poles for like-for-like replacements. However, we would not consider that to be the main concern for electric cooperatives; the bigger concern would be around the transformer capacity upgrades that we (and the industry) expect will be necessary to accommodate electrification initiatives like EV charging and all-electric buildings.” [↑](#footnote-ref-9)
10. See PSE memo, page 3 [↑](#footnote-ref-10)
11. See PSE memo, page 3 [↑](#footnote-ref-11)