

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460



OFFICE OF
AIR AND RADIATION

October 10, 2016

Dear Distribution Transformer Brand Owner or Other Interested Party:

The Environmental Protection Agency (EPA) has completed and is providing a supplemental analysis intended to address stakeholder questions raised during a recent webinar on the ENERGY STAR Draft 2 Distribution Transformers specification regarding weight and A/B factor choices.

Weight Considerations

Stakeholders expressed concern regarding the increased size and weight of more efficient transformers. In response, EPA performed an analysis comparing the size/weight of a minimum DOE-compliant model with that of the lowest-first-cost model that 1) provides positive Total Ownership Cost over a minimum DOE-compliant model while 2) also providing energy savings as specified in Table 1 of Draft 2.

In analyzing the effects of increasing the efficiency requirements as proposed in Draft 2 for models in Design Lines 2 and 3, where weight is particularly critical, EPA found that the weight of certain core materials can be kept within 5% of the weight of the minimum DOE-compliant model. Per their published Technical Support Document, DOE assumes that a pole change-out will be necessary only if the weight is increased by more than 15% for pole-mounted transformers¹. In some cases, EPA found that using DR80 core steel can result in lighter units than the minimum DOE-compliant model and some amorphous core steels (indicated as SA1 in the table) result in a weight increase of 10% or less.

The table below provides two examples of percent weight increases for a DR80 steel core (Design Line 2) and an amorphous core (Design Line 3) over the minimum DOE-compliant model. The products noted in the table would meet the proposed ENERGY STAR Draft 2 criteria for the specific kVA ratings and A/B factors listed. It is important to note that EPA's analysis is based on designs that present the lowest first cost, that meet the proposed Draft 2 energy savings criteria, and that achieve a positive TOC. Designs with a higher initial purchase price may yield different cores/weights that also meet the proposed energy savings requirements. To assess the full range of potential options, stakeholders are encouraged to reference the data in the analysis EPA developed to propose the Draft 2 criteria, which is available on the [ENERGY STAR Distribution Transformers product development page](#).

¹ U.S. Department of Energy (DOE): Technical Support Document, Chapter 6 "Estimation of Pole Replacement Costs", <http://www.regulations.gov/#!documentDetail;D=EERE-2010-BT-STD-0048-0760>

Weight Analysis of Proposed ENERGY STAR Compliant Designs in Draft 2 of the Version 1.0 Specification								
DL	kVA	A Factor	B Factor	Core Material Minimum DOE- compliant	Energy Savings of 14%		Energy Savings of 20%	
					Core Material	Weight Increase	Core Material	Weight Increase
2	25	\$8.00	\$3.00	M2	DR80	0%		
		\$7.00	\$2.80	"	DR80	0%		
		\$6.00	\$2.50	"	N/A	N/A		
3	500	\$8.00	\$3.00	M2			SA1	0%
		\$7.00	\$2.80	"			SA1	3%
		\$6.00	\$2.50	"			SA1	10%

A/B Factor Choices

In developing proposed criteria in Draft 2, EPA sought to use A and B factors that are reflective of those used by utilities where electricity generation and distribution are somewhat more expensive than average, and where buying a more efficient transformer is most likely to be attractive. To determine appropriate A and B factors, EPA consulted the historical DOE rulemaking analysis, where DOE collected A factors from public bid information available online. EPA then adjusted these A-factors for inflation (see table below), using an average of producer price index (PPI) ratios for electric power generation, electric bulk power transmission and control, and electric power distribution for 2015 and 2010. Each segment of the electric grid's weighting was calculated based on the total annual investment in generation, transmission, and distribution for IOUs², cooperatives³, municipalities⁴, and federal-owned utilities:

	PPI for Electric Power Generation	PPI for Electric bulk power transmission and control	PPI for Electric power distribution
2010 Average	137.9000	116.9000	130.6000
2015 Average	132.2000	153.1000	144.5000
Ratio	0.9587	1.3097	1.1064
Weight	36%	24%	40%
Weighted Average	1.1020		

² Edison Electric Institute Finance Department, "Projected Functional CapEx", 2015, http://www.eei.org/resourcesandmedia/industrydataanalysis/industryfinancialanalysis/QtrlyFinancialUpdates/Documents/EEL_Industry_Capex_Functional_2015.09.29.pptx

³ National Rural Electric Cooperative Association, "Electric Co-op Fact Sheet 2016", <http://www.nreca.coop/about-electric-cooperatives/co-op-facts-figures/electric-co-op-fact-sheet-2016-03/>

⁴ American Public Power Association, "Public Power: Shining a Light on Public Service", 2015, <http://appanet.files.cms-plus.com/PDFs/PublicPowerFactSheet20152.pdf>

A Parameter Midpoint 2010 \$/W	A Parameter Inflation-adjusted to 2016 \$/W	Cumulative Probability, Historical Data %
2.5	2.8	21%
3.5	3.9	28%
4.5	5.0	59%
5.5	6.1	67%
6.5	7.2	79%
7.5	8.3	92%
8.5	9.4	95%
9.5	10.5	95%
10.5	11.6	97%
11.5	12.7	97%
12.5	13.8	100%

EPA interpolated between the entries in the above tables to calculate the percentage of utilities that are likely to see A factors greater than or equal to each A factor analyzed by EPA, based on DOE historical distribution and adjusted for inflation:

A Factors Used in ENERGY STAR Analysis (\$/W)	% of Utilities with A Factor at or Above Given Value, based on DOE Historical Distribution, Inflation Adjusted
2.50	81%
4.00	68%
5.00	41%
6.00	34%
7.00	22%
8.00	11%
10.00	5%

Based on DOE’s rulemaking analysis, selecting an A factor at \$7.00 should be representative of at least 22% of utilities, a meaningful fraction of utilities nationally. EPA set B factors to \$2.80, which is equal to approximately 40% of the A factor based on the load factor (50% at high load) and a squared leveled peak load (PL²) of 1.15—both values should reflect typical utility operation. For comparison, DOE found in its rulemaking analysis that B factors average 46% of A factors for “utilities that place relatively higher economic value on load losses”⁵, such as ones serving higher density loads or permitting higher peak load on the transformer.

Submitting Feedback

All documents related to this specification development are posted on the [ENERGY STAR Distribution Transformers product development page](#). If you have any questions about the ENERGY STAR program and this effort in particular, please contact me at

⁵ U.S. Department of Energy, *Technical Support Document: Energy Efficiency Program for Consumer Products and Commercial and Industrial Equipment: Distribution Transformers*, April 2013, p. 8-11.

Radulovic.Verena@epa.gov and (202) 343-9845 or Matt Malinowski, ICF International, at Matt.Malinowski@icfi.com and (202) 862-2693. Thank you for your support of ENERGY STAR. I look forward to working with you during the specification development process.

Sincerely,

A handwritten signature in cursive script that reads "Verena Radulovic". The signature is written in black ink and is positioned above the printed name.

Verena Radulovic, Product Manager