LET'S BE PACIFIC™

June 2012 Volume 12 Number 2

DOE Mandated Minimum Efficiencies For Distribution Transformers

Medium Voltage Dry, Medium Voltage Liquid, Low Voltage Dry

At this moment almost everyone associated with Distribution Transformers, including transformer manufacturers, end users, suppliers of raw materials environmental petitioners (advocates), is anxiously awaiting the final ruling of the U.S. Department of Energy (DOE) on the new minimum efficiency levels that will be required of both liquid filled and dry type Distribution Transformers.

We are all aware that the first DOE mandated efficiency levels, known as **TP-1**, were required for low voltage ventilated dry type transformers beginning in January of 2007. Next the DOE implemented minimum efficiency levels for Medium Voltage Distribution Transformers in the categories of both liquid filled and dry-type transformers (ventilated and CAST) that became effective in January of 2010. These new efficiency levels for medium voltage are sometimes called TSL-2 or more correctly referenced: "MEETS EFFICIENCY LEVELS AS REQUIRED BY DOE 10 CFR 431 SECTION 196".

Brief Background

The new 2010 Medium Voltage mandated efficiencies were finalized by DOE in October 2007. Right after this final rule was published certain parties, called petitioners or advocates, filed petitions for review in the United States Courts of Appeals in the Second and Ninth Circuits, challenging this final rule by alleging that the DOE did not comply with certain provisions of the 1975 Energy Policy Conservation Act (EPCA). In other words the DOE had not set the newly mandated efficiencies at a high enough level to suit the petitioners.

Under the aegis of the courts the petitioners entered into a settlement that directed the DOE to review the mandated energy efficiency standards for Medium Voltage Dry and Liquid Distribution Transformers and publish their final findings by **October 1, 2012**.

The DOE decided that they would include the Low Voltage Ventilated Dry Transformers also in their evaluation of whether new mandated efficiency levels were needed.

Higher efficiency levels prescribed by the DOE are required by law to be (1) technologically feasible; (2) economically justifiable; and (3) provide a significant energy savings and an overall benefit to preservation of the environment and natural resources.

Exhibits 1 and 2 provide a graphical representation of how the dry-type transformer efficiencies have been raised to higher levels starting in 2007 for Low Voltage and in 2010 for Medium Voltage, then will move to recommended higher levels effective in 2016. The left bar, colored blue, represents the efficiency prior to the implementation of any of the DOE mandated efficiencies. The middle bar, shown in red, is the present efficiency level for both the Low Voltage and the Medium Voltage Dry Types. Finally the bar on the far right, colored **green,** represents the DOE proposed new efficiencies in its February 2012 NOPR (Notice of Proposed Rule Making).

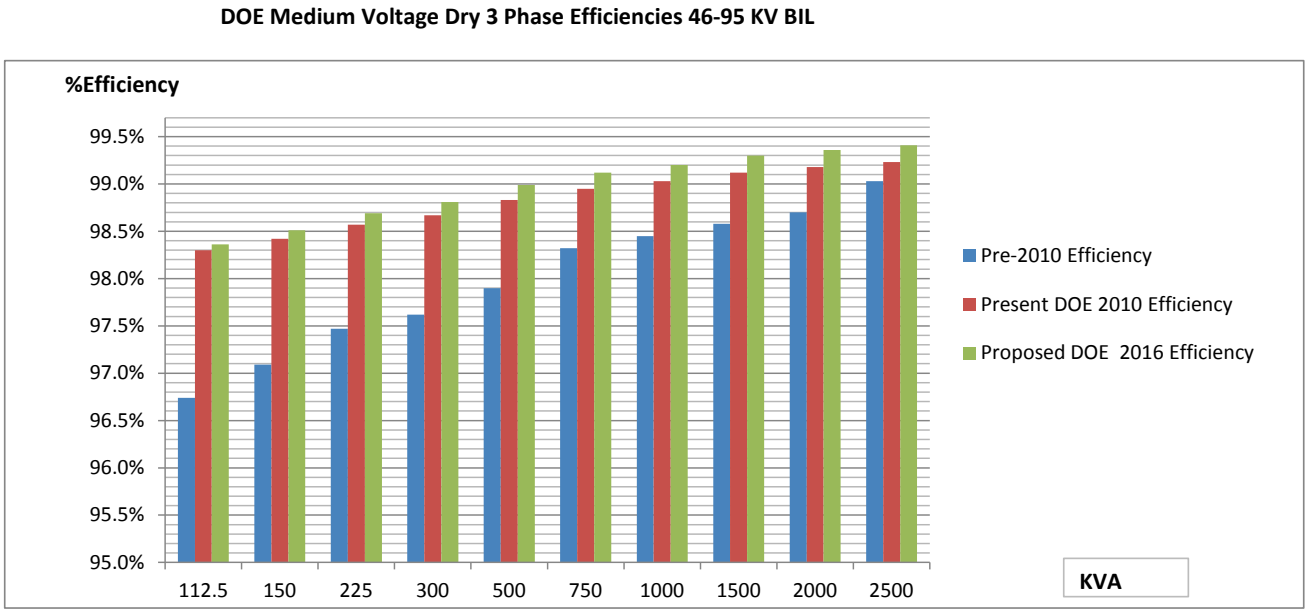

Exhibit 1

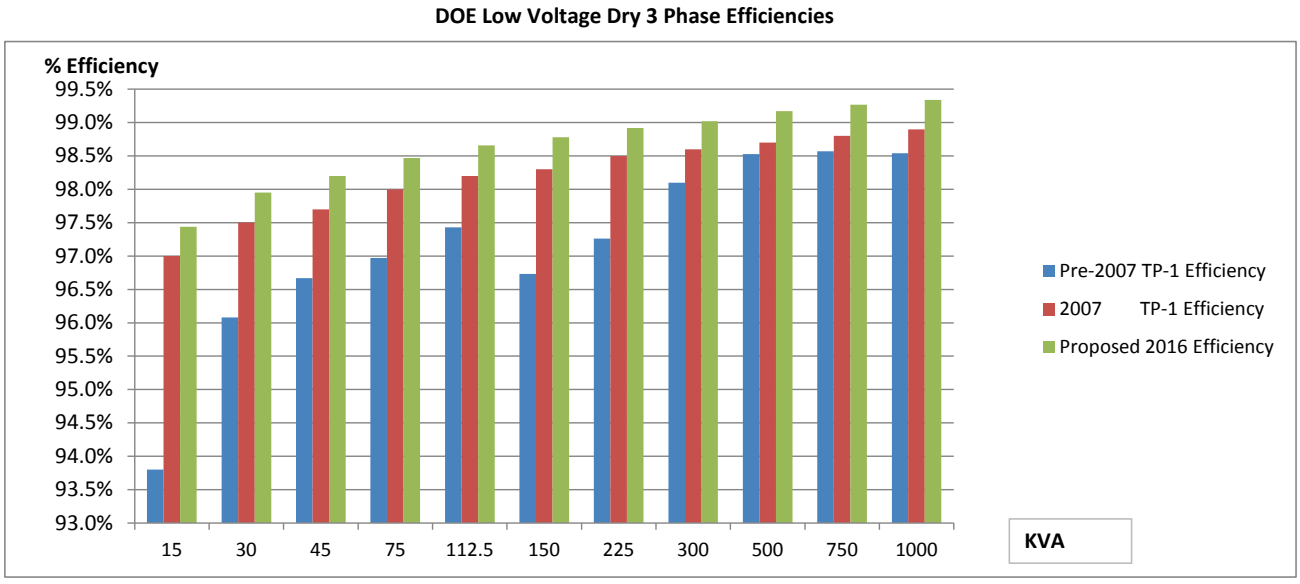

Exhibit 2

In this newsletter the graphical representation of the rising efficiencies is shown for only the three-phase units, as the single-phase units are basically not changing from the present levels in 2016. While the steps may seem small when presented graphically, the actual reduction in losses required to meet the proposed levels for 2016 represent a 50% to 60% **reduction** in wasted energy from transformer losses before being regulated.

Negotiated Rulemaking Activity

In the early part of 2011 the DOE decided that a team comprised of the transformer manufacturers and all other interested stakeholders, including transformer users, petitioners, and raw material suppliers, plus others like economists and NEMA representatives, would work toward reaching consensus on new transformer efficiency minimum levels. This "negotiated rulemaking" procedure had been used successfully in the major appliance and electric motor industries.

DOE engaged an analytical consultant, Navigant, who interviewed major stakeholders and compiled a lot of design data from the manufacturers. Navigant used the services from Lawrence Berkley National Labs (LBNL) for macroeconomic and transformer design data analyses. In addition a prominent software transformer design engineering company, Optimized Program Services, Inc. (OPS), was hired to provide transformer design data.

Obviously there wasn't time to analyze all of the liquid and dry designs; so representative designs as shown in Exhibit 3 were employed with the idea that other designs in similar categories would be scaled accordingly using a convention known as the 3/4 scaling factors.

During the analyses many different varieties of core steels were analyzed for the best efficiency performance as shown in Exhibit 4. Not only were there many core steel alternatives considered, but

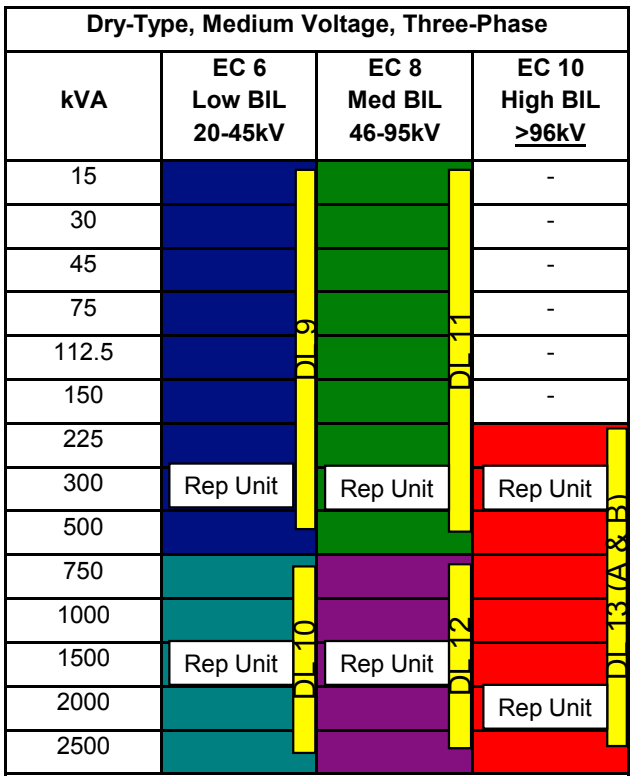

Exhibit 3

Design		CSL-0 (current)	CSL-1	CSL-2	CSL-3	CSL-4	CSL-5	CSL-6	CSL-7
6 25 kVA 1 phase dry 10kV BIL	Best option	M-3 M-4 M-6	M-4	M-4	SA1 M-4	SA1 M-4	SA1	SA1	
	Alternatives		M-6 M-0H laser M-3	SA1 M-0H laser M-3	M-0H laser M-3	M-0H laser			
7 75 kVA 3 phase dry 10kV BIL	Best option	M-6	M-6	M-6	M-6	M-3 M-6 M-0H laser M-4	M-0H laser SA1 M-3	SA1	SA1
	Alternatives	M-12	M-12	M-3 M-4	M-3 M-4		M-4		
8 300 kVA 3 phase dry 10kV BIL	Best option	M-6 M-5	M-5	M-5	M-0H laser	SA1	SA1		
	Alternatives		M-6 M-3 M-4	M-3 M-0H laser	M-3 M-4				
9 300 kVA 3 phase dry 45kV BIL	Best option	M-5	M-5	M-0H laser	SA1	SA1	SA1		
	Alternatives	M-3 M-6	M-3 M-0H laser M-6	M-3 M-5 SA1	M-0H laser				
10 1,500 kVA 3 phase dry 45kV BIL	Best option	M-5	M-5	SA1	SA1	SA1	SA1		
	Alternatives			M-5 M-0H laser	M-0H laser M-3				
11 300 kVA 3 phase dry 45kV BIL	Best option	M-3 M-4 M-0H laser	M-0H laser M-3 M-4	SA1 M-0H laser	SA1	SA1	SA1		
	Alternatives		SA1	M-3 M-4					
12 1,500 kVA 3 phase dry 95kV BIL	Best option	M-5	M-5 M-4 M-0H laser	M-0H laser SA1	SA1	SA1	SA1	SA1	
	Alternatives	M-4 M-0H	M-3	M-4 M-3	M-0H laser				

Exhibit 4

also the manufacturers like Federal Pacific most likely will be forced to invest in new core cutting and forming equipment that will yield higher efficiency core performance. An example of this conversion is shown in Exhibit 5 where the wound core may replace the traditional stacked core. Certainly the step-lap miter core (a stacked core) requiring expensive core cutting equipment, will replace in most cases the often used butt-lap core construction.

Most of this analytical activity was done and presented in six separate three-day meetings in Washington, D.C. by usually 20-30 participants, that were part of the 24 member rule-making negotiating team or their alternates, and the consultants engaged by the DOE. During this approximate six month time period there were also several teleconferences that included the negotiating team members.

The result of all of this effort yielded a lot of excellent information on possible more efficient transformer designs; however only one of the transformer segments, the Medium Voltage Dry-Type, MVDT, reached consensus on the new efficiency levels. This situation left the DOE without consensus recommendations to develop NOPR (Notice of Proposed Rulemaking) proposing new efficiencies for 2016 published in the Federal Register on February 10, 2012. This NOPR does an excellent job of explaining how the DOE arrived at the new efficiency levels.

Exhibit 5

Summarizing graphically the complexity of evaluating designs and trying to get consensus by all stakeholders Exhibit 6 illustrates many of the different interests and possibilities associated with this effort.

Federal Pacific is proud to have been a major participant in the negotiated rule making activity, and is publishing in this newsletter a graphical summary in Exhibit 7 of the end user benefits of installing higher efficiency transformers. Federal Pacific, a NEMA Premium® participant, was especially pleased with the support and leadership shown by NEMA toward working for a consensus position on higher transformer efficiencies. Exhibit 7 illustrates the savings that the NEMA Premium® transformer offers over a 20 year period relative to the presently regulated TP-1 designs.

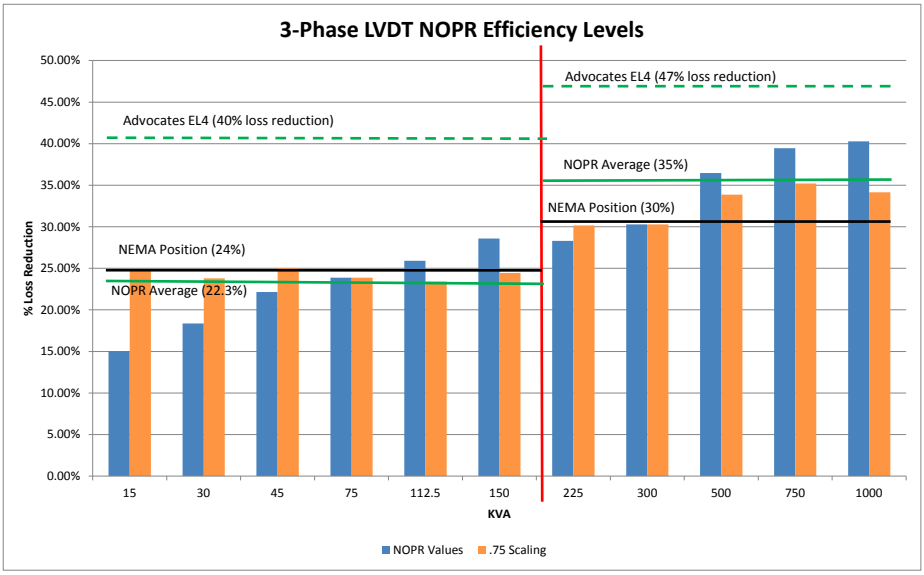

Exhibit 6

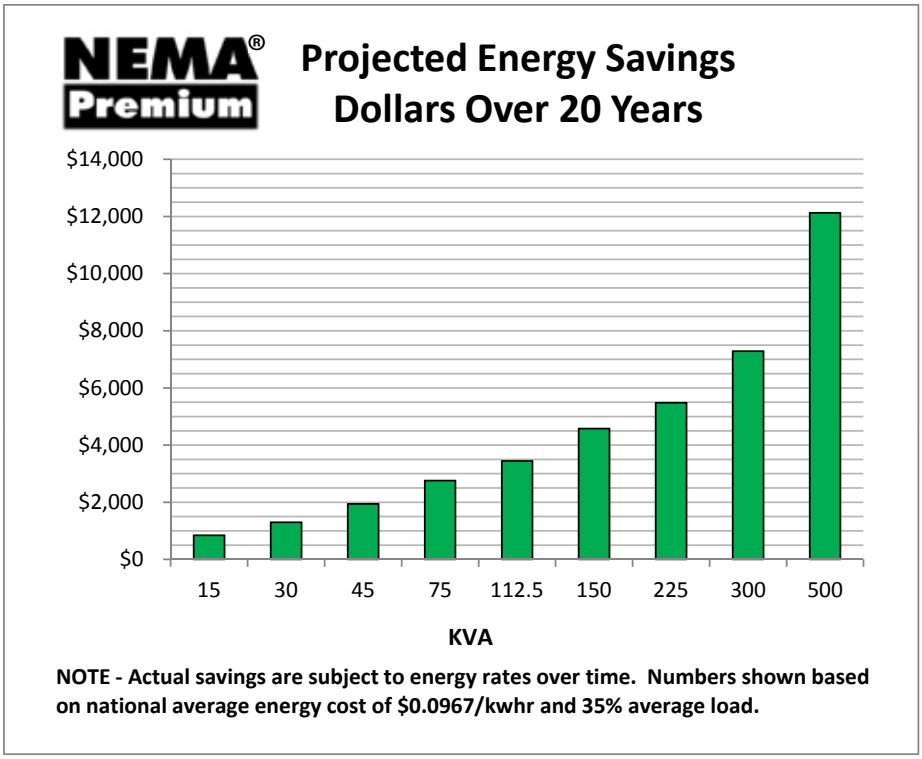

Exhibit 7