Transformer Change-out

New DOE rules mandate more efficient (and expensive) equipment.

By Subba Nishtala and Karen Gregg Price

When a federal court ordered the DOE to develop more than 20 energy-efficiency rules,[1] the first rule DOE created was a commercial rule for energy transformer distribution equipment. The new DOE rule, published at the end of last year, is the first increased efficiency standard created since the beginning of the Bush administration in 2001.[2] Transformers were high on the list possibly because upgrading them puts the burden on businesses as opposed to the consumer, at least initially, to bear the costs of efficiency improvements.

Source: Mitsubishi Electric Power Products, Inc.

In the final rule for distribution transformers, DOE determined that energy-conservation standards for liquid-immersed and medium-voltage, dry-type distribution transformers result in significant conservation of energy. Furthermore, DOE determined these new standards technically are feasible and economically justified. The new standards will go into effect on Jan. 1, 2010.

According to the published rule, it could raise the cost of liquid-immersed transformers by up to 12 percent, but it should decrease electrical losses by as much as 23 percent. It also would raise the cost of medium-voltage, dry-type transformers by up to 13 percent, but should decrease electrical losses by as much as 26 percent. For liquid-immersed transformers, the energy savings nationwide would reduce generating capacity requirements by 2.5 GW, or roughly six 400-MW power plants. For dry-type transformers, the energy savings from the new standards would reduce the installed generating capacity by 100 MW. These savings take on added significance in today's challenging environment of rising costs for power generation fuel and infrastructure.

Some industry groups are disappointed by the seemingly timid restrictions in comparison to what major buyers and the largest supplier, the ABB Group, originally proposed. However, DOE completed extensive analysis of cost-to-efficiency on several transformer standards levels to determine the best proposed designs and candidate standards levels. The engineering analysis provided a cost-efficiency relationship relating manufacturer selling price, no-load losses, and load losses for a wide range of transformer designs. Finally, distributor markup and installation costs were incorporated into the analysis. The model incorporates specific load growth and electricity price trends as inputs from the DOE, available in the supporting documentation at the DOE website.

The rule leaves energy companies to deal with the costs associated with transitioning to the newer standards, equipment that will, in the long run, deliver energy-cost savings. Eventually these costs will be passed on to consumers, at least in part. But because rate regulation generally results in a significant lag time between utility capital expenditures and cost recovery, investment in the required equipment will fall squarely on the shoulders of utility companies.

Suppliers of distribution transformers also face changes in design, raw-material supply, supply-price uncertainty, and risks in assessing demand. In general, suppliers expect neither an unusual increase in demand for compliant trans-

formers after the new rule goes into effect, nor a spike in demand from customers buying non-compliant designs before the Jan. 1, 2010 date. Whether their expectations prove correct will depend in part on how utilities approach their compliance activities.

Sourcing Challenges

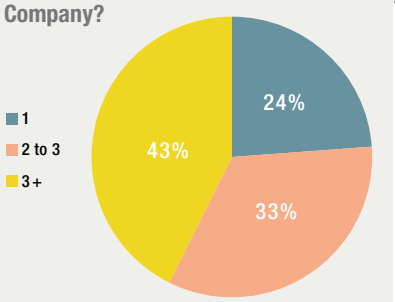
Changes required by the new DOE rule mean many utility procurement professionals soon will be engaging in a sourcing effort for distribution transformers. Traditionally, the sourcing process involves reviewing the business and market conditions using a construct like the Porter's Five Forces model. Utility procurement professionals sourcing distribution transformers face daunting market forces that all seem to be arrayed against them.

Supplies of raw materials needed to comply with the new rules are constrained. Raw materials required for manufacturing distribution transformers, such as magnet wire, strip aluminum, transformer oil, and core steel, are in scarce supply globally. Consequently, prices of raw materials and fuel have reached unprecedented levels. Over the past several months, scarcity of these raw materials, coupled with increasing demand, has driven transformer prices upward.

Furthermore, compliance with the DOE rule will require additional quantities of raw materials in the new designs, and the shortage of these materials, combined with the limited plans for development of additional supplies, strains the ability of the transformer manufacturers to diversify their supply base.

Most (if not all) of the resulting cost increases eventually will be borne by the utility buyer. Manufacturers of transformers already have addressed higher commodity prices with their customers and in the past two years, many have established pricing contracts with a similar structure consisting of a base price and a variable surcharge adjusted on a periodic basis to account for raw materials costs. There is limited flexibility in pricing for utility buyers, and future price trends are affected by multiple factors.

FIG. 1 TRANSFORMER SUPPLIERS



Source: Epsilon survey of electric and gas utilities

Almost a quarter of all respondents sole-sourced their distribution transformers and over 40 percent of respondents have more than 3 suppliers. The likelihood that buyers have overlapping suppliers is high and would add weight to the value of group purchasing contracts.

For example, in April, steel futures began trading on the London Metals Exchange, and other exchanges are expected to soon follow. Steel is one of the most heavily traded commodities by value in the world, and some market participants worry that the changes accompanying futures-markets trading will push up future steel prices. Likewise, costs to transport and ship any new product also will increase because of higher fuel costs—a significant factor for distribution transformers, which can weigh more than a ton.

Additionally, it's unclear whether transformer manufacturers can or will expand their production capacity.

Suppliers for distribution transformers interviewed for this article did not expect to see significant increases in the volume of orders as a result of the new rule. Additionally, the slow-down in the economy (particularly new housing starts) might discourage some manufacturers from being aggressive in adding new manufacturing capacity for distribution transformers.

The result for utility buyers could be high prices and limited room for negotiation. Distribution transformers are must-have items for utilities, yet existing budgets only will accommodate a finite amount of cost increases. The DOE, in its manufacturer impact assessment, expected utilities might manage higher costs by reducing proactive replacement programs (*i.e.,* replacing units only upon failure), reducing inventory costs by procurement of multi-voltage (primary) distribution transformers, and selecting slightly lower kVA ratings. »

REFURBISHMENT OPTIONS

Given current market conditions, repair and refurbishment of transformers is one of few strategies utilities have to control procurement costs. Refurbishment includes minor work such as replacement of connectors or bushings, or major repair work such as rewinding of the transformer.

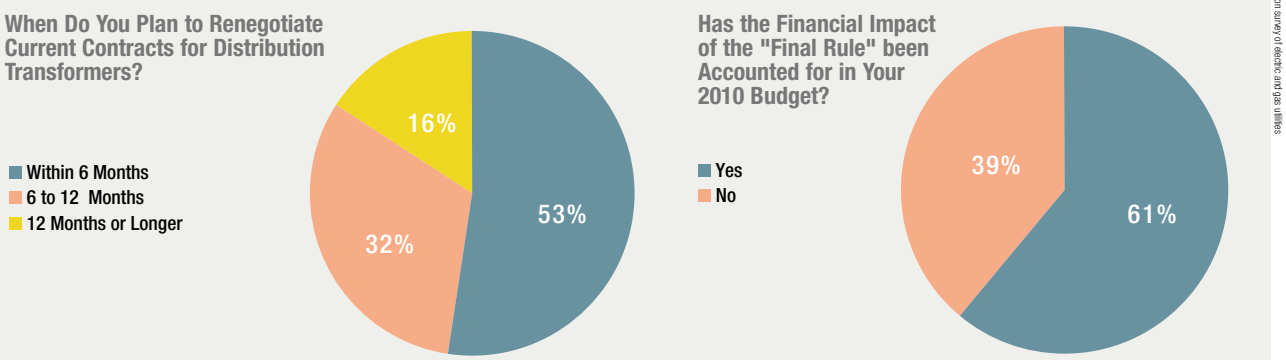
In 1995, The Oak Ridge National Laboratory published a report[1] that estimated annual refurbished capacity, including rewound units, to be approximately 1 percent of the in-service transformer capacity. This number might increase in the near future as a result of the new DOE rule.

Sheri Burgess, procurement supervisor at Central Vermont Public Service Corp., says, "Although our transformer repair program has been in place for several years, because of the new DOE rule, we felt it was important to increase the number of units to repair. In the past we would only repair a transformer if it met certain criteria, and we are currently reviewing these criteria to determine if we can repair or refurbish more transformers in our shop."-***SN***

Endnote

1. Barnes, P. R., J. W. Van Dyke, B. W. McConnell, S. M. Cohn, and S. L. Purucker: *The Feasibility of Replacing or Upgrading Utility Distribution Transformers During Routine Maintenance*, Oak Ridge National Laboratory, 1995, available at: *www.ornl.gov/~webworks/cpr/v823/rpt/78562.pdf.*

FIG. 2 & 3 **PREPARING FOR COMPLIANCE**



Source: Enporion survey of electric and gas utilities

Surprisingly, more than 50 percent of survey respondents haven't calculated the impact of larger poles, pads and other components necessitated by heavier transformer designs. Within the next six months, over 50 percent of the respondents will be planning to renegotiate current contracts with their suppliers, which means it's a good time to review current contracts and suppliers. Overall, almost 40 percent of surveyed energy utilities have not yet accounted for the financial impact of the new standards.

Buyer Strategies

A major U.S. electric utility commissioned Enporion, a supply-chain management company, to conduct a survey of peer utilities to gain insight into the changes in procurement activities resulting from the new DOE rule on efficiency requirements.

In total, 22 U.S. electricity and gas utilities participated in the survey, representing a broad cross-section of customer size, geography, regulatory environment, and market capitalizations. Survey respondents included companies with annual revenues ranging from over $300 million to over $17 billion.

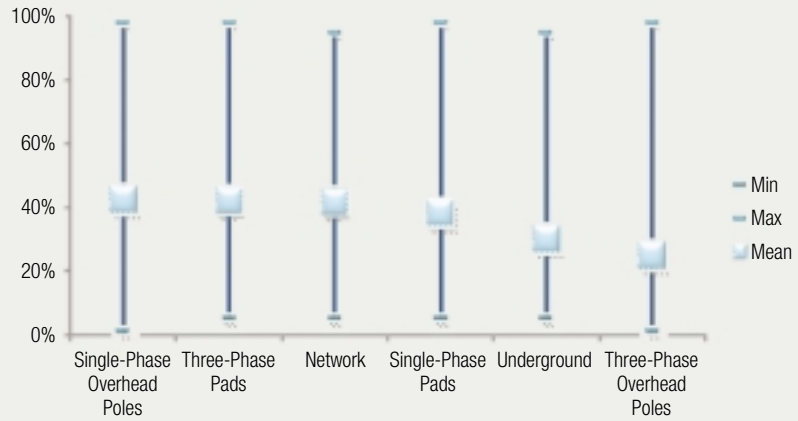
All 22 respondents indicated their discussions with suppliers have included design changes, manufacturing capacity, and material procurement plans. In fact, utilities appear to be examining how suppliers source and manage their own manufacturing inputs, such as raw materials and commodities. To mitigate risk, some utility companies are even asking to see suppliers' long-term procurement plans. The most frequent expected impact was the clear potential for price and supply uncertainty.

> Economic slow-down might discourage manufacturers from adding new capacity.

Companies impacted by the new rule are taking actions to manage the higher costs of heavier compliant transformer designs, including working directly with manufacturers to understand and plan for the full impact, and working with them to mitigate controllable cost variables (*e.g.,* overhead costs); collaborating with manufacturer's engineering teams to ensure they're designing the most cost and quality efficient units; consolidating SKUs; and making sure the utility's requirements are incorporated in the manufacturer's capacity plans. Additionally, buyers for some utility companies are putting efforts into developing efficient electronic procurement and contract-management systems.

Utilities are seeking financial relief by working with jurisdictional authorities to demonstrate their transformer replacement strategies are cost effective and prudent. Many companies »

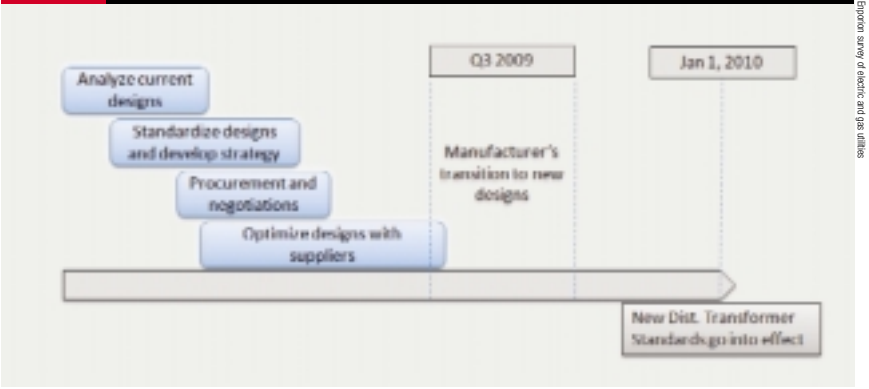
FIG. 4 **COMPLIANT DESIGNS**



Source: Enporion

In evaluating compliance, single-phase pad transformers were the most compliant of all designs, while three-phase overhead pole transformers were the least compliant with the new standards. Additional analysis of current inventory and operational resources has a hand in deciding to rehab or repair transformers, as opposed to buying newly manufactured equipment.

Fig. 5 Compliance Timeline



Source: Enporion survey of electric and gas utilities

are rehabilitating more transformers and reviewing transformer repair options (*See sidebar, Refurbishment Options.*) And some are incorporating market hedging into their plans to control cost increases—even to the point of stocking up on non-DOE compliant units prior to the mandate, and sourcing compliant transformers for the 2010 to 2012 period as early as possible. F

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Endnotes:

1. Consent decree in consolidated civil actions, *New York v. Samuel Bodman and DOE*, and *Natural Resources Defense Council v. Bodman and DOE*, U.S. District Court for the Southern District of New York, Nov. 3, 2006, available at: *ag.ca.gov/globalwarming/pdf/2-27-08consent_decree_NYvBodman.pdf.*
2. U.S. Department of Energy Distribution Transformers Energy Conservation Standard, Final Rule 72 FR 58190, Oct. 12, 2007, available at: *www1.eere.energy.gov/buildings/appliance_standards/commercial/distribution_transformers.html.*

Breaking the Cartel

(Cont. from p. 10)

the Big Oil cartel. Only then can we address climate change. F

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Endnote

1. In May 2008, Sen. Chuck Grassley (R-Iowa) released documents he said showed the Grocery Manufacturers Association—which represents Kraft, Nestle and other processed food companies—had launched "a national smear campaign against ethanol": http://grassley.senate.gov/public/index.cfm?FuseAction=PressReleases.View&PressRelease_id=ee2bfce2-f5dc-7670-0f23-38fc3f9755d8. Kraft Foods published a study in June linking food price increases and ethanol mandates: http://www.foodbeforefuel.org/files/Role%20of%20Biofuels%206-19-08.pdf. Also in June, Nestle SA CEO Peter Brabeck-Letmathe authored an op-ed column in the *Wall Street Journal* titled "Biofuels are Indefensible in our Hungry World":http://online.wsj.com/article/SB121336637192571721.html.