ComEd
An Exelon Company

Date: April 10, 2012

To: Ms. Brenda Edwards
U.S. Department of Energy, Building Technologies Program
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Phone: (202) 586–2945

cc: Michelle Blaise (VP, ComEd Engineering & Project Management)
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Subject: Notice of Proposed Rulemaking (NOPR) for Energy Conservation Standards for Distribution Transformers, Docket Number EE–2010–BT–STD–0048, and Regulatory Identification Number (RIN) 1904–AC04

Dear Ms. Edwards,

Commonwealth Edison Company (ComEd) appreciates the opportunity to submit comments on the Notice of Proposed Rulemaking (NOPR) for Energy Conservation Standards for Distribution Transformers, which was published by the Department of Energy (DOE) in 77 Federal Register 7282 (Feb. 10, 2012).

ComEd is an electric distribution company that serves approximately 3.8 million electric customers in Illinois.

ComEd annually adds or replaces approximately 2.5% of its transformer population per year (approximately 12,500 transformers per year of a total population of approximately 500,000 transformers).

In a letter dated September 26, 2006, Exelon (the parent company to ComEd) supported the current DOE distribution transformer efficiency standard which is consistent with Exelon's vision for environmental stewardship.

ComEd strongly supports DOE's energy conservation standards program for consumer products and certain commercial and industrial equipment. We believe the program's value is not just in setting efficiency standards but in choosing efficiency levels that ensure that customers who purchase the product save money.

ComEd fully supports the efficiency levels recommended by DOE in the above mentioned NOPR. In addition to the comments set forth herein, ComEd also supports the comments which will be submitted by the Edison Electric Institute relating to this NOPR.

The Edison Electric Institute (EEI) an association of U.S. Shareholder-Owned Electric Companies. ComEd is an EEI member company. Combined, the membership serves 95 percent of the ultimate customers in the shareholder-owned segment of the industry, and represent approximately 70 percent of the U.S. electric power industry.

ComEd would not favor any changes to the proposed efficiency levels that are not economically justified or which would create supply and reliability problems for the utility Industry.

ComEd would not favor any effort by DOE that would delay publication of the final rule by the October 1, 2012 due date.

In the subsequent pages, ComEd has attempted to reply to the 30 Issues on which DOE has requested further input. The responses in this document reflect actual utility experiences at ComEd and/or other electric utilities operating in the United States.

Issues for further comment per DOE request:

Issue 1: DOE requests comments on primary and secondary winding configurations on how testing should be required, on efficiency differences related to different winding configurations and on how frequently transformers are operated in various winding configurations.

Response: ComEd buys a limited number of dual primary ratio (4kV and 12kV) transformers. These transformers are installed in areas with a 4kV supply. ComEd periodically changes 4kV supplies over to 12kV. The dual ratio transformer allows for easy and quick changeover from 4kV to 12kV with minimal interruption to the customer. While some dual ratio transformers may stay in service at 4kV for many years, the goal is to eventually have all operating at 12kV. ComEd recommends that dual winding transformers be tested only in the configuration it is expected to be in during its ultimate (final) use.

Issue 2: DOE requests comment on its proposal to require transformers with multiple nameplate kVA ratings to comply only at those ratings corresponding to passive cooling.

Response: ComEd has no comment on this issue.

Issue 3: DOE requests comment on its proposal to maintain the requirement that transformers comply with standards for the BIL rating of the configuration that produces the highest losses.

Response: ComEd has no comment on this issue.

Issue 4: DOE requests comments on its proposal to maintain the current test loading value requirements for all types of distribution transformers.

Response: The 50% loading number currently being used for test appears to be as good as any at this point in time.

Transformers operate on a load cycle which repeats every 24 hours. A typical load cycle consists of load fluctuations throughout the day.

As such, load cycles allow for planned overloading above the transformer nameplate rating.

This is routinely employed by utilities across the United States.

At ComEd, aggregated load factors range from approximately 40 to 70% depending on the customer class (residential, commercial, industrial).

Issue 5: DOE requests comment on its proposal to require rectifier and testing transformers to indicate on their nameplate that they are for such purposes exclusively.

Response: ComEd has no comment on this issue.

Issue 6: DOE requests comments on its proposal to maintain the definition of mining transformers but also requests information useful in precisely expanding the definition to encompass any activity that entails the removal of material underground such as digging or tunneling.

Response: ComEd has no comment on this issue.

Issue 7: DOE requests comment on its proposal to maintain the current kVA scope of coverage.

Response: All ComEd's transformer purchases are within the current scope. ComEd supports maintaining the current scope. DOE has spent significant efforts developing efficiency levels for each kVA size. ComEd supports specifying the best fit efficiency for each kVA transformer.

Issue 8: DOE requests comments on its proposal to continue not to set standards for step up transformers.

Response: ComEd agrees that DOE does not need to address step-up/step down transformers. Such applications would be unique at ComEd and utilized only in areas where system voltage cannot be quickly converted or failed supply lines can't be quickly repaired.

Issue 9: DOE requests comments on the negotiating committee's proposal to establish a separate equipment class for network/vault transformers and on how such transformers might be defined.

Response: The specific issues surrounding transformers installed in vaults and manholes dictates that they be treated as a separate group. As efficiency requirements increase for these units so does the size. Transformer sizes, especially in existing vaults and manholes, are governed by the size of the vault or manhole. Vaults and manholes are much more prevalent in city environments where expansion of the vault or manhole is normally physically impossible due to space constraints. Transformers in these environments feed large influential loads, thus having a compatible replacement transformer available is essential. ComEd supports the Negotiating Team's recommendation and the definition recommended for this type equipment. ComEd also recommends that the efficiency level for this type of transformer not be increased from the current levels that have been in effect since January 1, 2010.

For street & building vaults, a slightly larger transformer would potentially cause severe problems when replacing an existing transformer with respect to the equipment openings, operating clearances, and the loading capacity of floors and elevators used to transport the transformer to the vaults.

Street/Sidewalk Vaults
The street/sidewalk vaults are typically owned by ComEd. These vaults are typically used for secondary network system applications and have a large standard opening for equipment. A slightly larger transformer as a result of increased efficiency should not be an issue as far as replacing an existing transformer. However, there is a larger probability that a slightly larger transformer installed in an existing street/sidewalk vault may violate certain company operating clearances inside the vault and possibly be deemed a safety issue.

Building Vaults
ComEd is unique in comparison to most investor owned utilities in the fact that it owns and maintains primary risers and transformers in highrise buildings.

The building vaults are designed on an individual basis. The equipment opening is designed to meet the customer's ultimate transformer capacity requirement.

Higher efficiency transformer designs will be larger and heavier than current designs. This will have some impact on the cost and resources required to perform transformer replacements due to:

- *Vault space constraints*
- *Floor loading*
- *Elevator load limitations*

ComEd utilizes a table of dimensions and weights based on historical transformer designs of different sizes used as a guide to determine the size of equipment opening needed to meet the ultimate transformer capacity requirement.

The building vault structure is owned by the customer. The customer typically provides the smallest vault possible that still meets the ComEd requirements in order to reduce costs. The equipment opening is designed to meet the ultimate transformer capacity requirement with a typical clearance of only a few inches. Additionally, larger transformers may not be able to be maneuvered through building hallways.

- *A slightly larger transformer as a result of increased efficiency would potentially cause severe problems when replacing an existing transformer with respect to the equipment opening.*
- *A slightly larger transformer as a result of increased efficiency installed in an existing building vault may violate certain company operating clearances inside the vault and possibly be deemed a safety issue.*
- *A slightly heavier transformer as a result of increased efficiency may cause severe problems if it exceeds the loading capacity of floors and elevators used to transport the transformer to the vault.*

The customer would have the burden of providing a larger opening and facilities (elevators and floors) needed to support a larger and heavier transformer which may result in an extended outage and a large cost incurred by the customer.

ComEd's network transformer limiting dimensions and weights are as follows:

12 kV & 13.2Y/7.6kV	*Maximum Overall Dimensions - Inches*			*Max. Total Weight (lbs.)*
kVA	*Height*	*Length*	*Width*	
500	*72*	*80*	*42*	*7200*
750	*74*	*82*	*42*	*9000*
1000	*76*	*84*	*46*	*10,800*
1500	*76*	*86*	*51*	*13,500*
2000	*80*	*92*	*51*	*16,800*
2500	*86*	*96*	*51*	*20,000*

34kV	*Maximum Overall Dimensions - Inches*			*Max. Total Weight (lbs.)*
750	*84*	*96*	*49*	*11,000*
1000	*84*	*98*	*52*	*12,800*
1500	*86*	*100*	*58*	*16,000*
2000	*88*	*102*	*64*	*19,000*
2500	*94*	*104*	*70*	*22,500*

For ComEd, the definition of a "vault transformer" could apply to a variety of transformer types including:

- *Liquid filled 1 phase and 3 phase transformers that are not designed to be submerged because that are installed in a building vault that is dry.*
- *Dry type transformers*

The vault provides limitations to safely install and operate equipment.

ComEd's dry type transformer limiting dimensions and weights are as follows:

ComEd - Single Phase Dry-Type Transformers (HV Wind. 60 - 95 kV BIL)				
Tr. Capacity (kVA)	*Max. Dimensions*			*Max. Weight (lbs.)*
	Height (in.)	*Width (in.)*	*Depth (in.)*	
75	*62.0*	*35.5*	*29.5*	*1150*
100	*62.0*	*35.5*	*29.5*	*1400*
167	*62.0*	*35.5*	*29.5*	*1800*
250	*66.0*	*40.0*	*35.0*	*2550*
333	*70.0*	*42.0*	*35.0*	*3050*
500	*76.0*	*49.0*	*35.0*	*4150*
833	*90.0*	*64.0*	*46.0*	*5800*

ComEd - Three Phase Dry-Type Transformers (HV Wind. 60 - 95 kV BIL)				
Tr. Capacity (kVA)	*Max. Dimensions*			*Max. Weight (lbs.)*
	Height (in.)	*Width (in.)*	*Depth (in.)*	
112.5	*52.0*	*48.0*	*29.5*	*2100*
150	*52.0*	*48.0*	*29.5*	*2400*
225	*60.0*	*52.0*	*32.0*	*2800*
300	*60.0*	*60.0*	*36.0*	*3550*
500	*66.0*	*60.0*	*36.0*	*4350*
750	*90.0*	*104.0*	*54.0*	*8600*
1000	*97.0*	*120.0*	*54.0*	*10000*
1500	*100.0*	*120.0*	*54.0*	*12800*
2000	*107.0*	*120.0*	*54.0*	*13500*
2500	*107.0*	*120.0*	*54.0*	*19300*

Rooftop dry type transformer installation

Dry type transformer installation

Dry type transformer installation (Bank of Single Phase transformers)

Issue 10: DOE requests comments on the negotiating committee's proposal to establish a separate equipment class for data center transformers and on how such transformers might be defined.

Response: ComEd has no comment on this issue.

Issue 11: DOE seeks comments on the operating characteristics for data center transformers. Specifically, DOE seeks comment on appropriate load factors and peak responsibility factors of data center transformers.

Response: ComEd has no comment on this issue.

Issue 12: DOE requests comment on whether separate equipment classes are warranted for pole mounted, pad mounted, or other types of liquid-immersed transformers.

Response: The installation of pole mounted transformers is much more challenging than for pad mounted transformers. The nature of the pole mounted transformer – i.e. installed on poles - makes the size and weight of the transformer much more important. As efficiency requirements increase, the size and weight of the pole mounted units increase. Utility poles have a limited load rating before they prematurely fail. Add to that the presence of other utilities lines and equipment on shared utility poles – which in many localities is mandated by local ordinances, - and the problem just gets worse. Besides the weight issue, transformer size can also present challenges. Section 23 of the National Electrical Safety Code requires utility lines be separated from other equipment and structures by a specified safe distance (dependent on voltage). As transformers get larger, this "Safety Zone" is breached requiring expensive pole change-outs and equipment relocations. Pole mounted transformers should be treated as a separate equipment class where the specific issues can be properly analyzed and factored into the final decisions on efficiency levels. I do not support delaying final decision making to address this issue at this time, however.

For transformers installed on poles, an increase in transformer weight may generate, depending on transformer size, an increase in the required pole class to sustain the load.

Pole 500kVA cluster mounted overhead transformers

Following the implementation of transformer efficiencies mandated by Final Rule dated October 12, 2007, ComEd determined that there are varying design capabilities of transformer manufacturers to meet the size and weight limitations of our existing infrastructure. In some cases, we have had to single source transformer designs.

Some specific situations may generate additional line work to meet National Electrical Safety Code (NESC) line clearances. The NESC "grandfathers" clearances including transformer change outs unless the pole is being changed for another reason. As such, the transformer can be replaced without changing the existing clearance requirements provided the replacement of the transformer does not also require replacement of the pole. If it did, the clearance at the pole location would no longer be "grandfathered" and require additional re-work not only of that pole but adjacent poles.

Some significant single phase overhead transformer design limitations are as follows:

- *ComEd cluster mounts up to three single phase 500 kVA overhead transformers on a single pole. ComEd's current vertical pole loading limit is 10,800 lbs. ComEd's single phase overhead transformer specification has a maximum weight limit of 3,600 lbs. An increase in transformer weight above 3,600 lbs will require poles with an increased vertical pole loading limit or will require possible platform mounting of three phase transformer banks. In applications where transformer banks are currently cluster mounted, platform mounting may not be feasible due to available space.*
- *ComEd's single phase overhead transformer specification has an allowable impedance range of 5.3% - 6.2% for 250 kVA, 333 kVA, and 500 kVA transformers. Manufacturers are already having challenges with transformer designs that meet the efficiencies required in the Final Rule dated October 12, 2007 and the minimum impedance requirement of 5.3%.*

In addition, ComEd believes that certain pad mounted transformers may require foundation upgrades. Due to the more extensive nature of these repairs, generator deployment will likely be necessary to maintain customer services.

Issue 13: DOE requests comment on setting standards by BIL rating for liquid-immersed distribution transformers as it currently does for medium voltage, dry-type units.

Response: ComEd supports efficiency standards based on BIL levels. Construction practices limit the ability to reach certain efficiency levels on the higher BIL rated transformers. By taking these issues into account a better standard can be written. ComEd does not support delaying final decision making to address this issue at this time.

Issue 14: DOE requests comments on how best to scale across phase counts for each transformer type and how standards for either single- or three-phase transformers may be derived from the other type.

Response: ComEd has no comment on this issue.

Issue 15: DOE requests comment on its proposal to scale standards to unanalyzed kVA ratings by fitting a straight line in logarithmic space to selected efficiency levels (EL's) with the understanding that the resulting line may not have a slope equal to 0.75.

Response: CpmEd believes DOE should use real data to determine the outcome for each line and that the slope should reflect those calculations. The 0.75 slope should not drive the results.

Issue 16: DOE seeks comment on symmetric core designs.

Response: ComEd recommends that the symmetric core designs not be included in the Final Rule based on the previous comments highlighting significant issues with the proposed designs.

Issue 17: DOE seeks comment on nanotechnology composites and their potential use for distribution transformers.

Response: ComEd has not heard that nanotechnology composites are being commercially applied to distribution transformers. ComEd recommends that, due to the lack of availability of this technology, it should not be included in DOE's Final Rule.

Issue 18: DOE requests comment on its materials prices for both the 2010 and 2011 cases.

Response: ComEd recommends that base costs, for both material and wholesale energy, should reflect from the most recent published data for the most recent year.

Issue 19: DOE requests comment on the current and future availabilities of high-grade steels, particularly amorphous and mechanically-scribed steel in the United States.

Response: ComEd is very concerned regarding the availability of a quality steel supply for the transformer manufacturing industry. Limited supply of transformers will have a significant negative effect on ComEd's ability to provide safe and reliable electric service to its customers.

Issue 20: DOE requests comment on particular applications in which transformer size and weight are likely to be a constraint and any data that may be used to characterize the problem.

Response: Any transformer design that is currently installed in constrained areas or spaces presents a problem if it needs to be replaced by a larger or heavier design. Refer to issue 9 above.

In particular, Network and Vault type liquid filled transformers present the most replacement challenges due to the limitations of the existing vaults and manholes.

Dry type transformers present similar problems. Photos of dry type transformers from the ComEd system were shown in issue 9 above. Customer provided space for these transformers is limited due to the value of real estate. In addition, typical installation of dry type transformers is on the upper levels of high rise buildings. Replacement of dry type transformers require transport on existing elevators which are both weight and size constrained. Thus, designs that increase the size and weight of dry type transformers could prohibit replacement of existing units.

The third category for consideration is pole mounted liquid filled transformers. ComEd has routinely cluster mounted 3 phase banks transformers up to 500kVA in size (3-500kVA or 1500kVA total).

Increasing the weight of these units may force a complete pole replacement to handle the additional load and meet the requirements of Section 25 of the National Electrical safety Code. Likewise, size increases could cause a violation of safety clearance issues which again would require the pole be replaced with a larger pole per Section 23 of the National Electrical Safety Code. Photos of large cluster mounted overhead transformers from the ComEd system were shown in issue 12 above

The constraints on pole installations in today's world are tremendous. In the past we shared the utility pole with the phone company. Then cable TV was introduced and they joined the party on the pole. Today, wireless carriers and special interest groups want to use pole space for their equipment and antenna, Government agencies want to use pole space for security lighting and/or security cameras. These additional occupancies, which we are legally bound to consider, along with the traditional utility needs, makes maintaining the pole integrity and safety clearances on the pole extremely challenging. The value of the incremental energy saved is minor compared to the cost of a potential injury or electrocution due to a failed pole or a clearance violation.

Every mandated increase in the efficiency level of transformers affects the weight and size of the transformer which creates installation challenges in the field. Resolution of those challenges is normally very costly and time consuming.

Issue 21: DOE requests comment on its steel supply availability analysis, presented in Appendix 3A of the TSD.

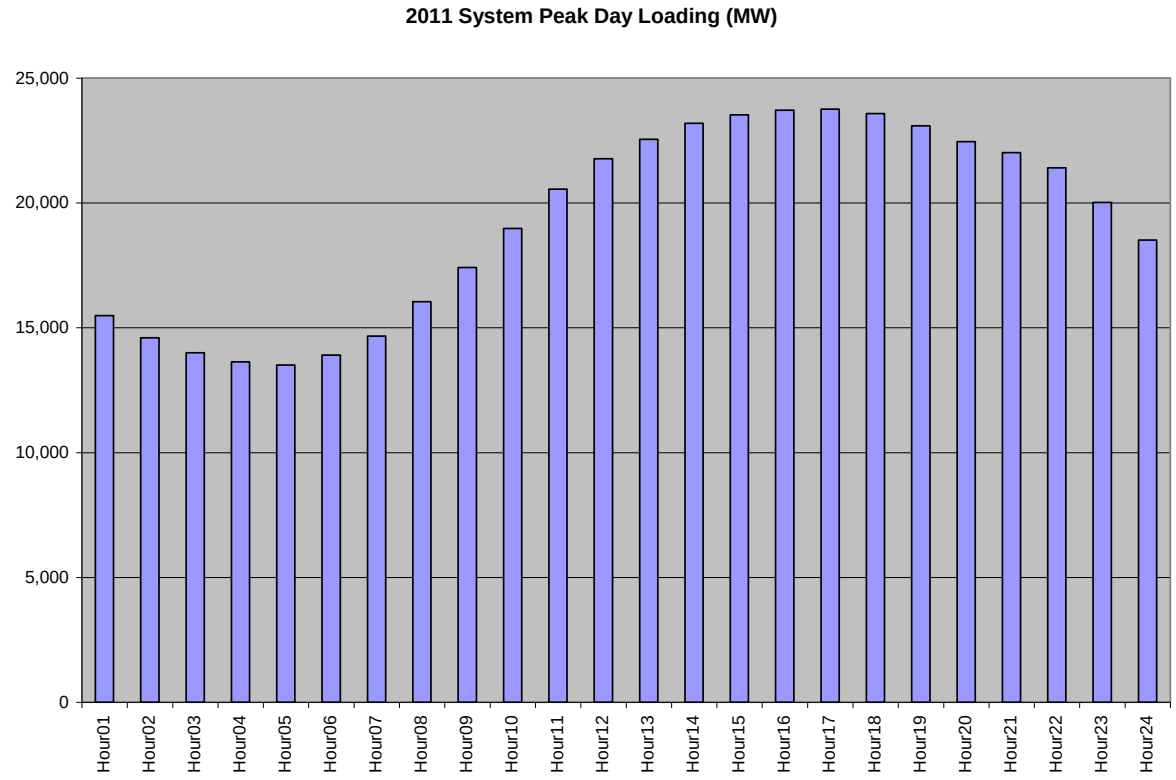
Response: ComEd remains concerned about the availability of core steel if DOE should decide to raise transformer efficiency levels past those recommended in the NOPR. DOE's life cycle analysis has shown the point where domestic steelmakers are no longer competitive and surpassing that level may be present significant issues for the industry. Likewise, overseas procurement of steel could present specification issues. ComEd is concerned regarding setting a standard which would require the use of specific core steel that is not readily available in the domestic market and which does not have a proven track record. This could have a negative impact on the electric grid.

Issue 22: DOE seeks comment on its proposed additional distribution channel for liquid-immersed transformers that estimates that approximately 80% of transformers are sold by manufacturers directly to utilities.

Response: While price negotiations are usually done directly between the manufacturer and the utility, in ComEd's experience, many transformer manufacturers will hire local representatives to provide customer service in order to respond quickly to any issues.

Issue 23: DOE seeks comment on any additional sources of distribution transformer load data that could be used to validate the Energy Use and End-Use Load Characterization analysis. DOE is specifically interested in additional load data for higher capacity three-phase distribution transformers.

Response: Provided below is a peak summer load curve for ComEd.



Issue 24: DOE seeks comment on its pole replacement methodology that is used to estimate increased installation costs resulting from increased transformer weight due to the proposed standards.

Response: The DOE may have underestimated the cost of pole change-outs. At ComEd, the average pole replacement cost is in the range of $4,000-$5,000. This does not include the cost of the transformer but does include the cost of the new pole along with any replacement material and labor used during the job.

Issue 25: DOE seeks comment on recent changes to utility distribution transformer purchase practices that would lead to the purchase of a refurbished, specifically re-wound, distribution transformer over the purchase of a new distribution transformer.

Response: ComEd has not changed our purchasing practices for distribution transformers at this time, however, utilities may be driven to purchase refurbished transformers in the future. In addition to savings, if new transformer requirements push costs up appreciably, utilities may choose refurbished designs to address the size and weight problems previously discussed. Purchasing replacement transformers that would not require the costly updates as part of the installation, offers utilities an attractive alternative with appreciable savings potential. In 2011, we refurbished approximately 682 transformers returned from the field.

Issue 26: DOE seeks comments on the equipment lifetimes of refurbished, specifically re-wound distribution transformers and how it compares to that of a new distribution transformer.

Response: ComEd considers a re-wound transformer to be a new transformer and would expect the life of the transformer to be equivalent to a new unit. Rewound transformers typically come with the same warranty as a new transformer. Refurbishments, unlike total rewinds, do not restore the transformer to a life expectancy of a new transformer.

ComEd has maintenance programs that help ensure a full life for in-service transformers. This program is focused mainly on pad mounted and vault/network type transformers.

Issue 27: DOE seeks comment on recent changes in distribution transformer sizing practices. In particular, DOE would like comments on any additional sources of data regarding trends in market share across equipment classes for either liquid-immersed or dry-type transformers that should be considered in the analysis.

Response: ComEd has not changed our distribution transformer sizing practices at this time.

Issue 28: DOE requests comment on the possibility of reduced equipment utility or performance resulting from today's proposed standards, particularly the risk of reducing the ability to perform periodic maintenance and the risk of increasing vibration and acoustic noise.

Response: Currently vaults or transformer rooms for network, vault type and dry type transformers are designed to allow for proper ventilation, maintenance and the safe operability of the transformers in the vaults/transform rooms. Any increase in size of the transformers housed in these containment areas infringes on the space designed specifically for these functions. In the worst case, the reduced space causes safety issues in operating and maintaining the transformer or may prohibit the utility's ability to operate or maintain the equipment completely. In this case, the transformers must be de-energized remotely which could require additional outages and service interruptions to customers not directly fed by the transformers. As room on the utility pole decreases, so does the separation from other utility equipment, making work on the pole by electric and communication workers more dangerous.

Dry type transformers are traditionally used in high rise buildings and may be installed in rooms next to apartments. In ComEd's experience, dry type transformers have caused vibration and noise issues with the customers.

Issue 29: DOE requests comment and corroborating data on how often distribution transformers are operated with their primary and secondary windings in different configurations and on the magnitude of additional losses in less efficient configurations.

Response: ComEd buys a limited number of dual primary ratio (4kV and 12kV) transformers. These transformers are installed in areas with a 4kV supply. We periodically change 4kV supplies over to 12kV supply. The dual ratio transformer allows for easy and quick changeover from 4kV to 12kV with minimal interruption to the customer. While some dual ratio transformers may stay in service at 4kV for many years, the goal is to eventually have all operating at 12kV.

Issue 30: DOE requests comments on impedance values and on any related parameters (e.g., inrush current, X/R ratio) that may be used in evaluation of distribution transformers. DOE requests particular comment on how any of those parameters may be affected by energy conservation standards of today's proposed levels or higher.

Response: Utilities that install single phase transformers (normally "round can" pole top units) banked to provide multiphase service must ensure that the impedances of the banked single phase units are matched. If they are not matched, then the utility would not be able to ensure that the load is balanced between the transformers (i.e. the lower impedance transformer would hog the load). The resulting circulating currents would lead to premature transformer failure and also could interfere with the operation of the customer's three phase equipment. If higher efficiency transformer requirements drive impedances outside the IEEE required range, then utilities would be required to change out the entire bank of transformers, even if only one transformer fails, to ensure matching impedances and a safe, reliable installation. We have experienced issues when the impedances of banked transformers are not matched. Currently, we specify the impedance for transformers purchased for this type of installation.

ComEd's single phase overhead transformer specification has an allowable impedance range of 5.3% - 6.2% for 250 kVA, 333 kVA, and 500 kVA transformers. Manufacturers are already having challenges with transformer designs that meet the efficiencies required in the Final Rule dated October 12, 2007, the minimum impedance requirement of 5.3% and weight limit of 3,600lbs.

For select ComEd designs (e.g. single phase overhead 500kVA 13.2kV-120/240V), only one of five suppliers from which ComEd is currently purchasing can meet the efficiency, impedance and weight requirements.

Supporting documents

"Dist Tr Efficiency Letter to DOE 09-2

Sincerely,

Peter Tyschenko