Distribution Transformer Subcommittee

Task force / Working Group Report

Document #:	**N/A**		
Document Title:	**Task Force on Transformer Efficiency and Loss Evaluation**		
Chair:	**Phil Hopkinson**	**Vice-Chair**	**David Brender**
Secretary	**Gerard Winstanley**		
Current Draft Being Worked On:	**N/A**	**Dated:**	
Meeting Date:	**April 3, 2017**	**Time:**	**9.30 – 10.45 AM**

Attendance:	**Members**	
	Guests	
	Total*	**107**

*** For details of attendance, please refer to AMS system of the Transformers Committee**

Meeting Minutes / Significant Issues / Comments:

The Chair welcomed the members to the meeting and noted that the high attendance indicted the level of interest in the topic.

This was the second meeting of the task group. The minutes of the last meeting were uploaded to the IEEE Transformer Committee Website. Also uploaded to the website were data from PG&E provided by Dan Mulkey. The data provides transformer loads recorded an hourly basis over one year for more than 1 million transformers. It was collected from smart meters from residential, commercial & industrial applications and broken down by transformer type and rating.

There were no additional items for the agenda.

Background

The DOE Energy Efficiency rules will be due for renewal or revision by January 1, 2022. The current loading is estimated at 50% of nameplate rating load for medium voltage transformers and 39% for low voltage transformers. There is a need for real data to replace these estimates. The quality and availability of data have benefited from the expanding use of smart meters. Utilities should be capable of providing data on transformer loading broken down into load types, geographic locations and other useful categories.

PG&E Data

Mr Hopkinson reviewed some of the key features of the PG&E data from a presentation he made to ASEAN.

1. Residential 10% to 78% of nameplate, 50% average
2. Commercial 40% to 80% of nameplate, 60% average
3. Industrial varies 40% to 90% of nameplate, 70% average

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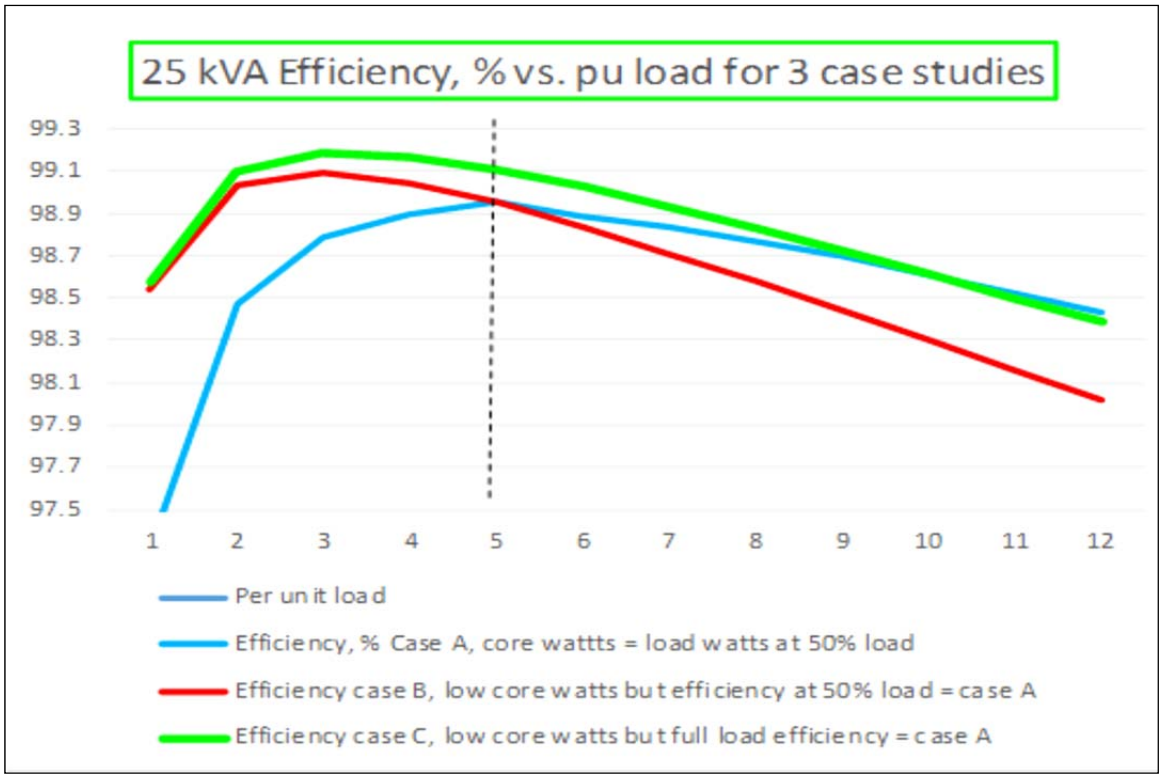
Transformers are drawn from stock as needed. There are a limited number of transformer sizes used to reduce the number of transformers needed to be held in inventory.

A transformer may go to any location – residential, commercial or industrial – with loads that could be 10% to 90% of nameplate.

Mr. Hopkinson used the graph below to illustrate efficiency for 3 case studies.



He proposed a new Total Loss Constraint:

1. Basis is total allowable loss at current measurement point for energy efficiency; i.e. at 50% or 35 % load, called "W"
   W= (pu Load) * kVA*1000*(1-PU Efficiency)/Efficiency
2. W/2 is starting assumed load loss.
3. W/2 * (1 /(pu load))^2 / Temperature correction factor = full load loss component = L
4. **Total Loss limit = L + W/2**
5. Suppose real core loss, C, < W/2
6. That is excellent and encouraged.
7. Two constraints must be satisfied.
   a) C < W/2.
   b) L' +C < L+W/2

<u>Discussion</u>

There was much discussion and interesting points were made. Some of the comments are given below:

- Is this intended as a proposal to DoE for the next rule making cycle? The consensus was not to push for any changes to the current requirements. If DoE does decide to revise the requirement this could be an option for a direction to consider.
- Fixing two points on the curve may be limiting the design alternatives.
- This proposal would result in a more expensive transformer that would be larger than presently required. This would increase transport and installation costs.
- Materials other traditional steel core will have different load efficiency curves.
- Number of buckets of transformer sizes – agreed minimum desirable.
- Is PG&E representative of country at large? Is data needed from other geographical regions and smaller utilities?
- The DoE rules of 2010 were better as driving efficiency goals than the 2016 rules.
- Having a smaller number of transformer sizes could result in transformers 2 or 3 sizes larger than necessary in new installations where the customer typically overestimates usage.
- Should there be different efficiency requirements for high voltage and high current applications?
- Reducing energy consumption across system includes energy used in manufacturing, transportation and installation.
- Total lifetime costs (TLC) should be the aim but very difficult to calculate all energy costs.
- New technologies such as electric vehicle charging, solar power and energy storage could have unforeseen impact on transformer loading.

Data Collection

According to Steve Rosenstock of Edison Electric Institute (EEI) residential loads represent 37% of the National Electricity consumption with Commercial at 31% and the balance industrial.

EEI is prepared to compile utility data (on anonymous basis if necessary) to match PG&E and combine if possible.

The chair asked members representing utilities if they were willing to share similar data with the task force. Two members said they were willing to share their data and disclosure of their organization would not be a problem.

Next Meeting

The next meeting will be in Louisville in October 2017.

Submitted by: Phil Hopkinson

Date: 04/04/17