Task Force to investigate Distribution Transformer Loading – DOE updates

Philip J Hopkinson, PE , David Brender, Senior Member

Presentation Items

1. **DOE has established 15 issues and / or questions in September 2017**
2. **23 Non-DOE Responses submitted by November 6, 2017.**
3. **Responses ranked by major category Chart 28**
4. **DOE activities to date**
4. **Data Gathering proposals from Dan Mulkey and from Steve Rosenstock**
5. **Issues and definitions: Load Factor and Capacity Factor**
5. **Future Direction**
6. **Discussion**

Building Technologies Office

DOE Issues a Request for Information Pertaining to Test Procedures for Distribution Transformers

The U.S. Department of Energy (DOE) has issued a pre-publication *Federal Register* notice initiating a data collection process through a Request for Information to consider whether to amend DOE's test procedure for distribution transformers.

- DOE requests and will accept comments, data, and information in response to the distribution transformers test procedure RFI until 30 days after the notice publishes in the Federal Register. DOE will send a follow-up e-mail when the notice publishes to announce the closing date of the comment period.
- Interested persons are encouraged to submit comments using the Federal eRulemaking Portal at http://www.regulations.gov. Alternatively, interested persons may submit comments, identified by docket number EERE-2017-BT-TP-0055, by Email (DistributionTransformers2017TP0055@ee.doe.gov), postal mail, or hand delivery/courier.
- DOE has gathered data and identified several issues associated with the test procedure on which DOE is interested in receiving comment. These issues mainly concern the degree to which the per-unit load testing measurement accurately represents in-service distribution transformer performance, and provides test results that reflect energy efficiency, energy use, and estimated operating costs during a representative average use cycle of an in-service transformer.
- DOE welcomes written comments from the public on any subject within the scope of this document (including topics not raised in this request for information).
- Find product information for Distribution Transformers including current standards and test procedures; statutory authority; waivers, exceptions and contact information. The docket for this rulemaking is EERE-2017-BT-TP-0055.

Task Force to investigate Distribution Transformer Loading – DOE updates

Philip J Hopkinson, PE , David Brender, Senior Member

6450-01-P

DEPARTMENT OF ENERGY

10 CFR Part 429 and 431

[EERE-2017-BT-TP-0055]

Energy Conservation Program: Test Procedure for Distribution Transformers

AGENCY: Office of Energy Efficiency and Renewable Energy, Department of Energy.

ACTION: Request for information (RFI).

SUMMARY: The U.S. Department of Energy ("DOE") is initiating a data collection process through this RFI to consider whether to amend DOE's test procedure for distribution transformers. To inform interested parties and to facilitate this process, DOE has gathered data, identifying several issues associated with the currently applicable test procedure on which DOE is interested in receiving comment. The issues outlined in this

Task Force to investigate Distribution Transformer Loading – DOE updates

Philip J Hopkinson, PE , David Brender, Senior Member

Issue 1. DOE seeks comment, data, and information regarding initial (first year) of service) PUL data for distribution transformers.

PUL data from loading studies to date shows considerable diversity,

1. light loading in rural settings

2. > 70% of nameplate in some urban settings as well as for Commercial and Industrial loads.

PUL means Per Unit Load

Task Force to investigate Distribution Transformer Loading – DOE updates

Philip J Hopkinson, PE , David Brender, Senior Member

Issue 2. DOE requests input on the initial RMS PUL values

PG&E on this subject has related the following load summaries:

Type	Rate	Peak	Annual LF	Peak Day LF	Peak Month LF
Residential	E7	7/23/06	38.6%	71.7%	46.7%
Residential	E1	7/23/06	39.3%	74.5%	51.3%
Commercial	A1	7/24/06	39.8%	62.1%	47.0%
Commercial	A10	7/24/06	47.3%	68.6%	55.0%
Commercial	E19S	7/24/06	59.2%	78.2%	65.4%
Commercial	A6	7/25/06	59.7%	85.8%	74.5%
Industrial	E20S	8/9/06	61.9%	78.7%	68.7%
Commercial	E19V	7/25/06	62.8%	83.5%	71.3%
Commercial	E19P	7/25/06	67.2%	84.6%	72.9%
Industrial	E20P	7/25/06	70.7%	89.0%	77.7%
Industrial	E20T	7/21/06	79.1%	94.9%	84.4%

Task Force to investigate Distribution Transformer Loading – DOE updates

Philip J Hopkinson, PE , David Brender, Senior Member

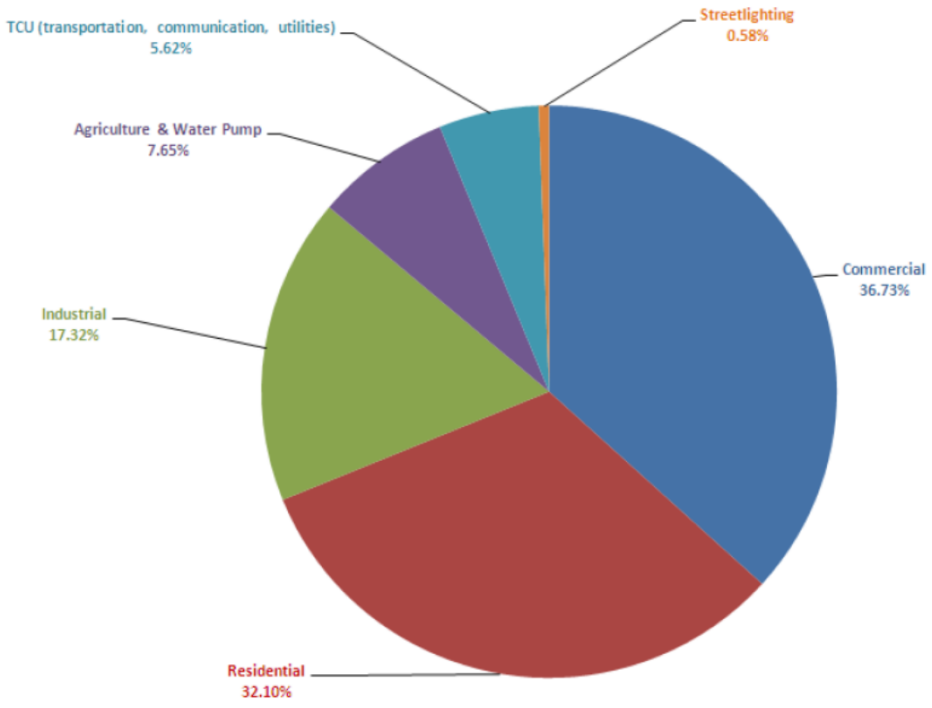
Rate Class Definitions

E1 Residential
E7 Residential Time of Use (TOU)
E19P, E19S, E19V - Medium General Demand-Metered TOU Service
E20P, E20S, E20T - Service To Customers With Maximum Demands Of 1000 Kilowatts Or More
A1 Small General Service
A10 Medium General Demand-Metered Service
A6 Small General Time-Of-Use Service

Task Force to investigate Distribution Transformer Loading – DOE updates

Philip J Hopkinson, PE , David Brender, Senior Member

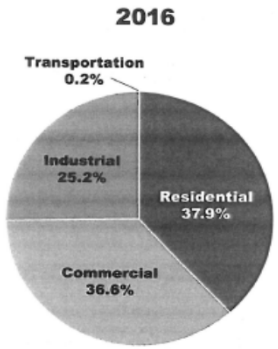
Figure D-1: Sector Shares of Total Electricity Consumption (2012)



Source: California Energy Commission staff

California energy consumption compared to total US where in 2016:

Use	California	Total US
1. Residential	32.1%	37.9%
2. Commercial	36.7%	36.6%
3. Industrial	17.3%	25.2%
4. Transportation	5.6%	0.2%
5. All Other	8.3%	0.0%



Proposal to establish Task Force to investigate Distribution Transformer Loading

Philip J Hopkinson, PE , David Brender, Senior Member

Data Gathering Per Dan Mulkey

1.**Single-phase overhead serves residential, small to medium commercial, agricultural, and industrial**.

2. **Three-phase overhead are mostly small to medium agricultural but also used to supply small to medium commercial and industrial**

3. **Single-phase submersible is mostly residential with some small commercial**

4. **Three-phase submersible is mostly small to medium commercial with some multi-family residential**

5**. Single-phase pad-mount is mostly residential with some small commercial**

6. Three-phase pad-mount is mostly commercial and industrial with some agricultural and some multi-family residential

Task Force to investigate Distribution Transformer Loading – DOE updates

Philip J Hopkinson, PE , David Brender, Senior Member

Issue 3. transformers of a given category (e.g., specific kVA, phases, application,

etc.). Specifically, commenters should specify whether the distributional

data they provide represents the first year of service, or the full lifetime.

PG&E data represents a total summary and not a first year only.

Task Force to investigate Distribution Transformer Loading – DOE updates

Philip J Hopkinson, PE , David Brender, Senior Member

Issue 4. DOE seeks comment, data and information regarding the load growth

No data on this subject.

1. **Load growth normally results from new loads being added to existing circuits.**
2. **LVDT's may be relatively constant.**
3. **MVDT's likely to see new loading associated with electrification of motor vehicles**

Task Force to investigate Distribution Transformer Loading – DOE updates

Philip J Hopkinson, PE , David Brender, Senior Member

Issue 5. DOE seeks comment, data and information regarding the extent to which efficiency is taken into account in transformer purchasing decisions.

Two Considerations:

1. **Must be DOE Compliant**
2. **Low Price and best delivery**

Task Force to investigate Distribution Transformer Loading – DOE updates

Philip J Hopkinson, PE , David Brender, Senior Member

Issue 6. DOE seeks comments, data, and information regarding Temperature Correction

1. Most stakeholders believe that temperature accurately measured
2. Base temperature corrected to 20 C
3. Full load temperature extrapolatable from initial conditions, local temperature and loading.

Task Force to investigate Distribution Transformer Loading – DOE updates

Philip J Hopkinson, PE , David Brender, Senior Member

Issue 7. DOE seeks comments, data, and information regarding how temperaturevaries with PUL

Temperature rise generally rises with load current to the 1.6 power at steady state conditions.

Task Force to investigate Distribution Transformer Loading – DOE updates

Philip J Hopkinson, PE , David Brender, Senior Member

Issue 8. DOE seeks comments, data, and information on the continued use of a single test PUL requirement.

1. **The 2016 rules for efficiency (50% of load for MV and 35% load for LV) are good**

2. **Insufficient data for changes in PULs.**

3. **Load diversity significant, dependent on transformer application.**

Task Force to investigate Distribution Transformer Loading – DOE updates

Philip J Hopkinson, PE , David Brender, Senior Member

Issue 8 Cont'd. Other comments on the continued use of a single test PUL requirement.

3.a. Many Transformers purchased in bulk and placed in stock and applied as needed.

3.b. Same transformer may be in a light or heavy loaded application.

3.c. Same transformer may be applied in residential, commercial or industrial applications.

4. Ideally, transformers should be designed to be energy efficient at light loads and at heavy loads.

Task Force to investigate Distribution Transformer Loading – DOE updates

Philip J Hopkinson, PE , David Brender, Senior Member

5. Existing metric measures efficiency at one load level, either 50% or 35% of rated load.

6. New low loss core materials have complicated the efficiency picture:

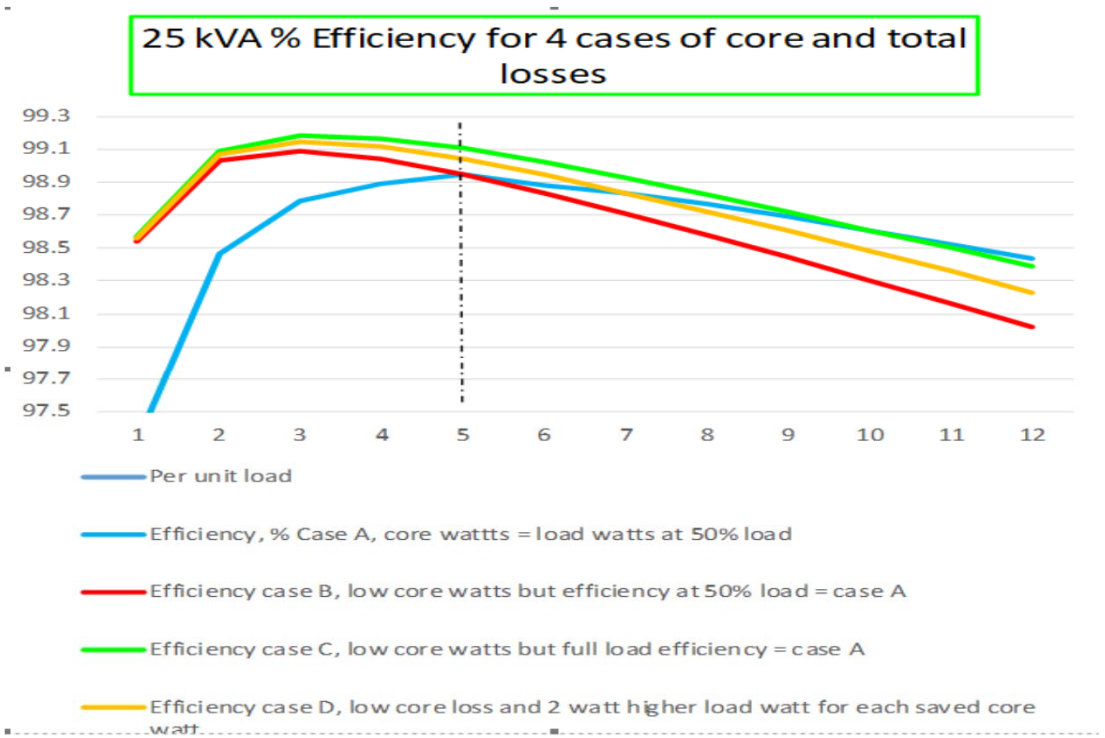
a. All transformers are at their maximum efficiency at the load where core loss equals load loss.

b. Transformers, using conventional grain oriented core steel, normally are at their peak efficiency at the measurement points of 50% load or 35% load, and are slightly less efficient at either side of the measurement load.

4. Ideally, transformers should be designed to be energy efficient at light loads and at heavy loads.

Task Force to investigate Distribution Transformer Loading – DOE updates

Philip J Hopkinson, PE , David Brender, Senior Member



4. Ideally, transformers should be designed to be energy efficient at light loads and at heavy loads.

Task Force to investigate Distribution Transformer Loading – DOE updates

Philip J Hopkinson, PE , David Brender, Senior Member

25kVA Designs studied for losses, efficiencies and costs

1. Material costs from 2016 DOE rule-making used to valuate designs
2. M3, M4, and SA1 Amorphous core materials compared
3. Copper and Aluminum conductors compared
4. All designs forced to meet DOE efficiency at 50% load
5. Losses and efficiency examined at peak load efficiency ant at full load
6. Hypothetical 400 watt limit introduced as max allowed losses to see impact
7. 400 watt limit was standard for 25 kVA pole types in 1966 for electric utilities

4. Ideally, transformers should be designed to be energy efficient at light loads and at heavy loads.

Task Force to investigate Distribution Transformer Loading – DOE updates

Philip J Hopkinson, PE , David Brender, Senior Member

Design Summary of 25 kVA Options | Philip J Hopkinson, PE | 10/3/2017

Design		Materials						Weights				Losses					Efficiencies			Material Costs			
Spreadshe et Number	Core Size	Inner LV	HV	Outer LV	Volt/turn	Score, kG	Tank D	Core lbs	LV lbs	HV Lbs	total lbs	NL watts	LL watts	FL Watts	50%Load	FL	%Load peak efficiency	total watts/ 22% load	efficiency at 22%load	Core Cost	LV	HV	Total
10	M3	AL	CU	AL	6.00	15.8	16	153	25.1	37.7	369	71	273	348	98.9%	98.64	58	83	98.54	$ 186.33	$ 32.83	$ 99.84	$ 433.97
11	M4	AL	CU	AL	6.00	14.0	16	152	25.6	41.9	402	75	296	330	98.9%	98.70	57	88	98.49	$ 206.15	$ 36.89	$ 106.15	$ 452.97
12	M3	AL	CU	AL	5.00	15.8	16	137	29.3	44.1	357	63	306	369	98.9%	98.54	48	77	98.64	$ 166.61	$ 40.54	$ 111.94	$ 423.97
13	M3	CU	CU	CU	6.00	16.4	15	144	48.7	38.0	357	73	282	335	98.9%	98.68	58	85	98.51	$ 186.83	$ 140.11	$ 91.38	$ 508.78
14	M3	AL	AL	AL	5.45	15.5	17	165	20.4	28.0	330	73	286	334	98.9%	98.68	55	85	98.51	$ 181.94	$ 60.23	$ 85.07	$ 481.99
15	M3	AL	CU	AL	6.00	15.5	15	163	22.5	37.1	360	72	286	338	98.9%	98.67	59	84	98.52	$ 183.56	$ 49.59	$ 94.76	$ 437.82
16	M3	AL	AL	AL	4.80	14.7	15	161	25.6	25.0	365	62	314	345	98.9%	98.52	47	78	98.68	$ 167.32	$ 52.48	$ 82.36	$ 439.45
17	M3	CU	CU	CU	5.00	17.1	15	115	58.2	48.4	350	66	243	334	98.9%	98.56	50	79	98.60	$ 137.24	$ 187.45	$ 117.57	$ 530.98
18	SA1	AL	CU	AL	5.22	13.5	17	165	17.8	34.2	325	22	487	552	98.6%	98.00	22	44	98.22	$ 286.70	$ 51.09	$ 111.86	$ 513.13
19	SA1	AL	CU	AL	5.00	13.5	17	161	18.1	35.1	333	22	481	512	98.6%	97.99	22	43	98.23	$ 281.94	$ 42.42	$ 114.83	$ 522.89
22	SA1	AL	CU	AL	5.00	13.5	17	169	29.3	48.3	419	23	365	398	98.7%	98.25	27	55	98.32	$ 293.19	$ 65.10	$ 106.15	$ 508.18
23	SA1	AL	CU	AL	5.00	13.5	16	169	28.7	44.0	389	22	378	493	98.5%	98.43	25	59	98.30	$ 289.12	$ 54.91	$ 144.11	$ 564.15
24	M3	AL	CU	AL	5.00	13.5	16	156	23.4	39.8	375	49	371	422	98.9%	98.35	38	97	98.30	$ 181.45	$ 52.07	$ 100.53	$ 444.08
25	M3	AL	CU	AL	5.00	13.5	16	156	23.8	46.1	374	49	351	410	98.9%	98.43	39	97	98.30	$ 181.50	$ 52.84	$ 116.62	$ 450.96

Notes:

1. All designs meet the 2016 DOE efficiency requirement of 98.62% at 50% load.
2. SA1 Amorphous core designs 18, 19, and 22 assume that amorphous ribbon is purchased in the US and fabricated into finished cores in a US or Far Eastern transformer manufacturer.
3. All designs optimized for material prices per page 21 that were used in 2016 rule making.
4. Columns T and U examine the total losses and efficiency at the efficiency where amorphous core designs see at peak efficiency at ~ 22% load.
5. Amorphous core design 22 reduces current densities to the same level as was done in M3 Core Steel designs such that total full load losses are similar to that of the silicon steel designs for improved efficiency at high loading.
6. Least first cost options examined seem to be with M3 core material, copper HV, and aluminum sheet LV.
7. Sheet 23 examines a reasonable upper limit on total losses of ~2.9 * 50% DOE losses that would be easily met by all of the DOE designs and assures the user that low core loss designs would still be efficient at all loads.
8. Sheet 24 examines M3 core material at 13.5 KG, the same as Amorphous core with total losses not constrained but meeting the DOE requirement at 50% load.
9. Sheet 25 examines M3 core material at 13.5 KG but with total losses constrained to 400 watts. Note that efficiency at 50% load now exceeds the DOE requirement.

Conclusions

1. Arbitrary limits of flux density normally lead to suboptimal performance and cost.
2. Highest overall efficiency occurs when peaked at RMS-equivalent load.
3. Transformers applied in diverse loading loads should be as efficient as possible over all of their expected loads.
4. Light load applications may be candidates for smaller kVA transformers.

4. Ideally, transformers should be designed to be energy efficient at light loads and at heavy loads.

Task Force to investigate Distribution Transformer Loading – DOE updates

Philip J Hopkinson, PE , David Brender, Senior Member

25kVA Designs studied for losses, efficiencies and costs

1. Design 15 with M3, copper HV and AL strip LV typical for CGO Steel

2. Design 19 with SA1 amorphous core, copper HV and Al strip LV typical of amorphous.

3. Both meet required efficiency of 98.95 % at 50% load

4. When total losses limited to 400 watts, both designs efficient at high loads

4. Ideally, transformers should be designed to be energy efficient at light loads and at heavy loads.

Task Force to investigate Distribution Transformer Loading – DOE updates

Philip J Hopkinson, PE , David Brender, Senior Member

Issue 9. DOE seeks comments, data, and information regarding testing a single transformer at multiple PULs.

Multiple PUL's are not necessary but a limit on total losses would flatten the efficiency curve.

1. **Medium Voltage limit ~2.9 * losses at 50% Load.**
2. **LV Dry Limit ~5* losses at 35% Load**

4. Ideally, transformers should be designed to be energy efficient at light loads and at heavy loads.

Task Force to investigate Distribution Transformer Loading – DOE updates

Philip J Hopkinson, PE , David Brender, Senior Member

Issue 10. DOE seeks comments, data, and information regarding the number of PULs (and the corresponding test PUL values) that parties believe may be appropriate for a multiple PUL test procedure. In addition, DOE seeks comments, data, and information

This is an overly burdensome consideration

Our Proposal:

1. **Continue to measure No-Load and Full Load Losses**
2. **Arrive at Pass-Fail by calculation**
   - **A. Continue efficiency at 35% load for LV and 50% load for MV**
   - **B. Introduce second limit at Full Load**

4. Ideally, transformers should be designed to be energy efficient at light loads and at heavy loads.

Task Force to investigate Distribution Transformer Loading – DOE updates

Philip J Hopkinson, PE , David Brender, Senior Member

Issue 11. DOE seeks comments, data, and information on whether there are any other options or alternative metrics not presented in this RFI that should be considered for measuring and rating the efficiency of distribution transformers.

Add total losses be added as a metric to the existing test requirements.

1. **Low Core Losses excellent**

2. **Low Winding losses also excellent**

3. **Both necessary to get high efficiency at all loads**

4. Ideally, transformers should be designed to be energy efficient at light loads and at heavy loads.

Task Force to investigate Distribution Transformer Loading – DOE updates

Philip J Hopkinson, PE , David Brender, Senior Member

Issue 12. DOE seeks comment regarding the sampling requirements for distribution transformers.

Many manufacturers do sampling

Task Force to investigate Distribution Transformer Loading – DOE updates

Philip J Hopkinson, PE , David Brender, Senior Member

Issue 13. DOE seeks comment regarding the represented values of efficiency relative to calculated values;

1. **Table values**
2. **Minimum Values**
3. **Maximum Values**

Most manufacturers use the efficiency table values.

Task Force to investigate Distribution Transformer Loading – DOE updates

Philip J Hopkinson, PE , David Brender, Senior Member

Issue 14. DOE's requirements related to AEDMs are at 10 CFR 429.70.

Manufacturers test each transformer produced for losses and apply AEDM

Task Force to investigate Distribution Transformer Loading – DOE updates

Philip J Hopkinson, PE , David Brender, Senior Member

Issue 15. DOE seeks information regarding the usefulness of the AEDM provisions, and whether and why manufacturers select the option to use AEDMs.

AEDM provisions are very useful

Task Force to investigate Distribution Transformer Loading – DOE updates

Philip J Hopkinson, PE , David Brender, Senior Member

DOE 25 Posted Responses received by November 6, 2017:

Items	Position
1,7 DOE	Asked 15 questions
5, 14 NEMA	Pushes for no new limits on losses
11. Powersmiths	Sees loading both light and high, recommends no changes to losses
22. NRECA	No further restrictions but WESC likes EPA program.
23. Prolec	Do not change losses.
24. APPA	Do not change anything
25. Howard Ind.	Do not change.
16. EEI	Sees loading increasing, wants limits on total losses
6. AK Steel	Sees increasing loads and advocates limit on total losses
3, 13 HVOLT Inc.	Summarized loading feedback and pushing for limits on total losses
15. ACEEE +ASAP	Sees light loading and wants Testing done at lower % Load
17 Metglass	Sees light loading and wants Testing done at lower % Load
18. PG&E, SCE, SDG&E	Like IEEE Data Collection Program
8. Babanna Suresh	Wants rectifier transformers included in efficiency standard
9. Babanna Suresh	Testing at 100% load added, clarify rectifier transformers
2, 10, 12, 19, 20, 21.	Annonymous Anti Global Warmer
4. Oleh Iwanuslw	Announced a portable losses test pushing limits on core, load losses

Task Force to investigate Distribution Transformer Loading – DOE updates

Philip J Hopkinson, PE , David Brender, Senior Member

March 12th discussions with Jeremy Dommu:

1. **Comment collection completed by DOE for now**
2. **No public meeting planned to review comments**
3. **If NOPR is issued then a public meeting will be held**
4. **Navigant Consulting is still involved**
5. **Mike Rivest is still the Navigant contact**

Proposal to establish Task Force to investigate Distribution Transformer Loading

Philip J Hopkinson, PE , David Brender, Senior Member

Loading Task Force Activities

Current Interested Participants:

a. **EEI via Steve Rosenstock**

b. **Several large Utilities:**

- i. **PG&E**
- ii. **So. Cal. Ed.**
- Iii. **PECO**
- iV **AEP**
- V **DUKE**
- VI **Con ED**

c. **Some Wind and Solar Customers**

Mechanics:

a. **Establish compatible EXCEL Data file for data reporting**

b. **Use real time data acquisition for key locations**

c. **Use neutral clearing house (EEI) for gathering data and maintaining neutrality.**

d. **Annual load cycles gathered by rate class and logged over full 8760 hourly period/yr.**

Proposal to establish Task Force to investigate Distribution Transformer Loading

Brad Kittrell Con Ed Distribution Engineering

Brad Kittrell
ConEd | Distribution Engineering | Eng. Supervisor

Definitions:

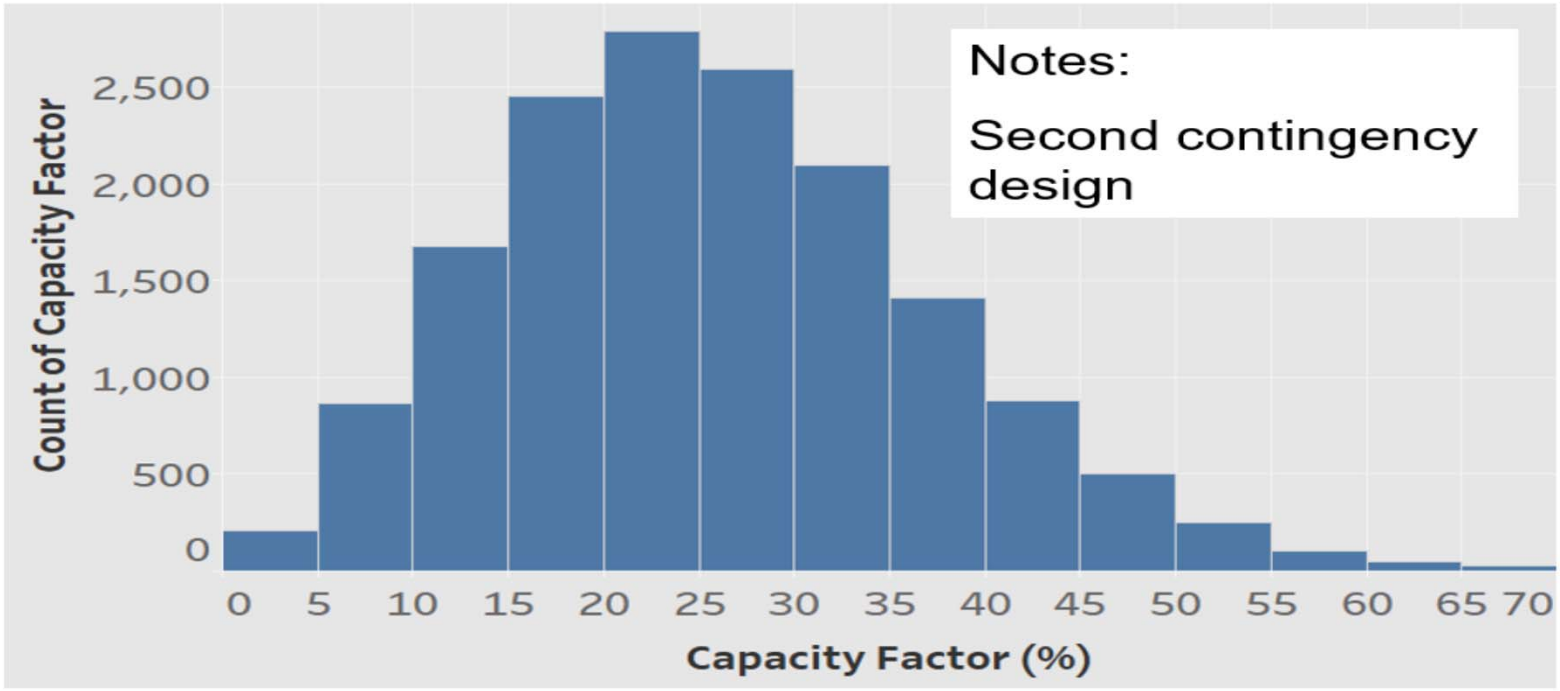
Load Factor = Average Load/Peak Load

Capacity Factor = Average Load/ Rated Load

Proposal to establish Task Force to investigate Distribution Transformer Loading

Brad Kittrell Con Ed Distribution Engineering

Overall Average Capacity Factor: 26%

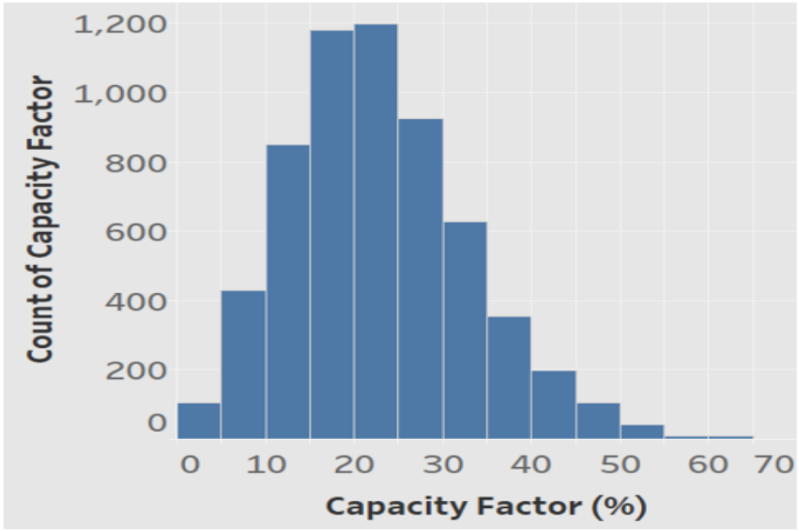


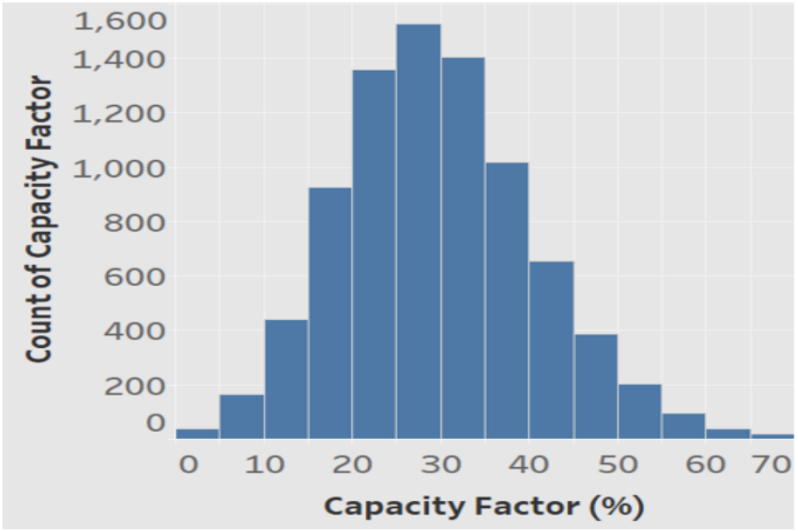
conEdison, inc. 1

Proposal to establish Task Force to investigate Distribution Transformer Loading

Brad Kittrell Con Ed Distribution Engineering

Multi-Bank vs Street Feeds





Avg. Multi-bank: 23%

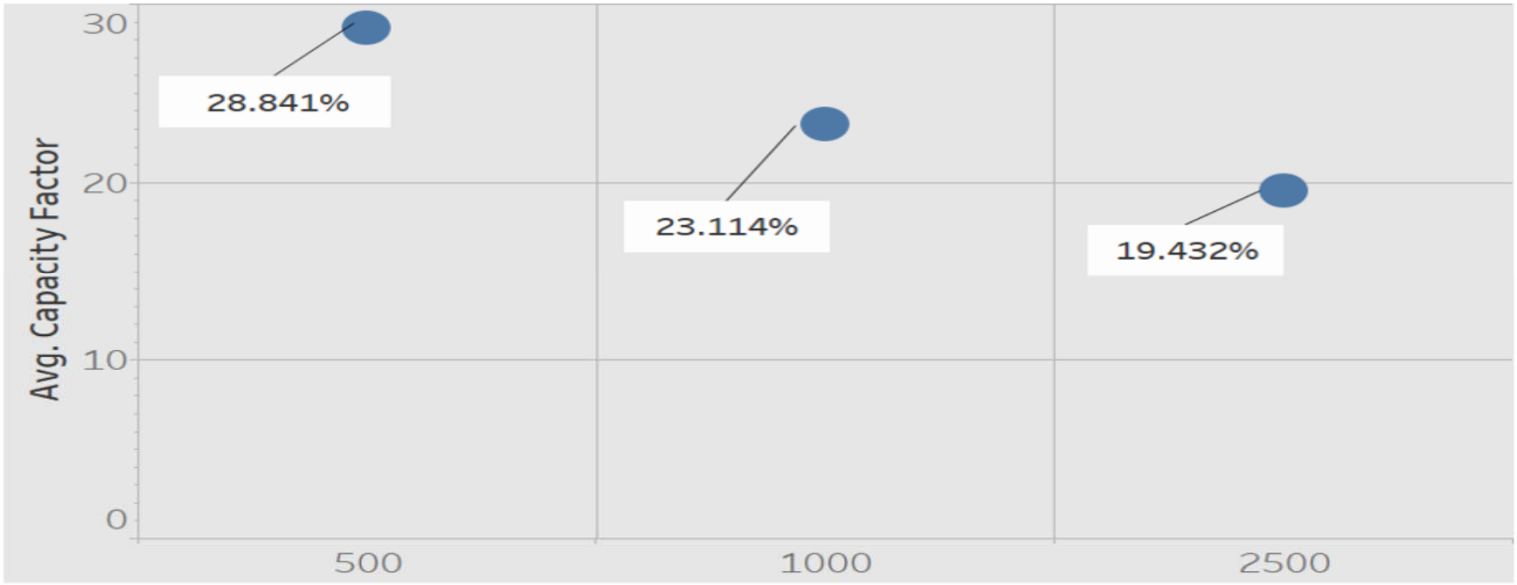
Avg. Street Feed: 30%

conEdison, inc. 2

Proposal to establish Task Force to investigate Distribution Transformer Loading

Brad Kittrell Con Ed Distribution Engineering

Average Capacity Factor by Transformer kVA



conEdison, inc. 3

Proposal to establish Task Force to investigate Distribution Transformer Loading

Brad Kittrell Con Ed

Capacity Factors Across Boroughs

Borough	Capacity Factor	Design
Manhattan	27%	Second
Brooklyn	28%	Second
Queens	23%	Second
Bronx	27%	First
Westchester	16%	First

Task Force to investigate Distribution Transformer Loading – DOE updates

Philip J Hopkinson, PE , David Brender, Senior Member

From Steve Rosenstock, EEI spokesman on 10/2/17:

1. **Table 1 of the PG&E report makes a nice template for a "first cut" of information gathering and identified as Tier 1.**

2. **Tier 2 could be more detailed data on sub-categories of residential / commercial / industrial as shown on your slides**

3. **Tier 3 is the most detailed data of sub categories based on geographic location or other key operational variables (such as trending data, if available).**

Proposal to establish Task Force to investigate Distribution Transformer Loading

Philip J Hopkinson, PE , David Brender, Senior Member

PG& E Perspective Conclusions:

1. Load cycles by hourly data logging should be accurate.

2. Load cycles by rate class capture daily, monthly, and annual load ranges

3. Load factors can be calculated by day, month and year vs. Load Cycles

4. RMS-equivalent easily obtained from hourly data but Load Factor OK.

5. Transformer nameplate kVA is less than peak capability based on modelling

Proposal to establish Task Force to investigate Distribution Transformer Loading

Philip J Hopkinson, PE , David Brender, Senior Member

Dan Mulkey

Utility				PG&E	PG&E	PG&E	PG&E	PG&E	PG&E
Transformer Type				1P-OH	1P-SUB	3P-SUB	3P-PM	3P-OH	3P-PM
Nameplate kVA				10	25	750	500	150	1500
# of Residential Customers				2	3				
# of Commercial Customers								5	
# of Industrial Customers						1	1		1
# of Agricultural Customers									
# of Other Customers								1	
	Date	day	hour	Time (hrs)	Transformer 126534	Transformer 126535	Transformer 126536	Transformer 126537	Transformer 126538	Transformer 126539
	12/31/06 5:00 PM	365	17	8753	1.18	1.99	287.44	241.91	66.53	820.49
	12/31/06 6:00 PM	365	18	8754	1.22	2.05	287.56	237.07	65.49	817.08
	12/31/06 7:00 PM	365	19	8755	1.16	1.92	283.59	228.53	62.80	808.54
	12/31/06 8:00 PM	365	20	8756	1.08	1.93	281.14	222.33	62.03	806.12
	12/31/06 9:00 PM	365	21	8757	0.99	1.90	276.16	217.49	60.13	795.69
	12/31/06 10:00 PM	365	22	8758	0.91	1.65	271.59	213.65	57.74	783.36
	12/31/06 11:00 PM	365	23	8759	0.85	1.37	267.71	211.66	56.07	775.47
	Max				2.00	3.38	555.70	556.38	116.11	1666.77
	Min				0.41	0.67	253.39	199.85	51.48	712.86
	Av				0.79	1.31	373.55	329.46	72.89	1177.99

Proposal to establish Task Force to investigate Distribution Transformer Loading

Philip J Hopkinson, PE , David Brender, Senior Member

Data Gathering Per Dan Mulkey

1. **Single-phase overhead– most used size is the smallest size purchase – currently the 15 kVA**

2. Three-phase overhead – most used size is 150 kVA (next to largest available size) presumably agricultural load

3. Single-phase submersible – most used size is 100 kVA (most are used in residential subdivisions where customers are aggregated up to the design voltage drop or flicker limit)

4. Three-phase submersible – most used size is 150 kVA (smallest available size) presumably commercial load

5. Single-phase pad-mount – most used size is 100 kVA (most are used in residential subdivisions where customers are aggregated up to the design voltage drop or flicker limit)

6. Three-phase pad-mount – most used size is 150 kVA (default type commercial and industrial)

On a percent by transformer unit – the small single-phase transformer serving residential will absolutely overwhelm everything else. Change that to % of kVA or % of energy or % of cost, I suspect that the commercial/industrial served by a three-phase pad-mount will slightly exceed the residential served by single-phase transformer.

Proposal to establish Task Force to investigate Distribution Transformer Loading

Philip J Hopkinson, PE , David Brender, Senior Member

Discussion:

1. **Is the PG&E approach typical of others?**
2. **Are load cycles gathered by other utilities?**
3. **Is loading data relatable by rate class?**
4. **Are load cycle peaks the basis of sizing transformers?**
5. **Is there a common format for collecting data?**
6. **Can other data be shared publicly?**
7. **Would it be preferable to use EEI for Utility data?**

Proposal to establish Task Force to investigate Distribution Transformer Loading

Philip J Hopkinson, PE , David Brender, Senior Member

Future Assignments

1. Charts to members of Task Force and all on web site.
2. Request loading data summaries.
3. RMS-equivalent loading by Nameplate is the goal.
4. Other formats will be collected as submitted.
5. EEI ready to assist as needed.
6. Ultimate desire is to collect data for Liquid, Dry, and LV Dry.

Next Meeting Jacksonville October 15, 2018