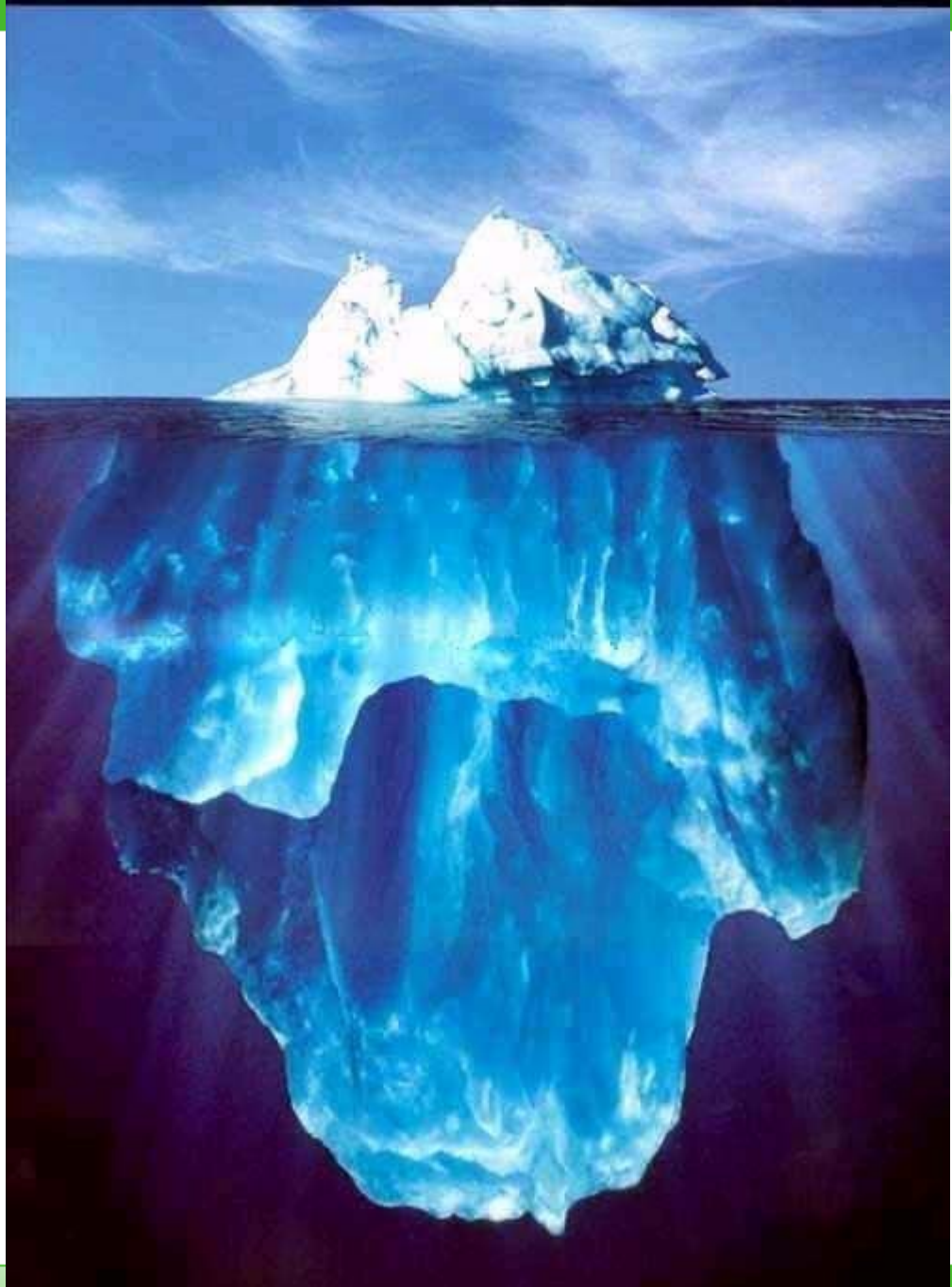


# The Need to Take Transformers beyond EPACT 2005





- Founded in 1996
- Power Quality & Energy Efficiency
  - ISO 14001 environmental management system
  - First to meet proposed DOE Efficiency Class 3
  - Education for Sustainability Tools
  - Participate in Sustainability Oriented Organizations



**US PARTNERSHIP**  
 DECADE OF EDUCATION FOR SUSTAINABLE DEVELOPMENT  
 UNITED NATIONS DECADE (2005-2014)



*Power for the Future*

# FACTS: Transformer vs. Life Cycle Cost

- Few Products, if any, will remain functional longer than transformers, 35 – 40+ years
- Lighting Comparison 2 - 3 X
- HVAC Comparison 1 - 2 X
- Low Voltage Transformers represent less than ½ of 1% Building Cost



CRITICAL ROOM



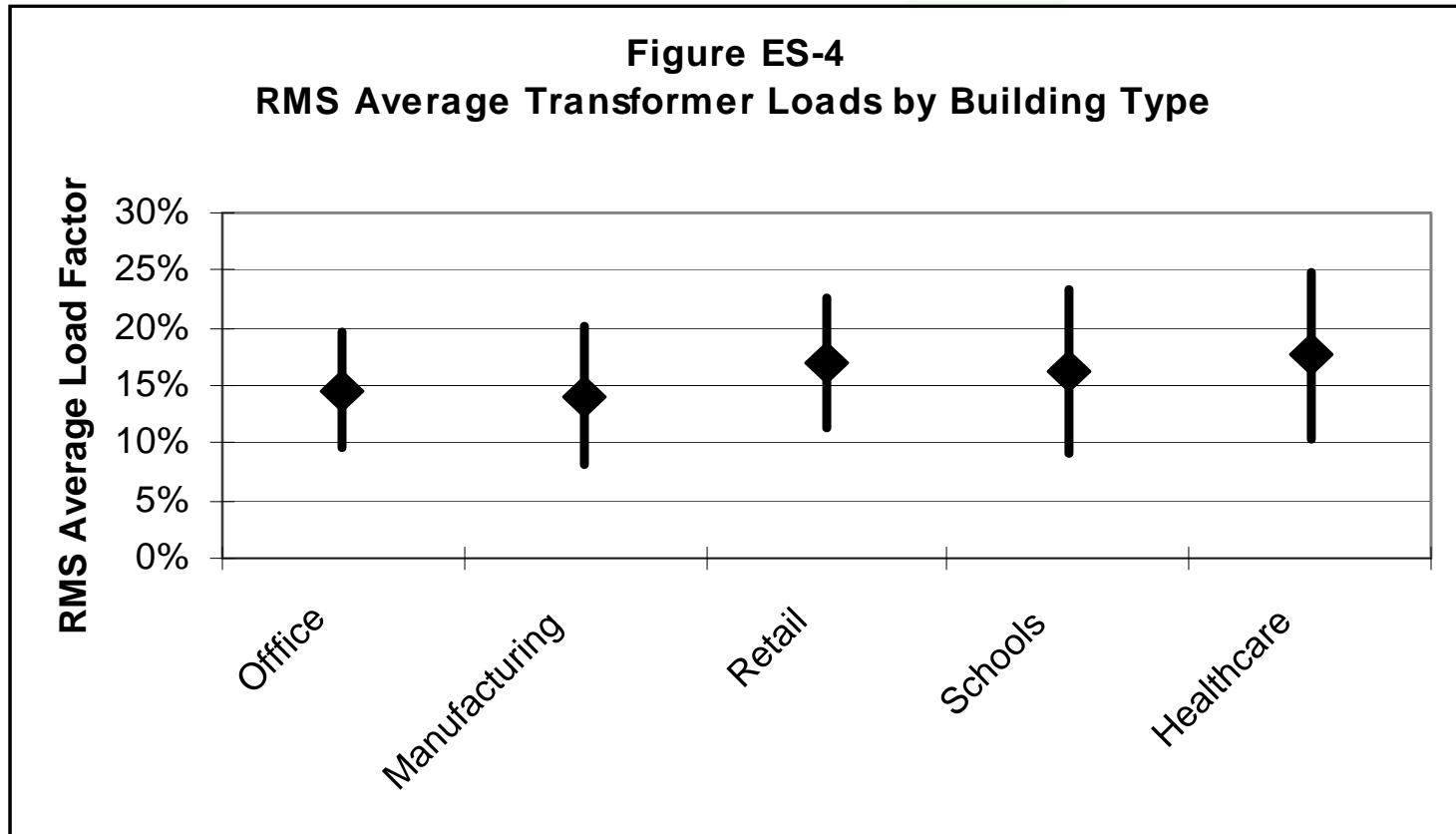
**You Never Know  
What Happens  
Behind Closed Doors.**



*The E-SAVER™ reduces energy losses up to 60% or more and is manufactured with the lowest environmental impact. (ISO 14001)*

# Transformer Loading ????

# Cadmus Study documents lightly loaded transformers in many applications

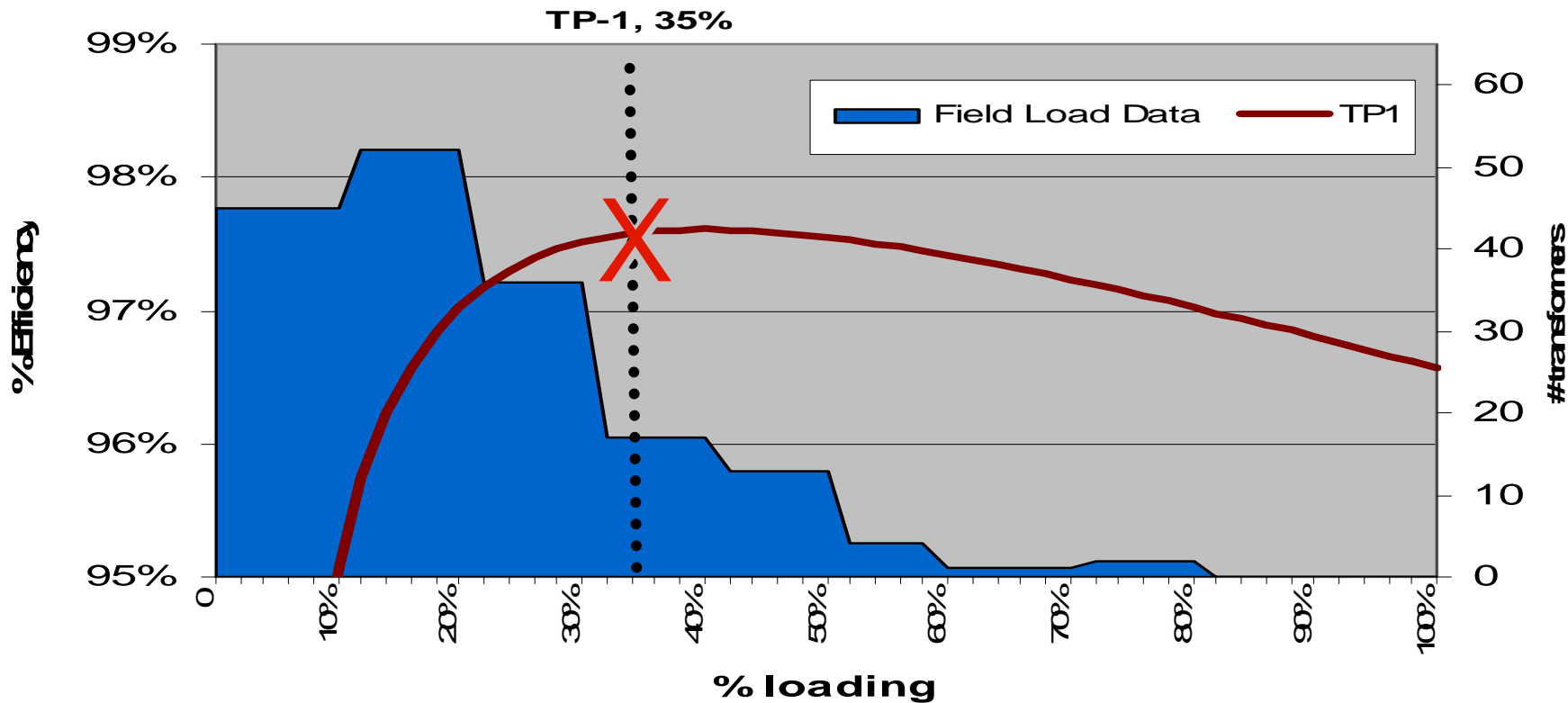


**Metered Load Factors for Low-Voltage, Dry-Type Transformers in Commercial, Industrial and Public Buildings**

The Cadmus Group Inc. 12/7/99, Prepared for Northeast Energy Efficiency Partnership

# High Performance vs. TP1 (EPACT 2005) transformer (Linear Loading Efficiency)

45kVA Efficiency Comparisons vs. Field Data & TP-1



EPACT & TP1 have single 35% performance point not matched to load profile

# From minimum Efficiency to Life Cycle

- NEMA TP1 as minimum efficiency – to rid market of worst offenders
- Significant losses remain
- 5 efficiency classes
- Finds low life cycle cost to be proposed Class Level 3
- K-RATED TRANSFORMERS ARE NO LONGER EXEMPT



Federal Register

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Thursday,  
July 29, 2004

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Part II

## Department of Energy

Office of Energy Efficiency and  
Renewable Energy

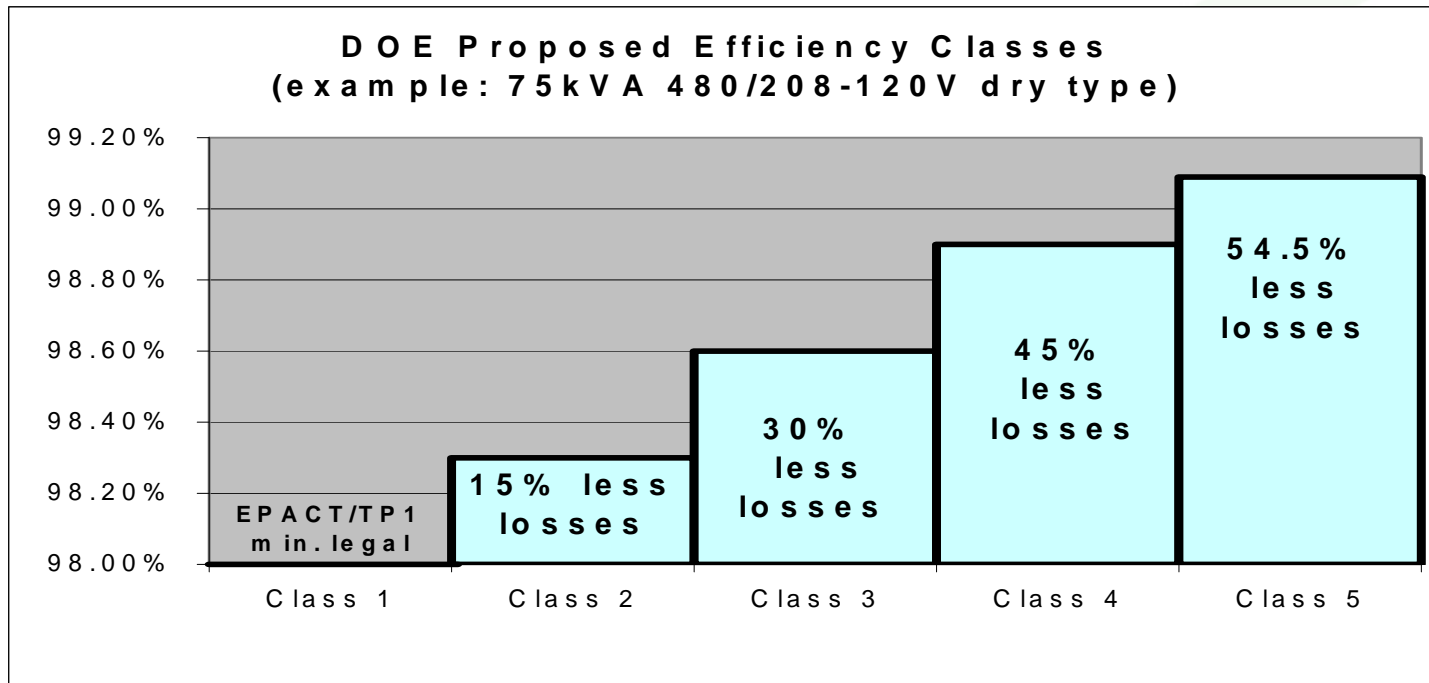
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10 CFR Part 430

Energy Conservation Program for  
Commercial and Industrial Equipment:  
Energy Conservation Standards for  
Distribution Transformers; Proposed Rule



# Moving to Life Cycle Assessment

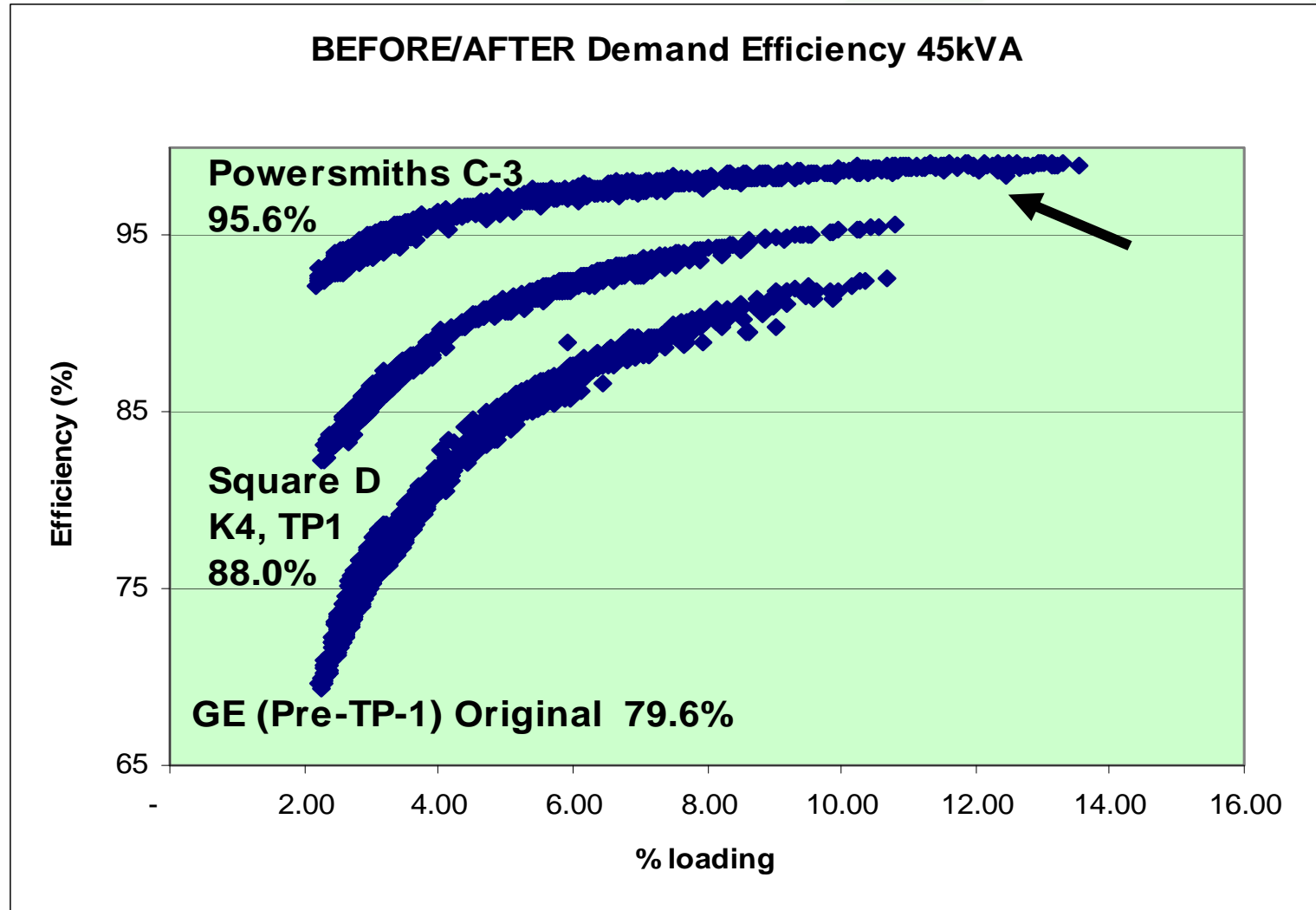


75kVA	Efficiency	Losses	Operating Cost Reduction
Class 1 (EPACT)	98.00%	2.00%	0%
Class 2	98.30%	1.70%	15.0%
Class 3	98.60%	1.40%	30.0%
Class 4	98.90%	1.10%	45.0%
Class 5	99.09%	0.91%	54.5%

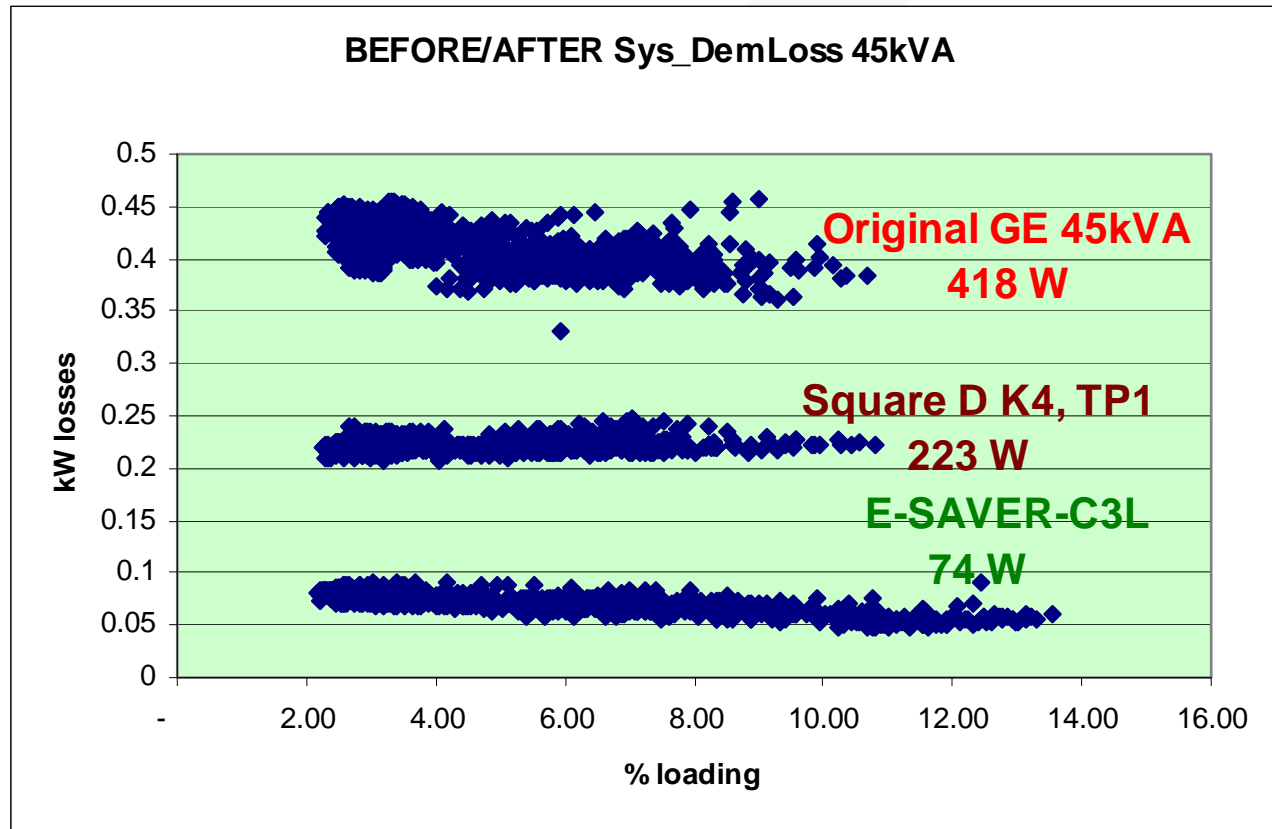
Low  
Life  
Cycle  
Cost



# Comparing Efficiency Classes



# Comparing Losses



# Detailed data

<b>45kVA Transformer</b>	<b>Original GE</b>	<b>Powersmiths ESAVER-C3L</b>	<b>Square-D K4 (AL) EE45T3H1SNL</b>
<b>Loading (kW)</b>	1.0-4.8 kW (1.8kW avg)	1.0-6.1kW (2.0kW avg)	1.0-4.9 kW (1.8kW avg)
<b>% loading</b>	2-10% (4% avg)	2-14% (5% avg)	2-10% (4% avg)
<b>Average Losses</b>	413 W	74 W	223 W

## Findings

45kVA Transformer	Original GE	Powersmiths ESAVER-C3L	Square-D K4 (AL) EE45T3H1SNL
Accumulated Transformer Losses after feeding 295kWh of load (roughly 1 week)	65.7 kWh	10.7 kWh	36.0 kWh
Performance Comparison	Baseline (existing)	84 % reduction in operating losses	45% reduction in operating losses
NOTE: Load profile has an average of 40% current distortion, typical of today's connected equipment			

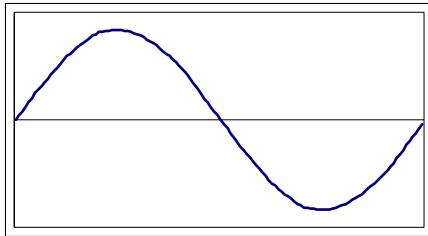
## Conclusions

- Energy Savings: **3 times lower** losses with Powersmiths compared to Square D
- Environmental Benefits of transformer upgrade to Powersmiths:

Annual Reduction in Greenhouse Gases (per EPA)	
3	tons of CO2
10	Tons of Coal
23	kgs of SO2
10	kgs of NOx

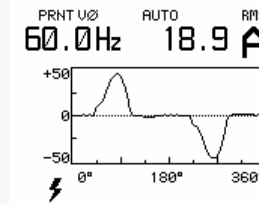
# Things to remember about transformers

## - electronics are everywhere

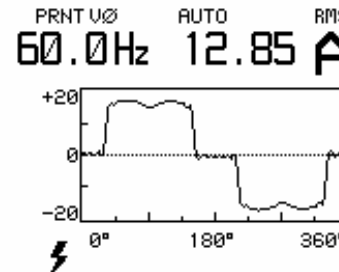


Electrical systems deliver optimum performance when feeding continuous “linear” loads:

- motors
- incandescent lighting
- resistive heating



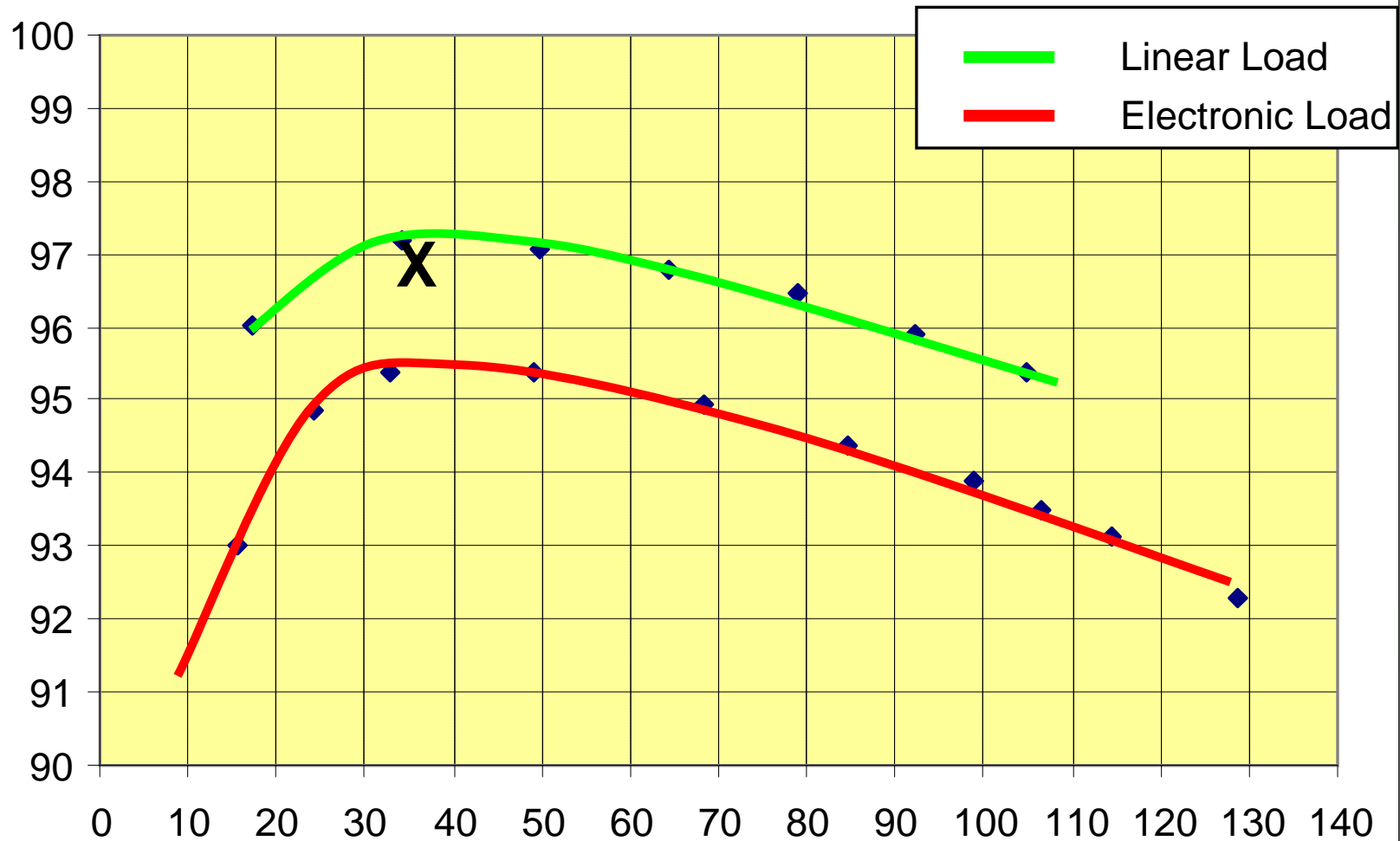
Electronics are everywhere  
- computers, lab, diagnostic & operating equipment, & patient care



Variable Speed Drives run Ventilation System

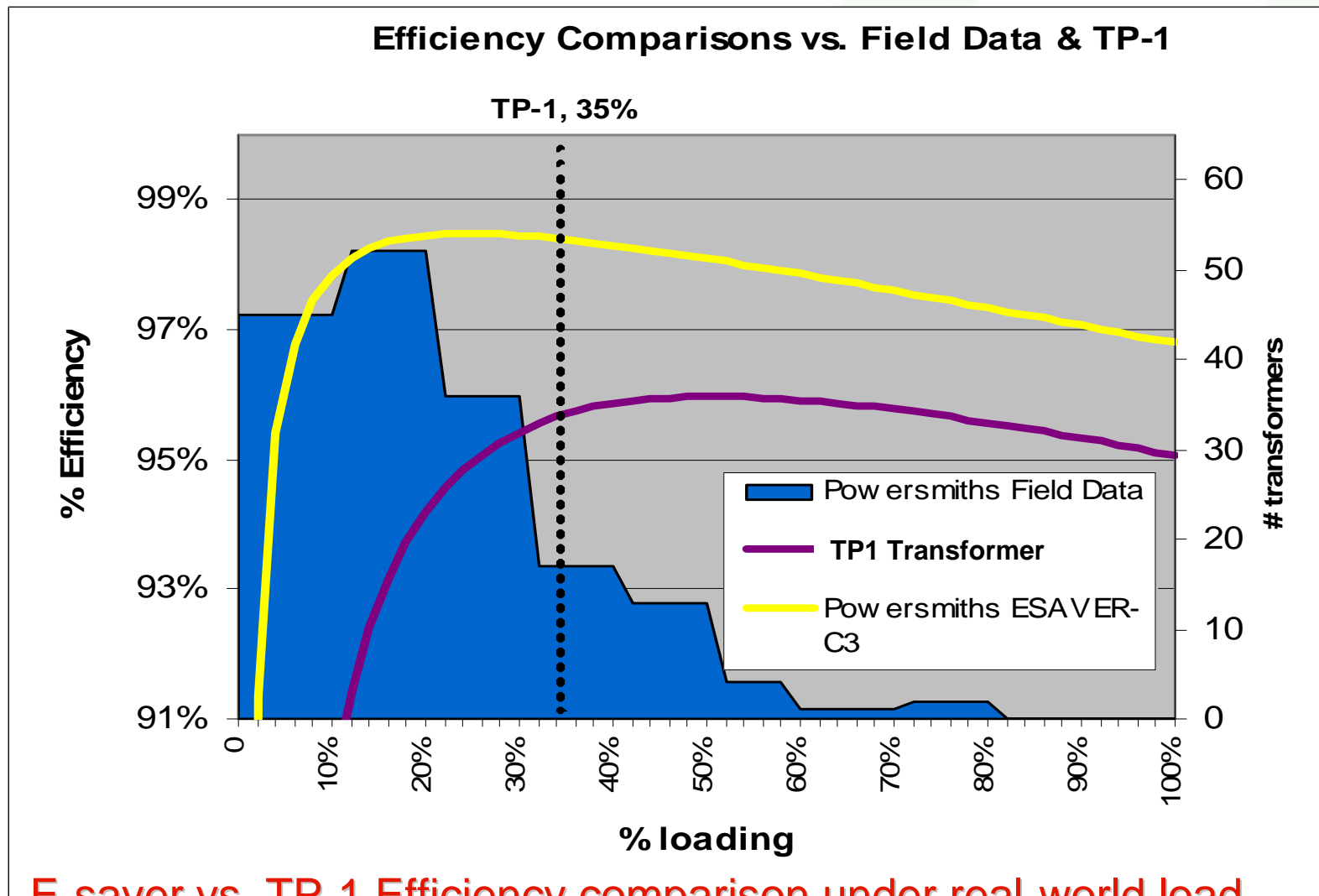
# 15kVA TP1 transformer Performance Comparison

## Ideal factory test profile (Linear) vs. Real World Electronic Loading





# High Performance vs. TP1 (EPACT 2005) transformer (Non-Linear Loading Efficiency)



# High Performance Green Buildings

