

Codes and Standards Program: Understanding Energy Code Compliance

EE Coordinating Council | July 13, 2016

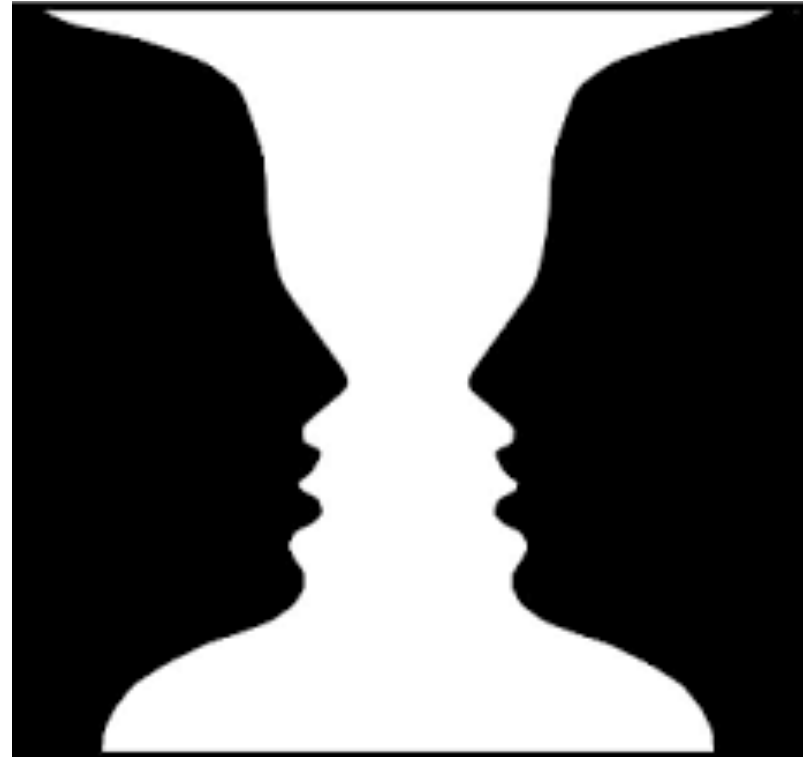
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Controversy Around Compliance

- Lots of conjecture and anecdotes about building compliance rates.
 - Res HVAC retrofits
 - NR lighting alterations
 - New construction
- Lack of compliance is a real problem, but where and how much?
- On what basis should policy decisions be made?



Data Sources for Code Compliance

- CPUC 2016 (DNV GL). “HVAC6 Phase One Market Assessment of Residential Permitting and Partial-Compliance.”
 - Sample size = 100 site visits
- CPUC 2014 (Cadmus). “Statewide C&S Program Impact Evaluation Report PY 2010-12.”
 - Sample size = 91 (NRNC), 75 (NR lighting alteration), 27 (re-roof)
- CPUC 2010 (Cadmus). “CA IOU C&S Program Evaluation for Program Years 2006-08.”
 - Sample size = 81 sites (Commercial), 194 (Residential)
- DOE 2016 (PNNL). “Single Family Residential Energy Code Field Study.”
 - Sample size = 1,158 homes across seven states

What is Compliance?



Proper
Paperwork

Documentation and
permit closed

May not reflect
installation or savings



Measure
Installation

Number of measures
installed

May not reflect energy
savings

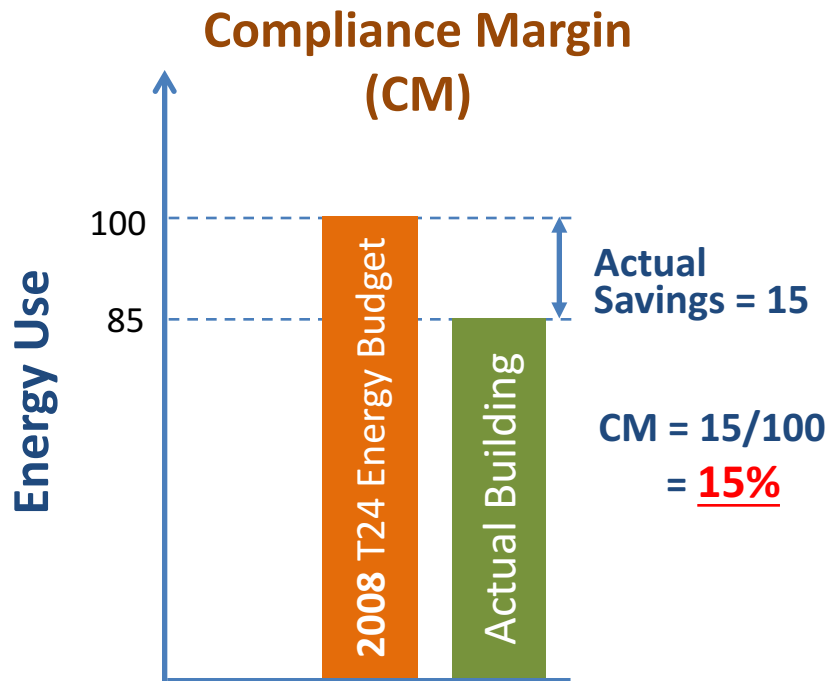


Achieving
Savings

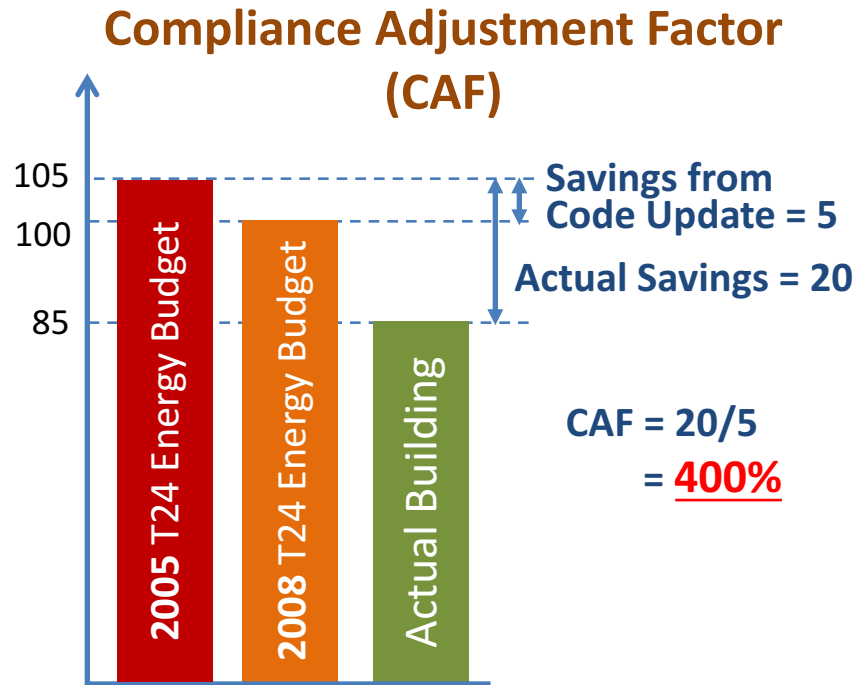
Equipment installed
& functioning

CPUC evaluation
metric

What is energy-based compliance?



- For incentive programs
- Savings: compared to **current** T-24
- 0% = just meets current code



- For C&S Program
- Savings: Compared to **prior** T-24
- 100% = just meets current code

CPUC C&S Impact Evaluation

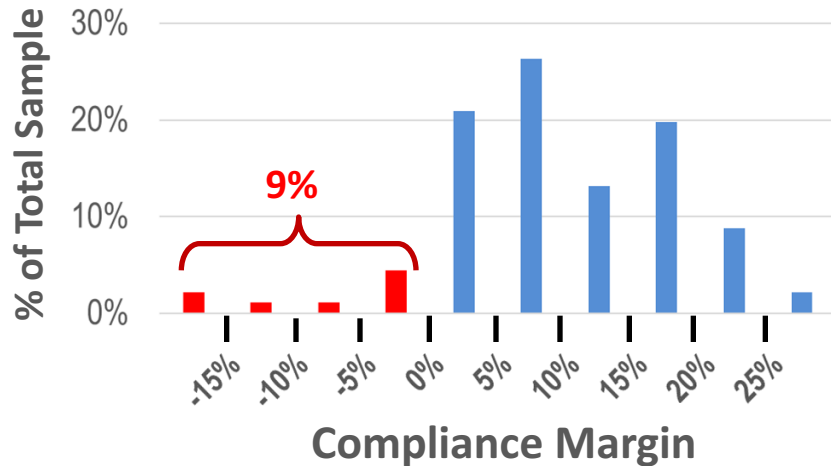
	Standards	Compliance Adj. Factor (CAF)	Compliance Margin (% above code)
2006 – 08 Evaluation	2005 T24 RNC (whole Building)	120% (Electric) 235% (Gas)	Not available
	2005 T24 NRNC	61.5% (8 – 100%)	
2010 – 12 Evaluation	2008 T24 NRNC	410% (kWh) 328% (kW) 118% (Therm)	13% (kWh) 14% (kW) 1% (Therm)
	2008 T24 NR Alteration	304% (Indoor lighting, kWh) 83% (Re-roof)	7% (Indoor lighting, kWh) Unknown for re-roof*

- **On average buildings are using less energy than required by code**
- **However**
 - **Average doesn't say how many are not meeting code**
 - **Samples selected from permitted buildings**

Compliance Margin: Average vs. Distribution

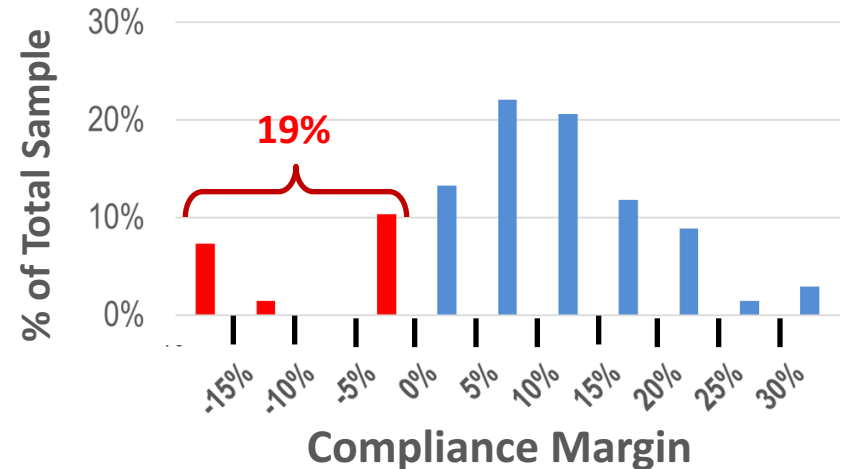
2008 T24 NRNC

Weighted Average = 13% CM
9% of sample with negative CM



2008 T24 Lighting Alter.

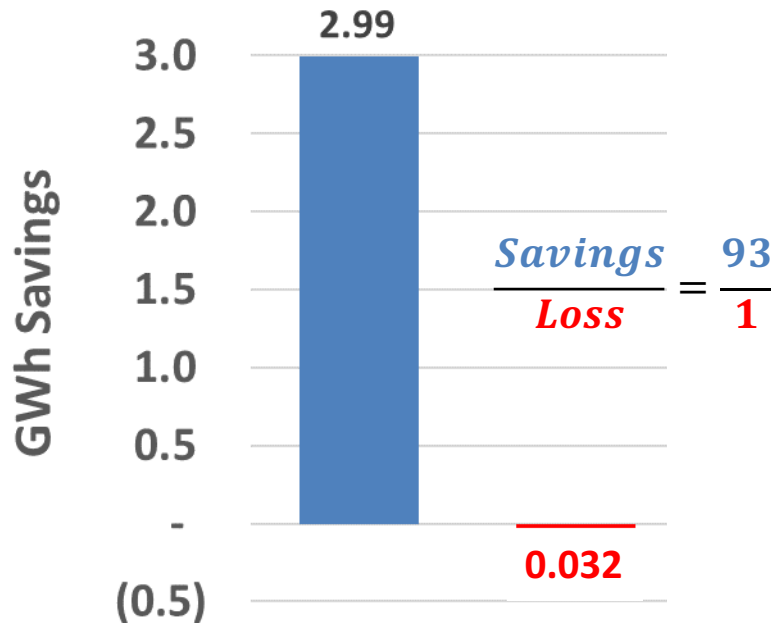
Weighted Average = 7% CM
19% of sample with negative CM



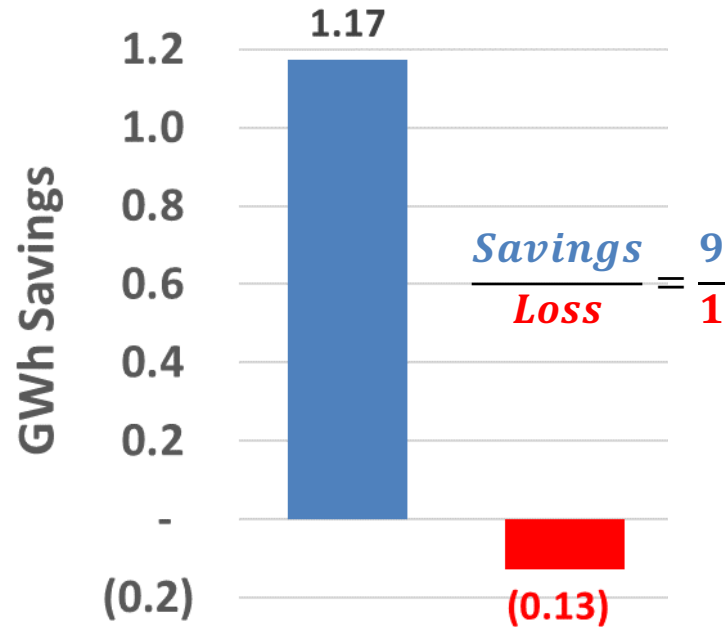
Average compliance margin does not provide the complete picture.

Savings: Gains vs Losses in Sample

2008 T24 NRNC

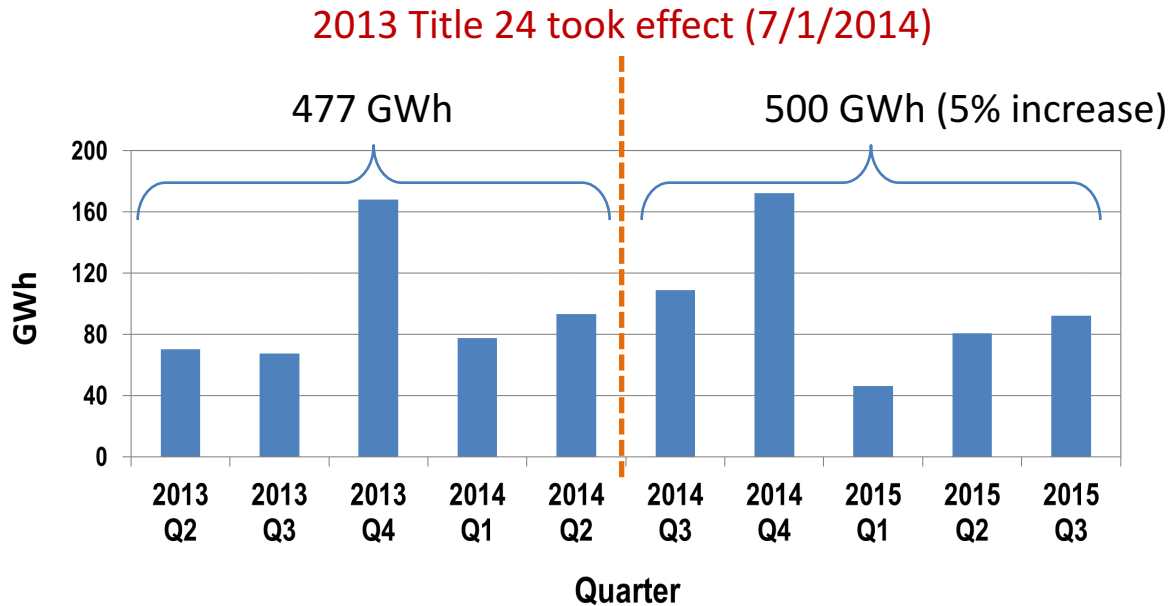


2008 T24 Lighting Alter.



Lighting Retrofit Incentive Project Savings before and after 2013 Title 24

Savings from IOU NR Lighting Retrofit Incentive Programs



Five Quarters after T-24
effective date are 5%
higher than Five
Quarters before

Reference: Based on CUPC EESat data

CPUC (DNV GL) Res HVAC Retrofit Study Phase 1

Based on randomly selected retrofits from RASS database.

- Sample size = 100
- 2/3's not permitted

Overall Energy Savings in Permitted retrofits only slightly higher³ than Energy Savings in retrofits without Permits



	Measure	No Permit		Open Permit			
		n	%	n	%		
Requirement Level Compliance ¹	SEER/AFUE/HSPF	63	100%	27	100%	9	100%
	Program T-stat	62	87%	27	93%	9	89%
	Load Calc	63	0%	27	100%	9	100%
	Mandatory Duct Ins	43	88%	7	57%	14	100%
	Refr Line Insul	26	96%	11	100%	3	100%
	Refr Charge	19	63%	11	27%	3	100%
	Airflow 350 cfm/ton	2	50%	2	100%	1	100%
	Fan Watt 0.58 W/cfm	2	50%	3	100%	1	100%
	T/P Measure Access	37	100%	16	100%	5	100%
	Prescrip Duct Insul	30	47%	12	25%	2	50%
	Duct Leakage	47	49%	17	41%	8	63%
	Energy Savings Compliance ²	Electric Savings	64	67%	26	74%	
Gas Savings		64	62%	26	77%		

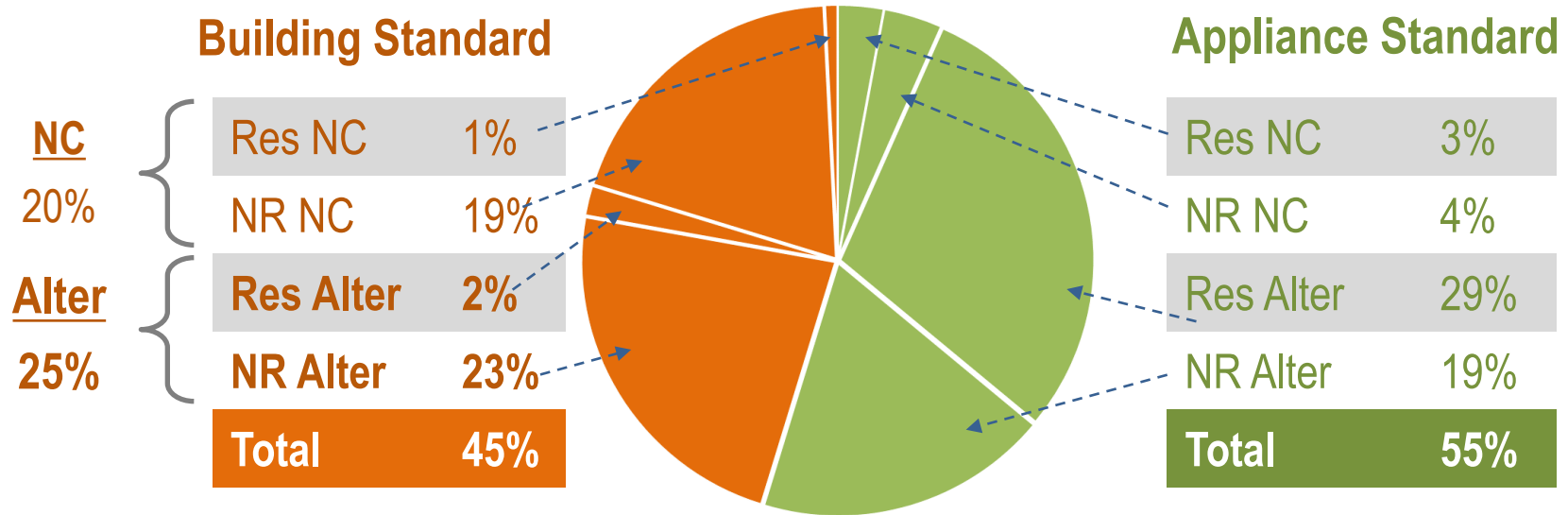
¹The percentage that field verification of a performance measure (e.g., Airflow) is compliant with the Standards (0-100%).

²Provides an estimate of partial compliance that accounts for different requirements that have different energy impacts (0-100%). See report for full methodology.

³The report states that there is not a statistically significant difference given that they have overlapping error bounds.

Source: CPUC (DNV GL) 2016 "HVAC6 Phase One Market Assessment of Residential Permitting and Partial-Compliance"

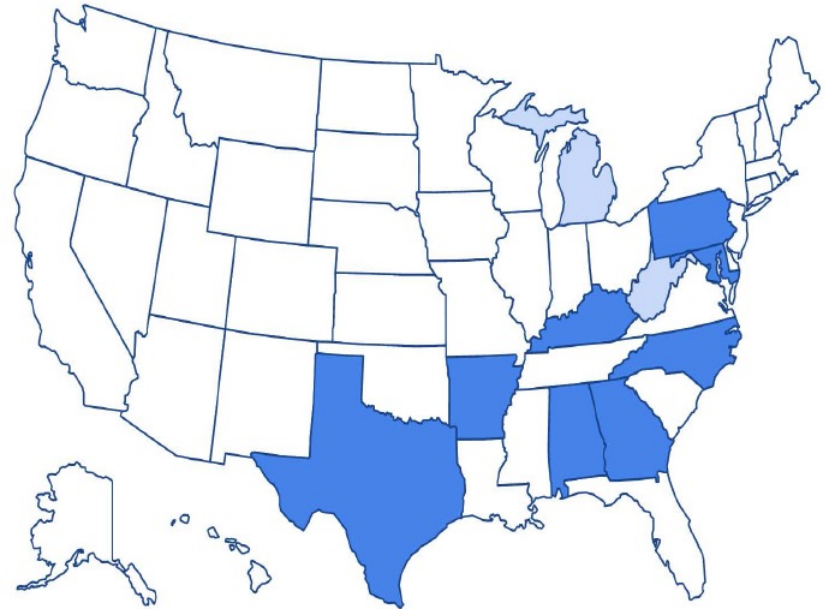
Segmented Codes & Standards Savings



- Standards adopted since 2004 (four T24 cycles)
- Building alteration standards = 25% C&S program savings
- Res HVAC retrofits building code < 2% of C&S savings.

DOE's Residential Energy Code Field Study

- “Compliance ≠ Energy Savings”
- “Many homes are using less energy than would be expected based on prescriptive codes (5 of 6 six states)”
- “There is still significant savings potential from individual code requirements:
 - Some are consistently better than code (e.g. windows)
 - Some are inconsistent with code (e.g. lighting)
 - Some are virtually always exactly at code (e.g. walls)
 - Nothing is consistently worse than code”



Summary

- From an energy perspective, overall compliance is robust
 - Noncompliance does occur but energy impacts are small
- Overall impact from Res HVAC alteration is <2% of C&S program savings
 - Impact from noncompliance is much smaller
- Savings from permitted lighting alterations exceed losses by factor of 9.

Discussion

- What are the State/CPUC energy efficiency priorities?
- How should the State/CPUC prioritize spending?
- What information should be collected to inform this decision?
- Other issues?