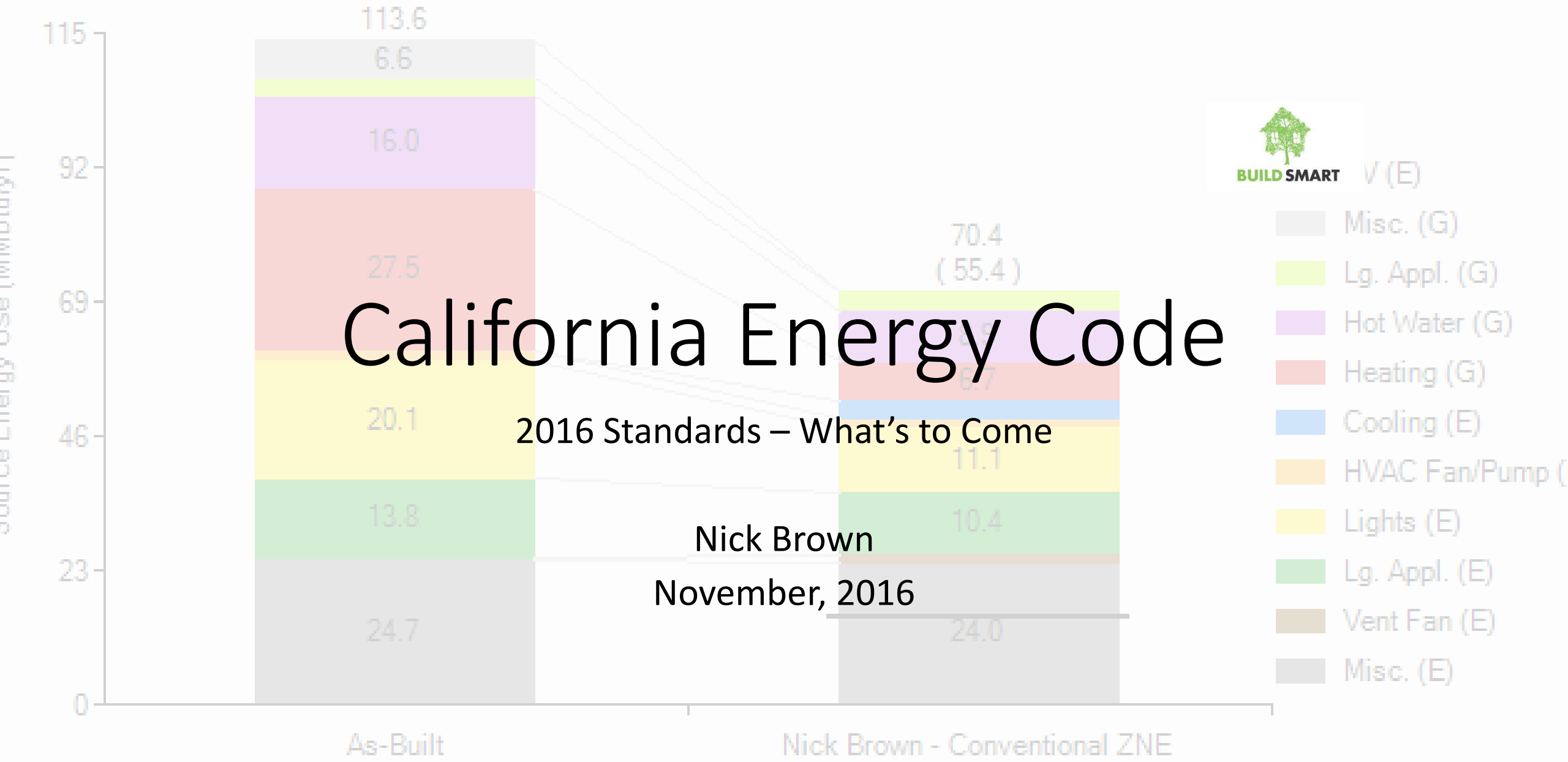
California Energy Code

2016 Standards – What's to Come

Nick Brown

November, 2016



Title 24 Energy Code

- Every 3 years, California Energy Commission issues new set of requirements
- Typically 20-25% reduction in energy use from prior code cycle
- Separate code for Residential, High-rise Residential, Commercial, and Remodeling
- 2016 standards go into effect January 1, 2017

What Happened Last Time?

- 2013 standards started July, 2014
- Made R-13+R-5 CI standard residential wall assembly
- But builders complied by upgrading other parts of the building
  - Tankless water heaters
- CI did not grow in CA

Tradeoffs in Title 24

- Builder uses energy model to show energy use of a home
- Model uses insulation values of walls, ceilings, floors, windows, plus HVAC system, hot water system, orientation to the sun, square footage, etc
- Design can have some parts of the house better than standard & others worse and still meet overall energy usage of standard house

ENERGY USE SUMMARY

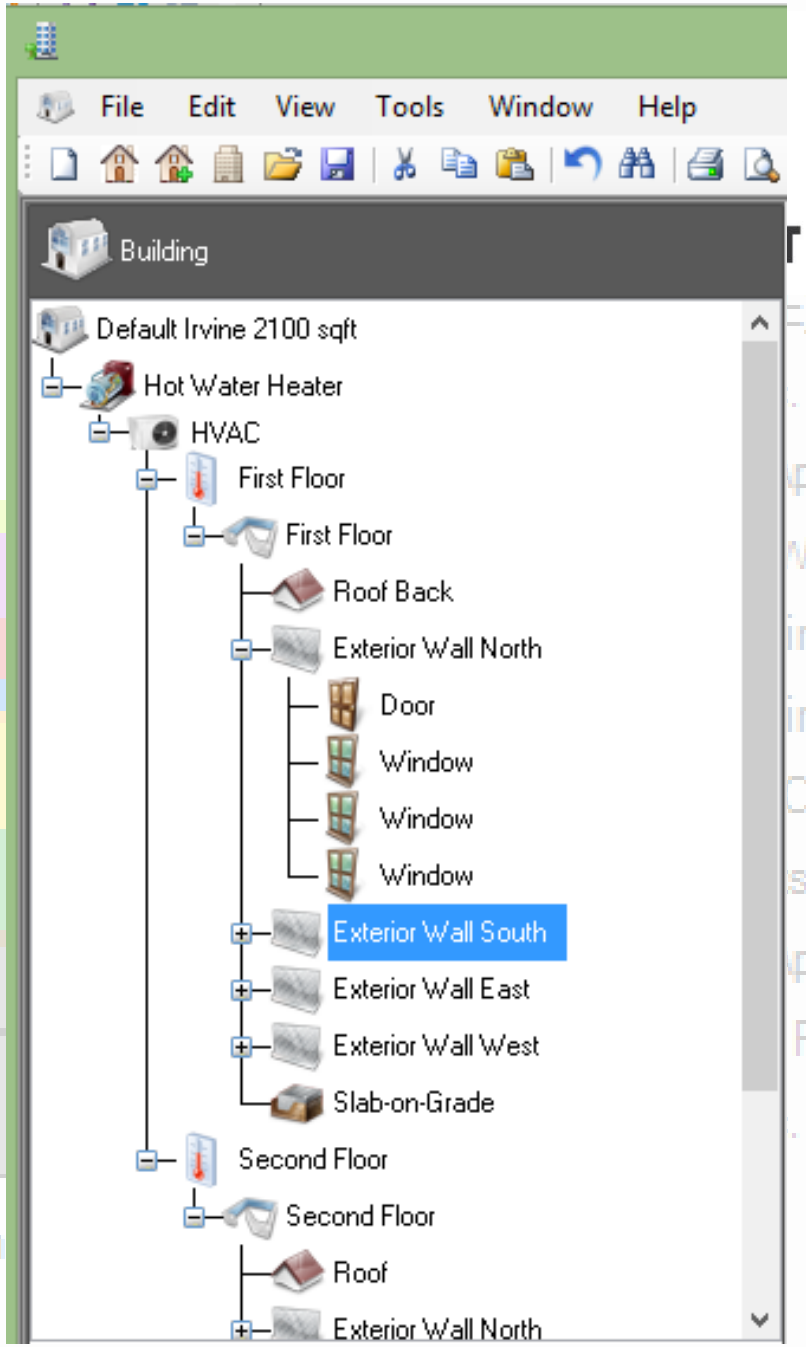
05	06			08
Energy Use (kTDV/ft^2-yr)	Standard Design	Proposed Design	Compliance Margin	Percent Improvement
Space Heating	3.59	3.75	-0.16	-4.5%
Space Cooling	[illegible]	18.58	-4.67	-33.6%
IAQ Ventilation	1.58	1.58	0.00	0.0%
Water Heating	12.97	12.27	0.70	5.4%
Photovoltaic Offset	----	0.00	0.00	----
Compliance Energy Total	**32.05**	**36.18**	**-4.13**	**-12.9%**

Plastering Industry's Role

- Bids for CI one-coat were 5-10% above 3-coat
- Expressed concern to builders around waterproofing, straight walls, skills of labor force
- Builders chose other upgrades instead of CI stucco
- Our industry has ultimate liability for water resistance, structural integrity, and aesthetics

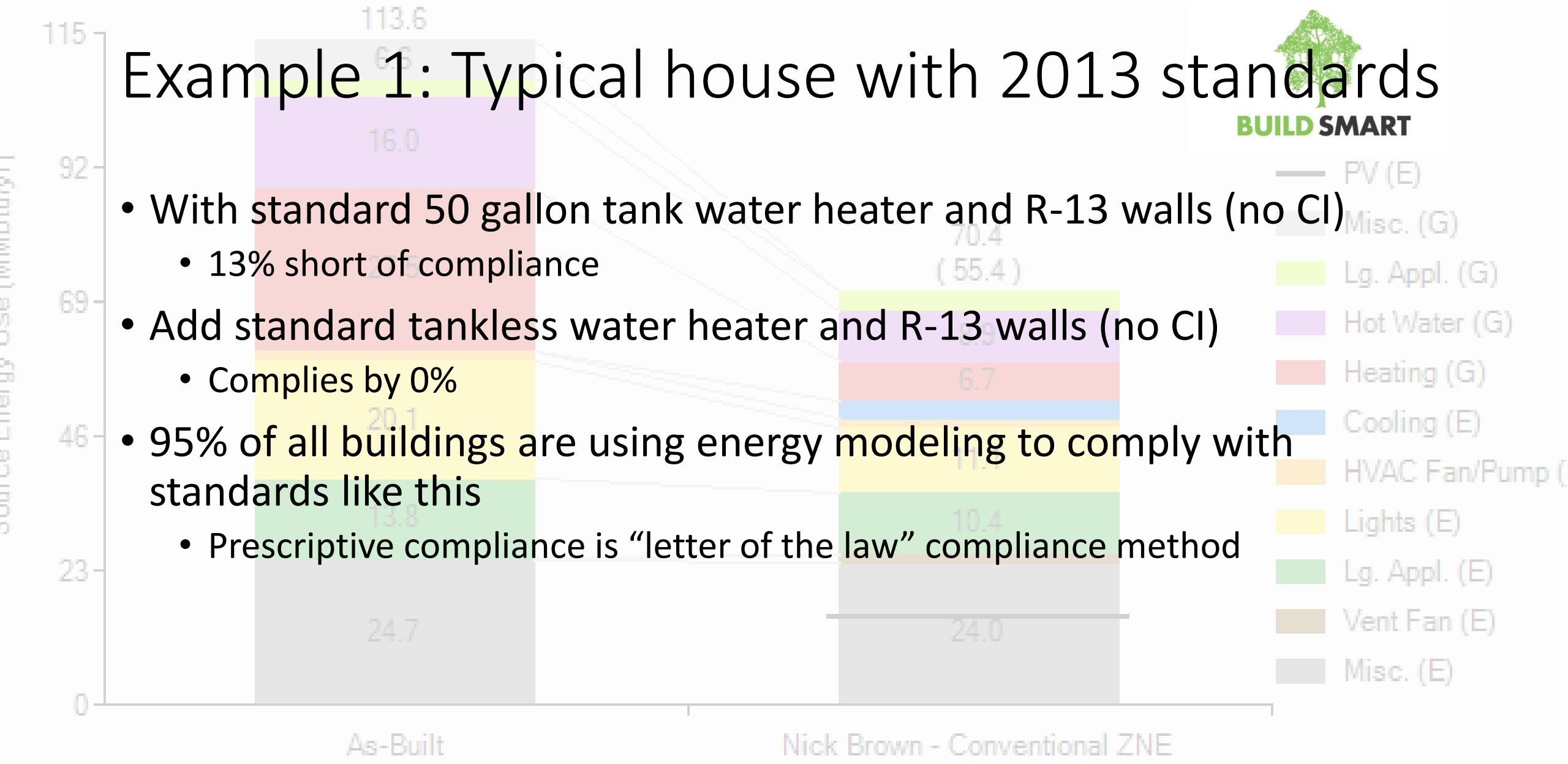
Here’s How it Works

- Energy consultant builds model
- Software spits out energy usage compared to standard building
- If it complies, design is good as is
- If not, design has to be changed
  - Builders choose most cost-effective way of compliance



Example 1: Typical house with 2013 standards

- With standard 50 gallon tank water heater and R-13 walls (no CI)
  - 13% short of compliance
- Add standard tankless water heater and R-13 walls (no CI)
  - Complies by 0%
- 95% of all buildings are using energy modeling to comply with standards like this
  - Prescriptive compliance is “letter of the law” compliance method



2016 Residential Wall Standards

- Wall standard U-factor going from 0.065 to 0.051 (except SoCal beach side of 405 – CZ 6&7)
  - 2x6, R-19 + R-5 CI
- Will 2016 be different than 2013 and force use of CI?
- Compliance credit for tankless water heaters cut way down
- Attic insulation standards also tightened significantly inland ("high-performance attics" in CZ 4,8-16)
- Running out of easier options to save energy, so may have to use CI

Prescriptive Standards

2013 Residential Standards

TABLE 150.1-A COMPONENT PACKAGE-A Standard Building Design

				Climate Zone															
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Building Envelope	Insulation[1]	Roofs /Ceilings		U 0.025 R 38	U 0.031 R 30	U 0.031 R 30	U 0.031 R 30	U 0.031 R 30	U 0.031 R 30	U 0.031 R 30	U 0.031 R 30	U 0.031 R 30	U 0.031 R 30	U 0.025 R 38	U 0.025 R 38	U 0.025 R 38	U 0.025 R 38	U 0.025 R 38	U 0.025 R 38
		Walls	Above Grade	2x4 Framed[2]	U 0.065 R 15+4 or R 13+5	U 0.065 R 15+4 or R 13+5	U 0.065 R 15+4 or R 13+5	U 0.065 R 15+4 or R 13+5	U 0.065 R 15+4 or R 13+5	U 0.065 R 15+4 or R 13+5	U 0.065 R 15+4 or R 13+5	U 0.065 R 15+4 or R 13+5	U 0.065 R 15+4 or R 13+5	U 0.065 R 15+4 or R 13+5	U 0.065 R 15+4 or R 13+5	U 0.065 R 15+4 or R 13+5	U 0.065 R 15+4 or R 13+5	U 0.065 R 15+4 or R 13+5	U 0.065 R 15+4 or R 13+5	U 0.065 R 15+4 or R 13+5
				Mass Wall Interior[3]	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.059 R 17
				Mass Wall Exterior[3]	U 0.125 R 8.0	U 0.125 R 8.	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.1025 R 8.0	U 0.125 R 8.0	U 0.070 R 13
			Below Grade	Below Grade Interior[3]	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.066 R 15
				Below Grade Exterior[3]	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.100 R 10	U 0.100 R 10	U 0.053 R 19
		Floors	Slab Perimeter		NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	U 0.58 R 7.0
			Raised		U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19
			Concrete Raised		U 0.092 R 8.0	U 0.092 R 8.0	U 0.269 R 0	U 0.269 R 0	U 0.269 R 0	U 0.269 R 0	U 0.269 R 0	U 0.269 R 0	U 0.269 R 0	U 0.092 R 8.0	U 0.138 R 4.0	U 0.092 R 8.0	U 0.092 R 8.0	U 0.138 R 4.0	U 0.092 R 8.0
	Radiant Barrier				NR	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	NR

2016 Residential Standards

TABLE 150.1-A COMPONENT PACKAGE-A STANDARD BUILDING DESIGN (CONTINUED)

				Climate Zone															
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Building Envelope Insulation	Walls	Above Grade	Framed[4]	U 0.051	U 0.051	U 0.051	U 0.051	U 0.051	U 0.065	U 0.065	U 0.051	U 0.051	U 0.051	U 0.051	U 0.051	U 0.051	U 0.051	U 0.051	U 0.051
			Mass Wall Interior[5]	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.059 R 17
			Mass Wall Exterior[6]	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.1025 R 8.0	U 0.125 R 8.0	U 0.070 R 13
		Below Grade	Below Grade Interior[7]	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.066 R 15
			Below Grade Exterior[8]	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.100 R 10	U 0.100 R 10	U 0.053 R 19
	Floors	Slab Perimeter		NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	U 0.58 R 7.0
		Raised		U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19
		Concrete Raised		U 0.092 R 8.0	U 0.092 R 8.0	U 0.269 R 0	U 0.269 R 0	U0.269 R 0	U 0.269 R 0	U 0.269 R 0	U 0.269 R 0	U 0.269 R 0	U 0.269 R 0	U 0.092 R 8.0	U 0.138 R 4.0	U 0.092 R 8.0	U 0.092 R 8.0	U 0.138 R 4.0	U 0.092 R 8.0

2013 Envelope Standards-Residential

BUILD SMART

TABLE 150.1-A COMPONENT PACKAGE-A Standard Building Design

				Climate Zone															
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Building Envelope	Insulation[1]	Roofs /Ceilings		U 0.025 R 38	U 0.031 R 30	U 0.031 R 30	U 0.031 R 30	U 0.031 R 30	U 0.031 R 30	U 0.031 R 30	U 0.031 R 30	U 0.031 R 30	U 0.031 R 30	U 0.025 R 38	U 0.025 R 38	U 0.025 R 38	U 0.025 R 38	U 0.025 R 38	U 0.025 R 38
		Walls	Above Grade: 2x4 Framed[2]	U 0.065 R 15+4 or R 13+5	U 0.065 R 15+4 or R 13+5	U 0.065 R 15+4 or R 13+5	U 0.065 R 15+4 or R 13+5	U 0.065 R 15+4 or R 13+5	U 0.065 R 15+4 or R 13+5	U 0.065 R 15+4 or R 13+5	U 0.065 R 15+4 or R 13+5	U 0.065 R 15+4 or R 13+5	U 0.065 R 15+4 or R 13+5	U 0.065 R 15+4 or R 13+5	U 0.065 R 15+4 or R 13+5	U 0.065 R 15+4 or R 13+5	U 0.065 R 15+4 or R 13+5	U 0.065 R 15+4 or R 13+5	U 0.065 R 15+4 or R 13+5
			Above Grade: Mass Wall Interior[3]	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.059 R 17
			Above Grade: Mass Wall Exterior[3]	U 0.125 R 8.0	U 0.125 R 8.	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.1025 R 8.0	U 0.125 R 8.0	U 0.070 R 13
			Below Grade: Below Grade Interior[3]	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.066 R 15
			Below Grade: Below Grade Exterior[3]	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.100 R 10	U 0.100 R 10	U 0.055 R 19
		Floors	Slab Perimeter	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	U 0.58 R 7.0
			Raised	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19
			Concrete Raised	U 0.092 R 8.0	U 0.092 R 8.0	U 0.269 R 0	U 0.269 R 0	U 0.269 R 0	U 0.269 R 0	U 0.269 R 0	U 0.269 R 0	U 0.269 R 0	U 0.269 R 0	U 0.092 R 8.0	U 0.138 R 4.0	U 0.092 R 8.0	U 0.092 R 8.0	U 0.138 R 4.0	U 0.092 R 8.0
	Radiant Barrier			NR	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	NR

2016 Envelope Standards-Residential

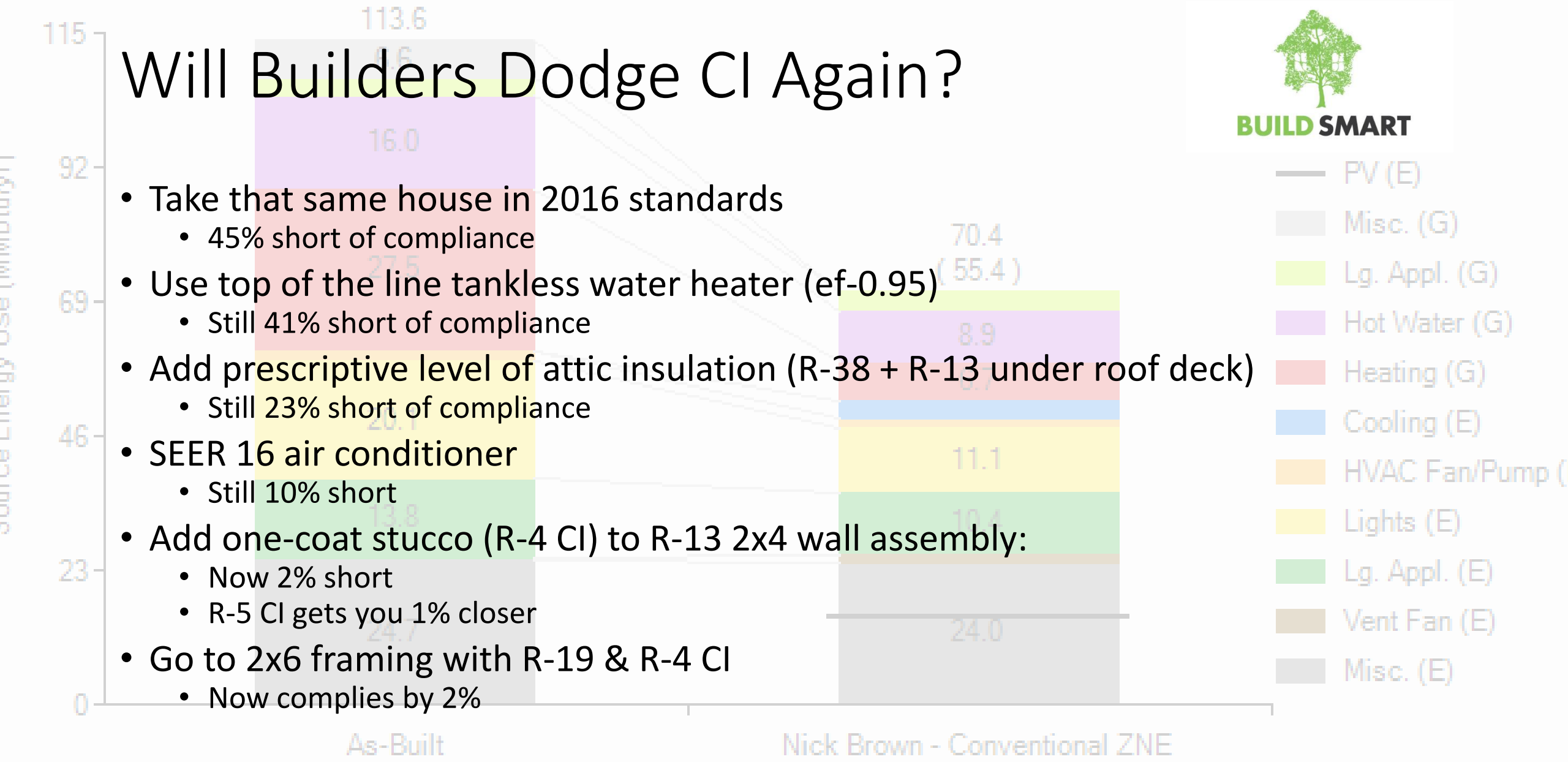
BUILD SMART

TABLE 150.1-A COMPONENT PACKAGE-A STANDARD BUILDING DESIGN (CONTINUED)

				Climate Zone															
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Building Envelope Insulation	Walls	Above Grade	Framed[4]	U 0.051	U 0.051	U 0.051	U 0.051	U 0.051	U 0.065	U 0.065	U 0.051	U 0.051	U 0.051	U 0.051	U 0.051	U 0.051	U 0.051	U 0.051	U 0.051
			Mass Wall Interior[5]	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.059 R 17
			Mass Wall Exterior[6]	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.1025 R 8.0	U 0.125 R 8.0	U 0.070 R 13
		Below Grade	Below Grade Interior[7]	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.066 R 15
			Below Grade Exterior[8]	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.100 R 10	U 0.100 R 10	U 0.053 R 19
	Floors	Slab Perimeter		NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	U 0.58 R 7.0
		Raised		U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19
		Concrete Raised		U 0.092 R 8.0	U 0.092 R 8.0	U 0.269 R 0	U 0.269 R 0	U0.269 R 0	U 0.269 R 0	U 0.269 R 0	U 0.269 R 0	U 0.269 R 0	U 0.269 R 0	U 0.092 R 8.0	U 0.138 R 4.0	U 0.092 R 8.0	U 0.092 R 8.0	U 0.138 R 4.0	U 0.092 R 8.0

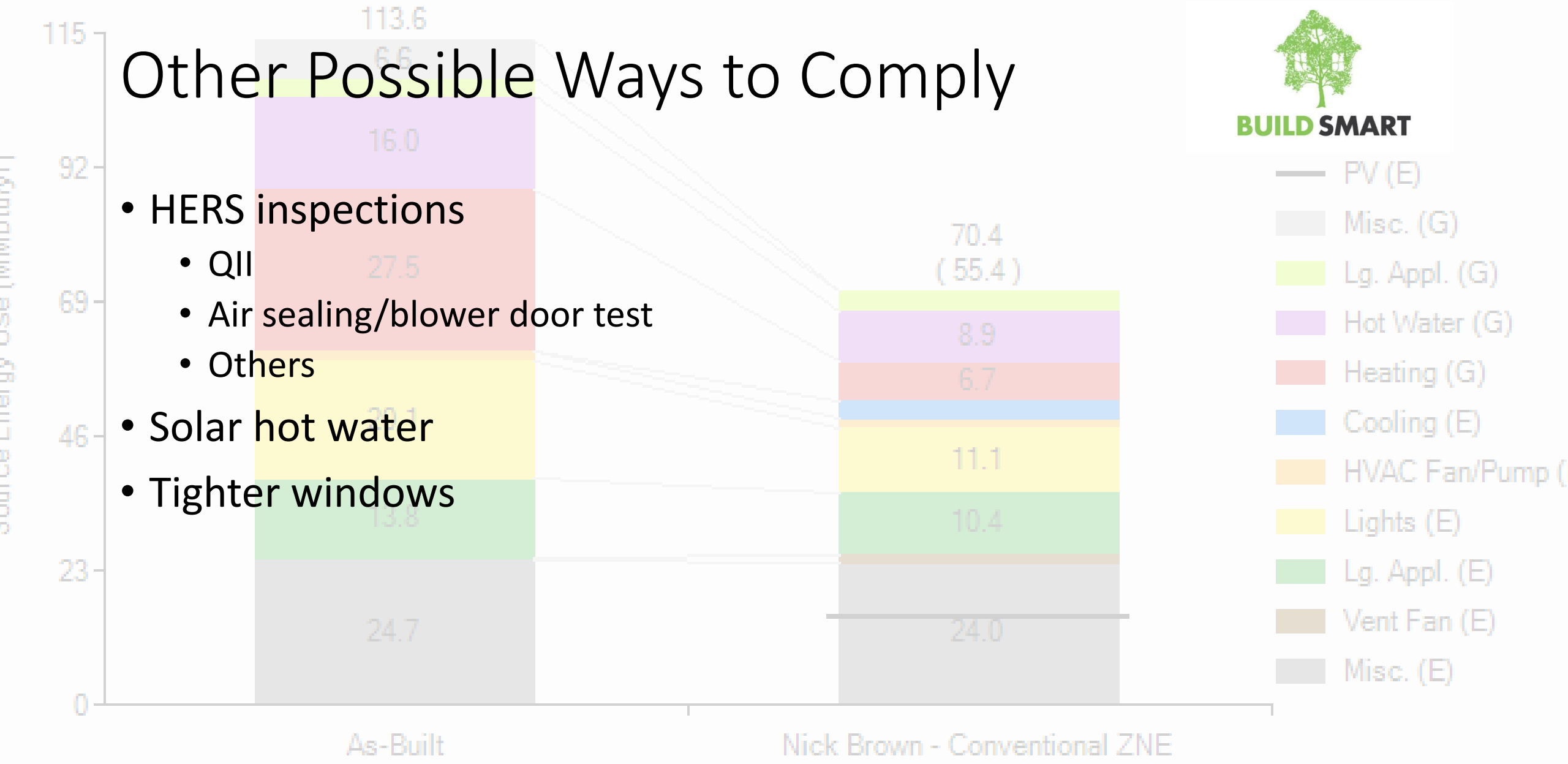
Will Builders Dodge CI Again?

- Take that same house in 2016 standards
  - 45% short of compliance
- Use top of the line tankless water heater (ef-0.95)
  - Still 41% short of compliance
- Add prescriptive level of attic insulation (R-38 + R-13 under roof deck)
  - Still 23% short of compliance
- SEER 16 air conditioner
  - Still 10% short
- Add one-coat stucco (R-4 CI) to R-13 2x4 wall assembly:
  - Now 2% short
  - R-5 CI gets you 1% closer
- Go to 2x6 framing with R-19 & R-4 CI
  - Now complies by 2%



Other Possible Ways to Comply

- HERS inspections
  - QII
  - Air sealing/blower door test
  - Others
- Solar hot water
- Tighter windows

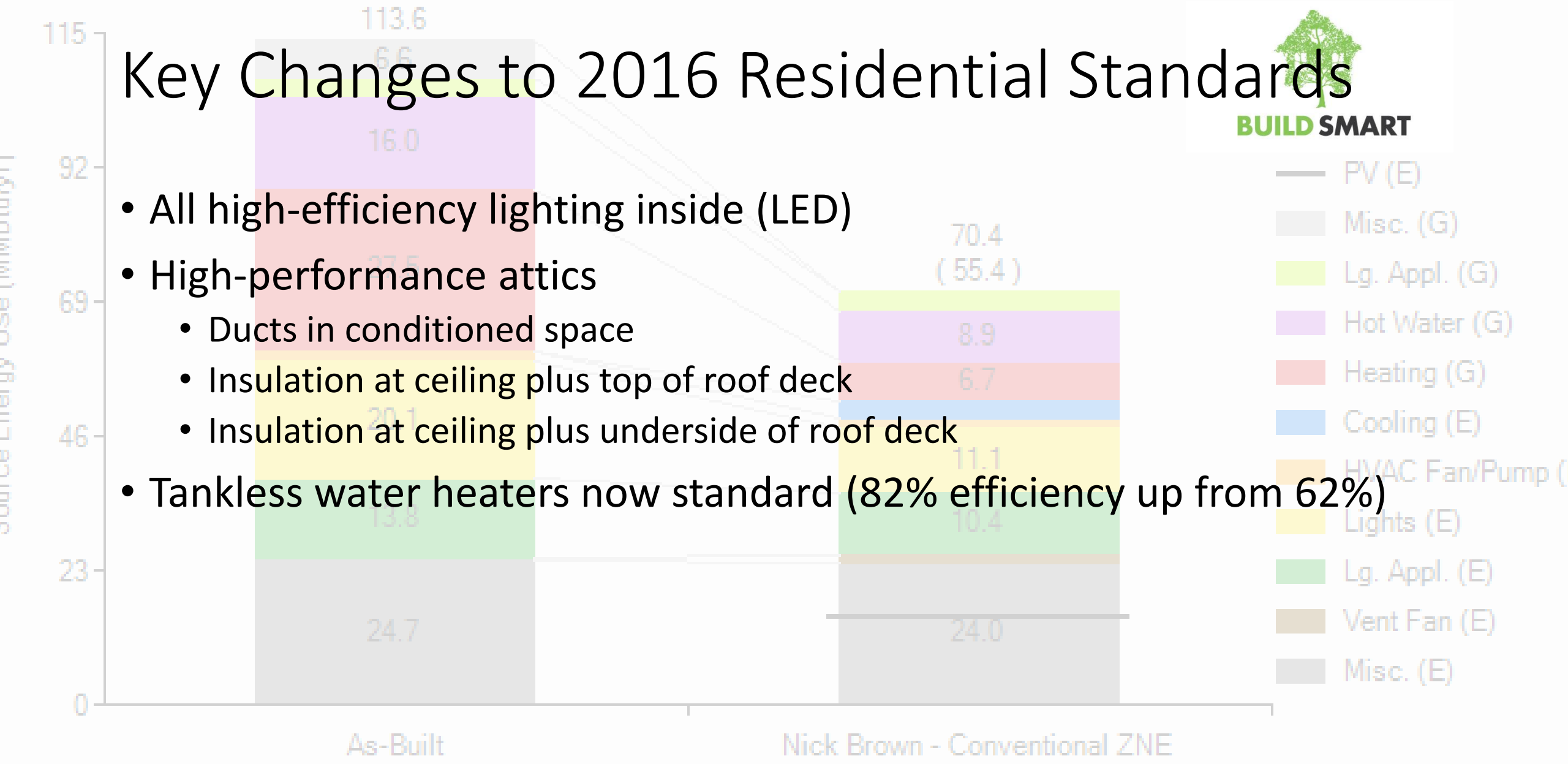


The Unpredictable PV Credit

- Concerns around HPW&HPA and industry readiness
- Negotiated PV credit
- Substitutes exactly for HPW&HPA
- Roughly 2kW PV system SFH (8 panels)
- Roughly 1 kW PV system MFU (4 panels)
- Cost ~ $5,000-$6,000 for 2 kW system
- Not available in Coastal SoCal (CZ 6&7)

Key Changes to 2016 Residential Standards

- All high-efficiency lighting inside (LED)
- High-performance attics
  - Ducts in conditioned space
  - Insulation at ceiling plus top of roof deck
  - Insulation at ceiling plus underside of roof deck
- Tankless water heaters now standard (82% efficiency up from 62%)



High Performance Attic Options

What about Additions & Alterations?

- Extensions of existing walls:
  - R-15 for 2x4 & R-19 for 2x6
- Additions > 1,000 sqft must have whole-building ventilation
- Various requirements around window sqft, HVAC systems and ductwork, roofing

What about High-Rise Residential Buildings?

BUILD SMART

Climate Zone	2013 High-Rise Residential	2016 High-Rise Residential
1,5,8 (Coastal)	.102	.059
3,6,7 (Coastal)	.110	.059
2,4,9,10,12,13 (Valleys)	.059	.059
15 (Socal deserts)	.042	.042
11,14,16 (Inland NoCal, Inland SoCal, Sierras)	.059	.042

Table 2: Wall U-factors for High-Rise (>3 stories) Residential Construction – wood framing

	2013 U & Assembly	2016 U & Assembly
CZ 6,7 LRR (Coast SoCal)	0.065: 2x4, R-13 + R-5 CI OR 2x4, R-15 + R-4 CI	same
All others LRR	0.065: 2x4, R-13 + R-5 CI OR 2x4, R-15 + R-4 CI	0.051: 2x6, R-19 + R-5 CI OR 2x6, R-21 + R-4 CI OR 2x4, R-15 + R-8 CI
CZ 1,3,5,6,7,8 HRR (Coastal)	0.102 or 0.110: 2x4, R-13	0.059: 2x6, R-19 + R-2 CI OR 2x4, R-15 + R-6 CI
CZ 11,14,15,16 HRR (Inland)	0.059 or 0.042: 2x6,R-19+R-2 CI	0.042: 2x6, R-19 + R-10 CI OR 2x6, R-21 + R-8 CI
CZ 2,4,9,10,12,13 HRR	0.059: 2x6, R-19 + R-2 CI	0.059 (no change)

High-rise Residential: 4 or more habitable stories

- Biggest change in Coastal CZs (1,3,4,5,6,7) from 0.1 (standard construction w/o CI) to 0.059
- Inland NoCal, Sierras, SoCal (CZs 11,14,16) also kicked up a notch
- Expect CI or 2x6 framing on all high-rises

What About Commercial Buildings?

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Type of Construction	Wall U-factor
Metal frame CZ 2,4,5,8-16	0.062
Metal frame CZ 1,6,7	0.069
Metal frame CZ 3	0.082
Wood frame CZ 15	0.042
Wood frame CZ 11	0.045
Wood frame CZ 2,4,9,10,12,13,14,16	0.059
Wood frame CZ 1	0.095
Wood frame CZ 5	0.102
Wood frame CZ 3	0.110

U-factor	Assembly that Complies
Metal 0.062	2x6, 24” o.c.,R-19+R-10 CI
Metal 0.069	2x8, 24” o.c., R-19+R-8 CI
Metal 0.082	2x4, 16” o.c., R-13+R-8 CI
Wood 0.042	2x6, 16” o.c., R-21+R-8 CI
Wood 0.045	2x6, 24” o.c., R-21+R-6 CI
Wood 0.059	2x6, 16” o.c., R-19+R-5 CI
Wood 0.095, 0.102, 0.110	2x4, 16” o.c., R-15+ no CI

Note that SIPS, masonry, and metal buildings may also be used and each have their own guidelines. Consult JA4.3 for U-factors of wall assemblies

Commercial Soffits

Soffit Insulation Requirements: Nonresidential non-mass w/ metal framing

Climate Zones	U-factor	Assembly
2,11,14,15,16	0.039	2x8, R-19 + R-14 CI
1	0.048	2x10,R-30+R-8 CI
2-10,12,13	0.071	2x12, R-38 or 2x6, R-19+R-4 CI

Soffit Insulation Requirements: High-rise Residential: non-mass w/ wood framing

Climate Zones	U-factor	Assembly
2,14,16	0.034	2x10, R-30
3,4,5,6,8,9,10,11, 12,13,15	0.039	2x10, R-25
7	0.071	2x6, R-11

Soffit Insulation Requirements: Nonresidential mass

Climate Zones	U-factor	Assembly
16	0.058	Concrete + R-15 CI
1,2,11,12,13,14, 15	0.092	Concrete + R-8 CI
3-10	0.269	Concrete

Soffit Insulation Requirements: High-rise Residential mass

Climate Zones	U-factor	Assembly
16	0.037	Concrete + R-25 CI
1,2,14	0.045	Concrete + R-20 CI
3,4,5,11,12,13,15	0.058	Concrete + R-15 CI
6,10	0.069	Concrete + R-12 CI
7,8,9	0.092	Concrete + R-8 CI

Commercial Energy Modeling

Buildings are modeled like homes, with tradeoffs between envelope, indoor lighting, mechanical, and hot water.

- Indoor Lighting far more complicated w/ daylighting requirements
- Mechanical systems typically more complex
- Outdoor lighting & sign lighting separate forms

- Expect energy consultant to have to re-run his models after VE'ing any part of the envelope
  - Must make changes prior to approval of plans by the City or resubmit energy model to the City

Predictions for 2016 Residential Walls

- Mix of 2x6 w/ 3-coat and 2x4 w/ 1-coat and PV credit
- Value proposition of $5k-$6k PV array is stronger than 2x6 w/ 1-coat
- If our industry can make 1-coat affordable to the builder, then we can be the hero of this code cycle
  - Help builders avoid $5k-$6k add to costs for solar PV or
  - Help builders avoid cost of 2x6 framing
  - Still need to be water-tight, flat and true, with clean aesthetics, texture, and color
  - Training needed for the workforce?

Nonresidential Air Sealing Requirement

- Air barrier must be continuous and sealed at all joints for its entire length.
- CZ 10-16 only
- 3 options:
  - Material has leakage < 0.04 cfm/ft2 (ASTM E-2178 test)
    - Plywood, OSB, foam board, spray foam, gypsum board, Portland cement @ 5/8” thick, metal sheets all on approved list
  - Assembly has average air leakage < 0.04 cfm/ft2 (ASTM E-2357,E-1677,E-1680/E-283 tests)
  - Building tests after construction to < 0.04 cfm/ft2

Approved Air Barriers

TABLE 140.3-A *MATERIALS DEEMED TO COMPLY WITH SECTION 140.3(a)9A*

	MATERIALS AND THICKNESS		MATERIALS AND THICKNESS
1	Plywood – min. 3/8 inches thickness	9	Built up roofing membrane
2	Oriented strand board – min. 3/8 inches thickness	10	Modified bituminous roof membrane
3	Extruded polystyrene insulation board – min. ½ inches thickness	11	Fully adhered single-ply roof membrane
4	Foil-back polyisocyanurate insulation board – min. ½ inches thickness	12	A Portland cement or Portland sand parge, or a gypsum plaster, each with min. 5/8 inches thickness
5	Closed cell spray foam with a minimum density of 2.0 pcf and a min. 2.0 inches thickness	13	Cast-in-place concrete, or precast concrete
6	Open cell spray foam with a density no less than 0.4 pcf and no greater than 1.5 pcf, and a min. 5½ inches thickness	14	Fully grouted concrete block masonry
7	Exterior or interior gypsum board min. 1/2 inches thickness	15	Sheet steel or sheet aluminum
8	Cement board – min. 1/2 inches thickness	---	----------

Fire & Over 4 Stories

IBC added NFPA-285 test requirement in 2012 to include WRBs. Previously WRBs were not considered.

- Foam insulation and nearly all WRBs are combustible
- Combustible materials require NFPA-285 fire test of entire assembly
  - Only if >40’ high and Type I,II,III, or IV construction
  - Each assembly must be tested if anything combustible
  - Exception 1: if WRB is only combustible part of assy w/ non-combustible outer layer (3-coat Stucco)
  - Exception 2: windows, doors, and their flashings
  - Exception 3: if WRB is only combustible item in the assembly and it passes ASTM E-84 & E-1354
- Judgment letter from engineer may also be considered in place of test
  - Must be clear substitution of less risky material in already tested assembly

Looking Ahead to 2020

- Expect another 20% more stringent code
- Expect PV credit to disappear, forcing HPW&HPA
- Expect peak shifting to earn credits (batteries, off-peak appliance scheduling)
- Expect time-of-use electric rates & net metering to be debated

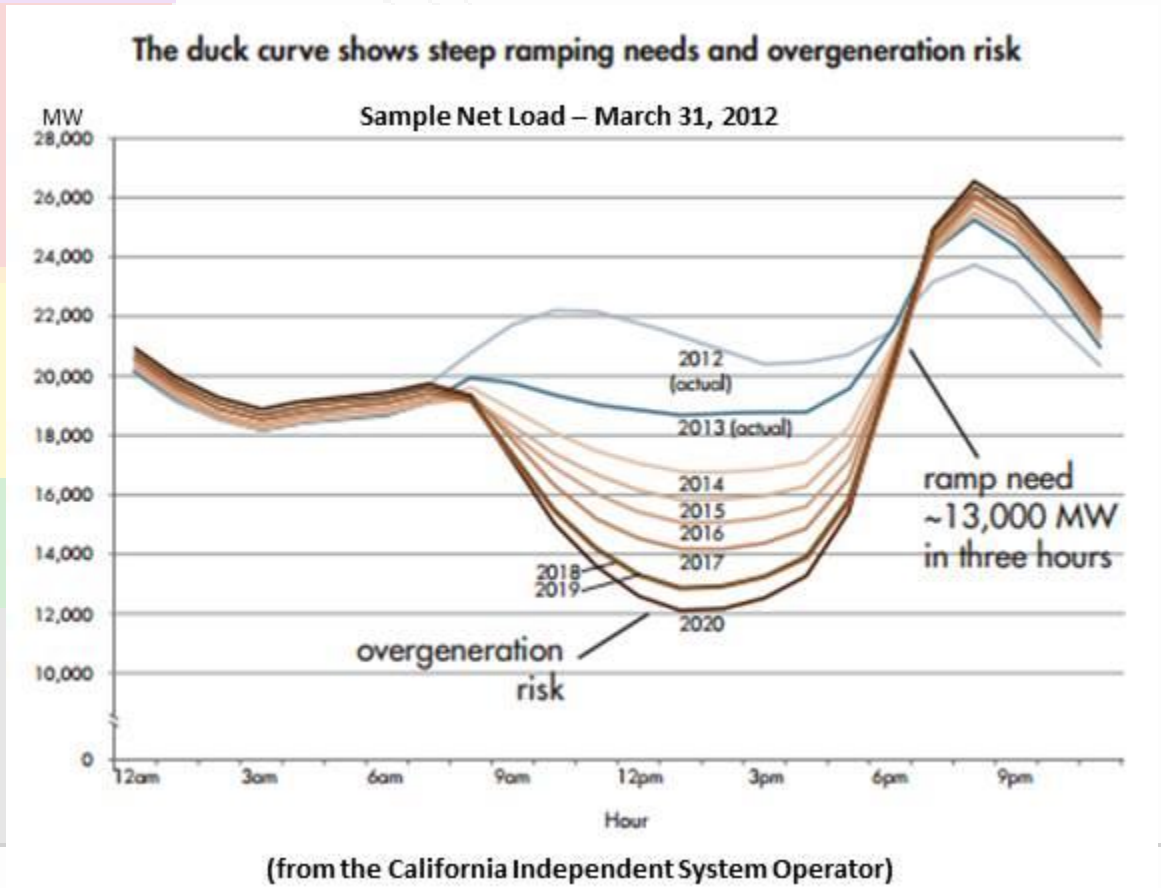
BUILD SMART

2020 RESIDENTIAL ZNE

Duck Curve

- Biggest deal in energy since the air conditioner
- Limits use of renewables like solar and wind
- Big opportunity for technologies that reduce late-afternoon & early-evening summer energy use
  - And for ways to use mid-day solar peak energy
- Batteries are logical solution, but costly with issues
- What happens when electric vehicles are plugging in after work?

Duck Curve



(from the California Independent System Operator)