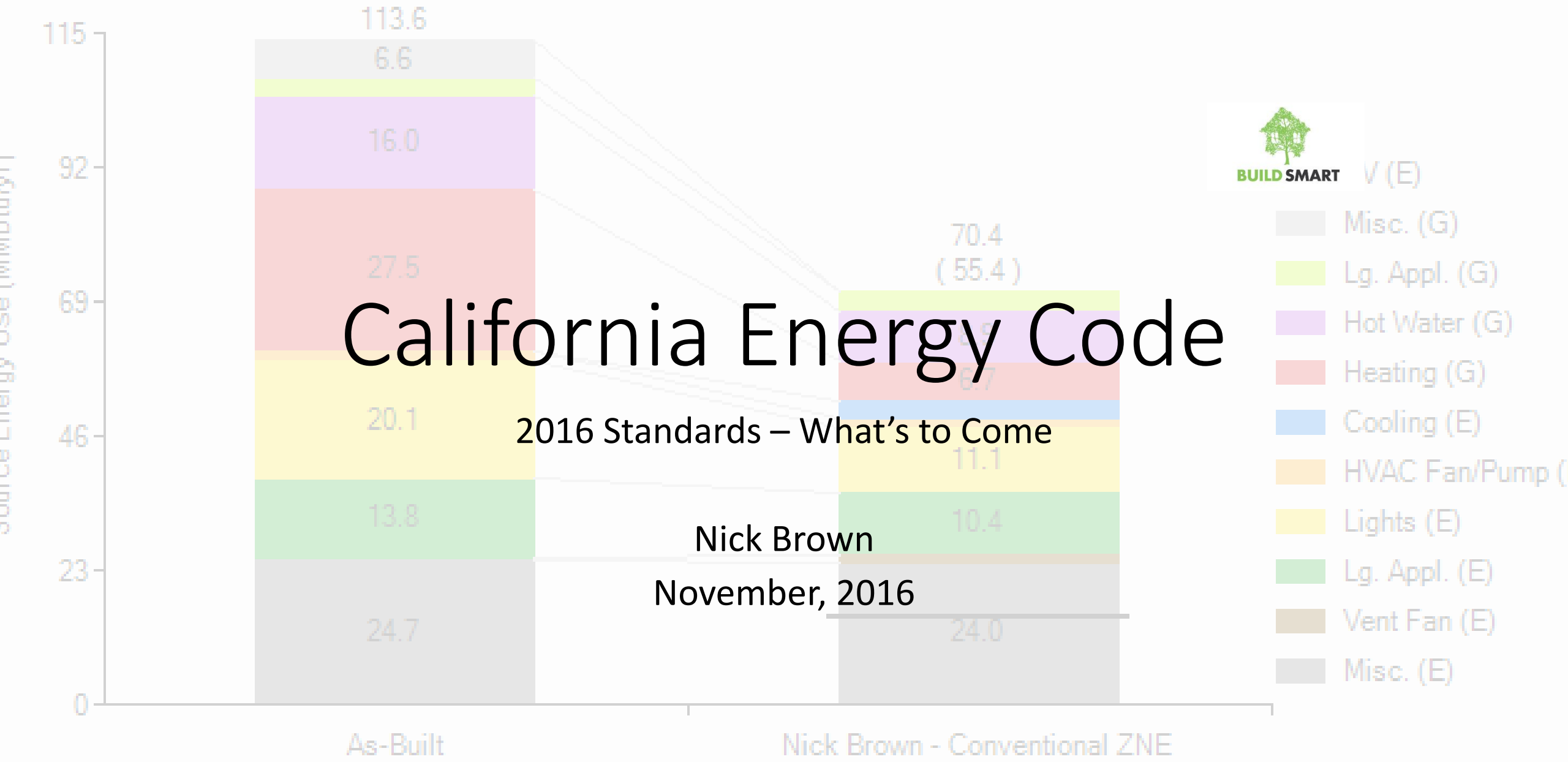
California Energy Code

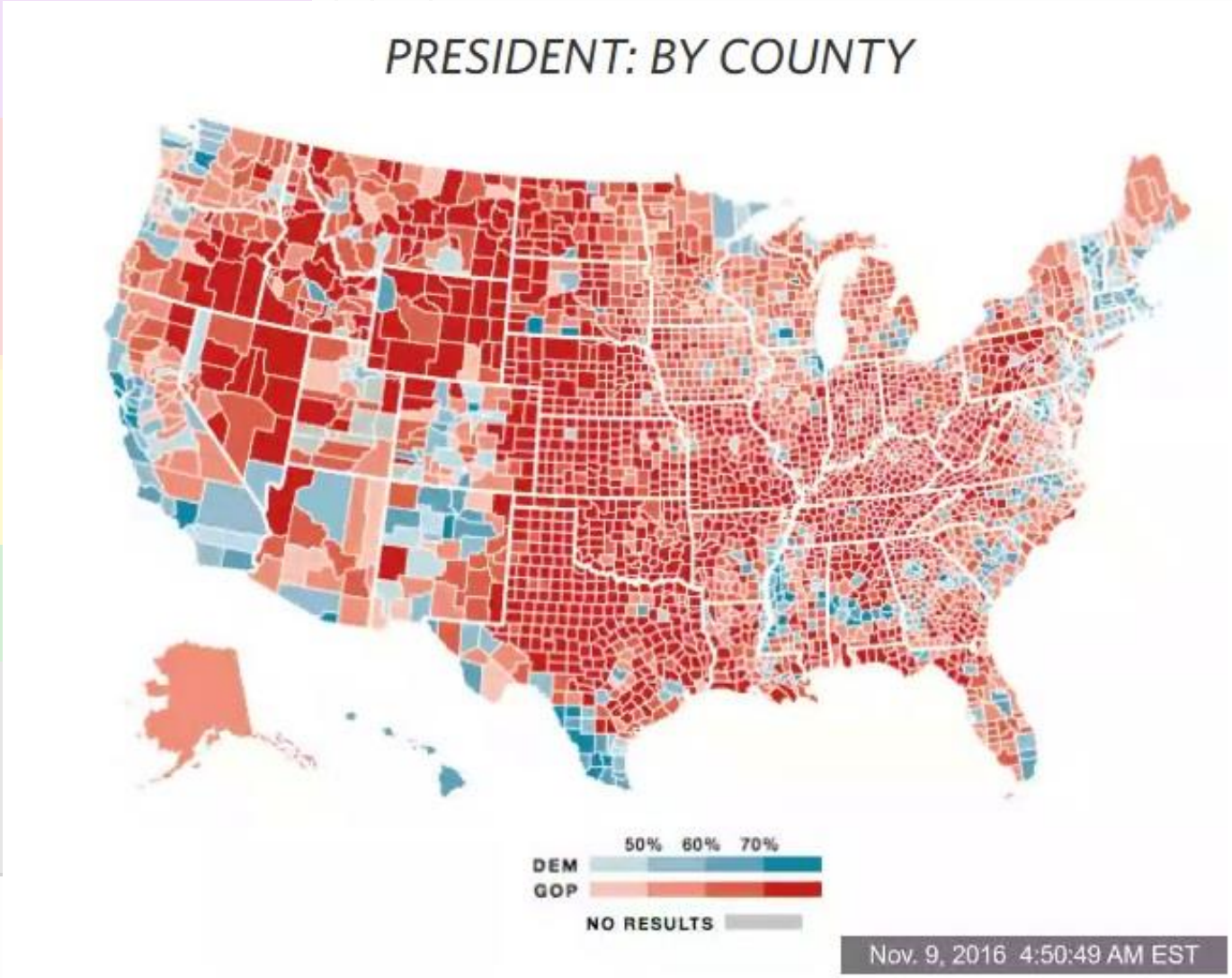
2016 Standards – What's to Come

Nick Brown

November, 2016



But First …



BUILD SMART

PV (E)
Misc. (G)
Lg. Appl. (G)
Hot Water (G)
Heating (G)
Cooling (E)
HVAC Fan/Pump (
Lights (E)
Lg. Appl. (E)
Vent Fan (E)
Misc. (E)

Title 24 Energy Code

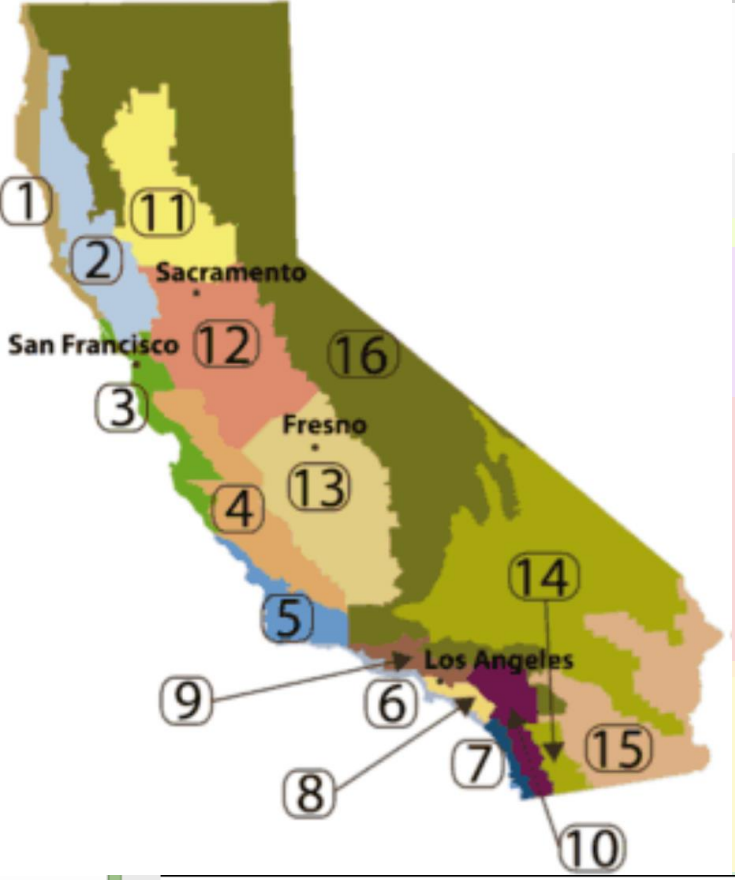
- Every 3 years, California Energy Commission issues new set of requirements
- Typically 20-25% reduction in energy use from prior code cycle
- Separate code for Residential, High-rise Residential, Commercial, and Remodeling
- 2016 standards go into effect January 1, 2017

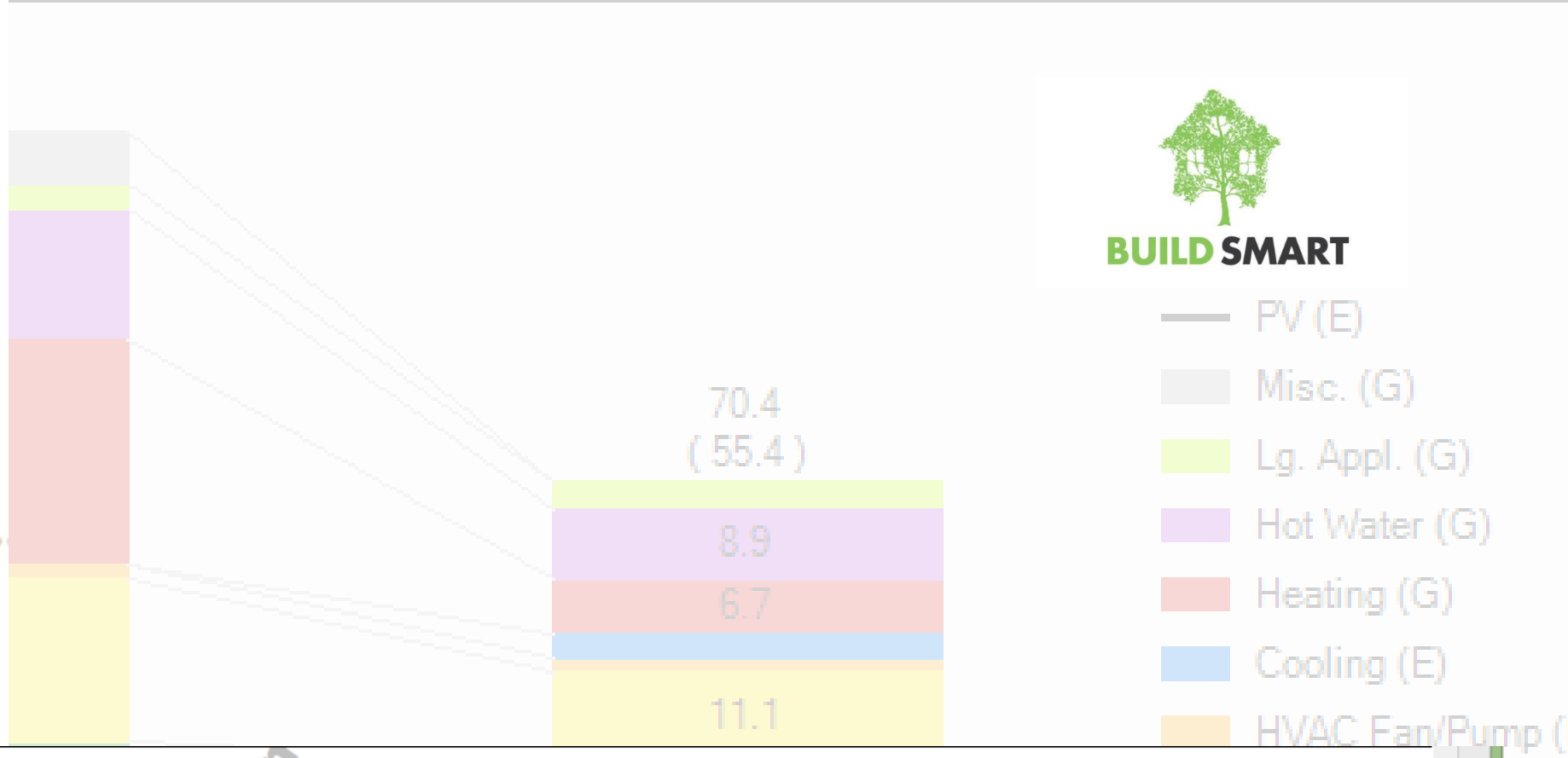
What Happened Last Time?

- 2013 standards started July, 2014
- Made R-13+R-5 CI standard 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





BUILD SMART

ENERGY USE SUMMARY

04	05	06	07	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	13.91	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

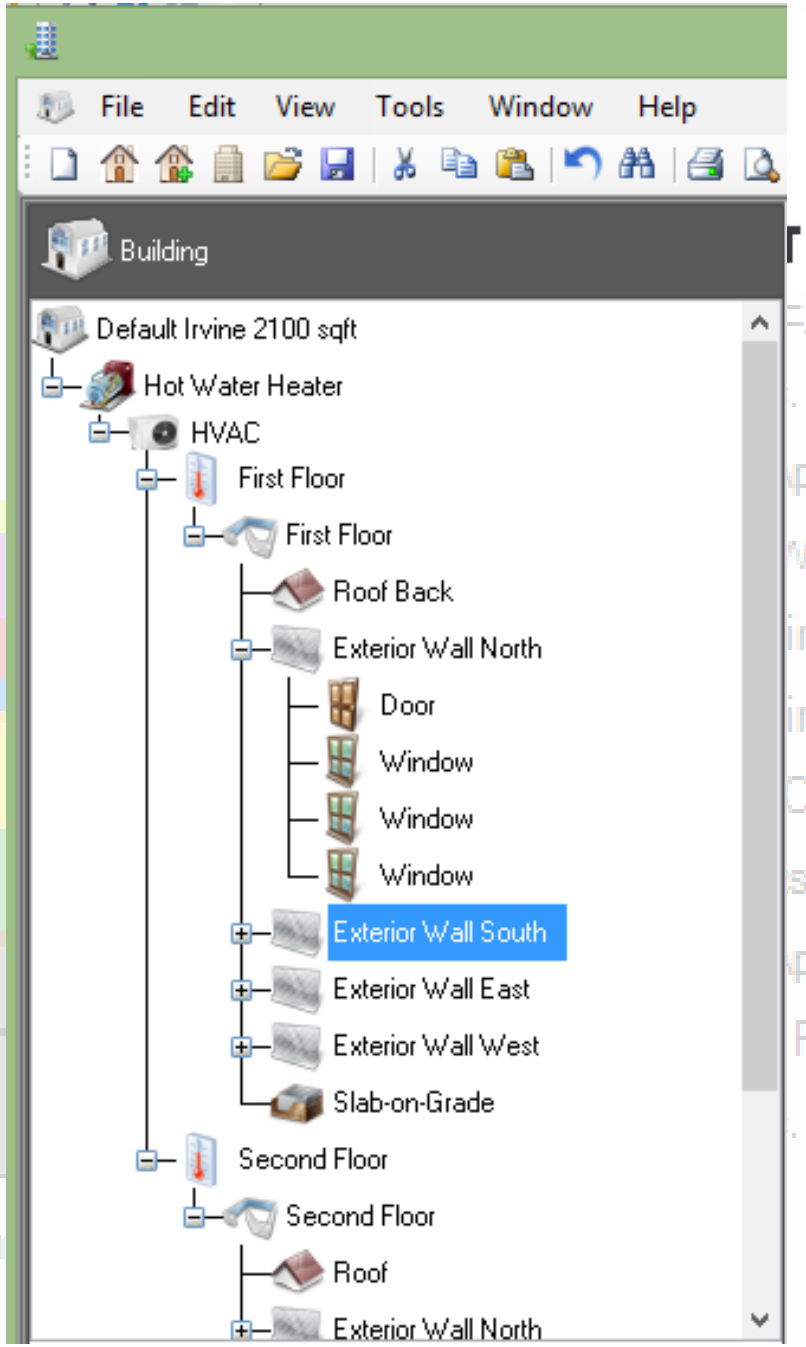
- Bids for CI one-coat were 5-10% above 3-coat
- Expressed concern to builders around waterproofing, straight walls, skills of labor force
- Builders chose other upgrades instead of CI stucco
- Our industry has ultimate liability for water resistance, structural integrity, and aesthetics

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

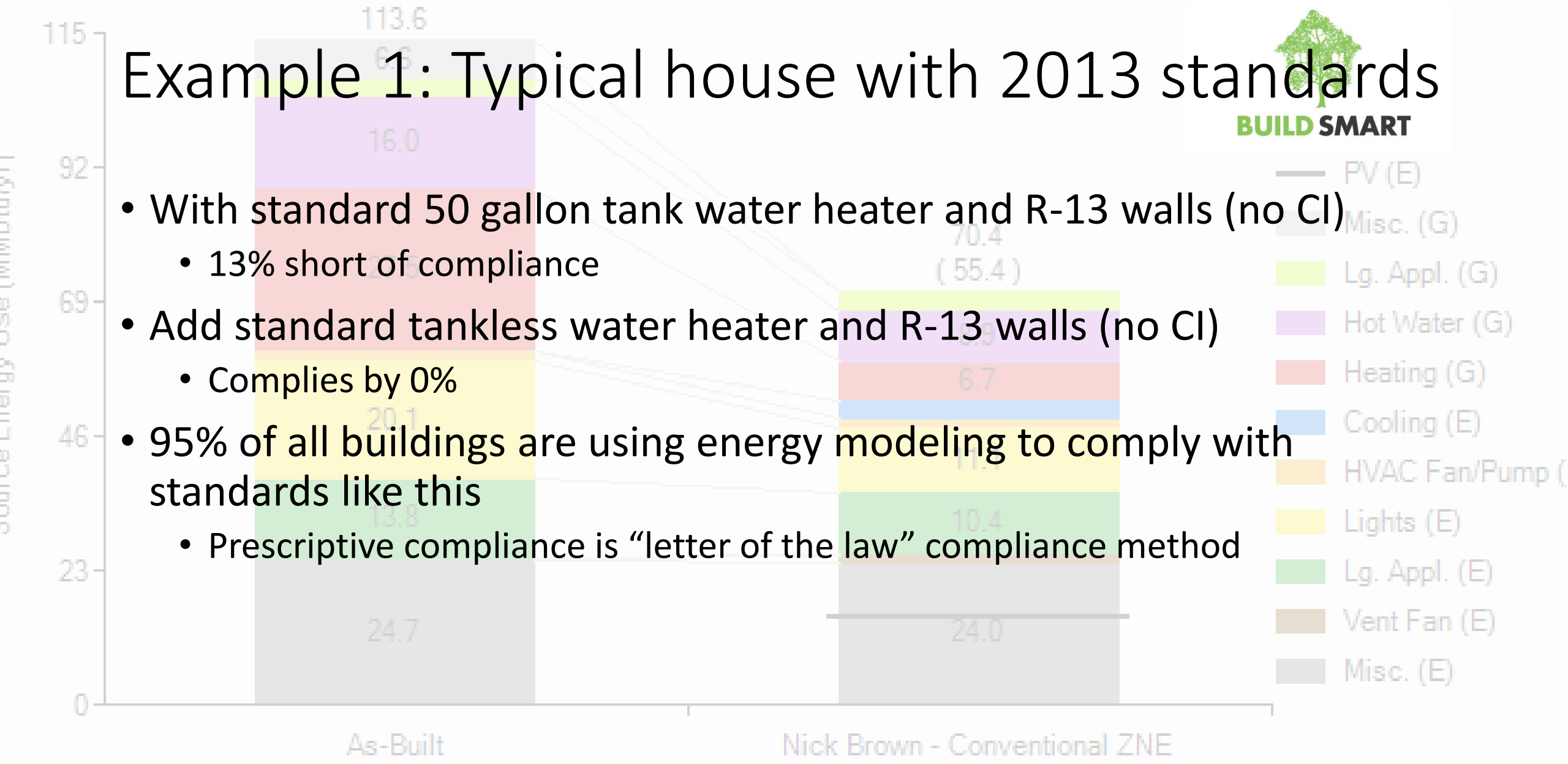
Here's How it Works

- Energy consultant builds model
- Software spits out energy usage compared to standard home
- 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



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Photovoltaic Offset	----	0.00	0.00	----
Compliance Energy Total	**32.05**	**36.18**	**-4.13**	**-12.9%**

ENERGY USE SUMMARY				
04	05	06	07	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	13.91	18.58	-4.67	-33.6%
IAQ Ventilation	1.58	1.58	0.00	0.0%
Water Heating	12.97	8.47	4.50	34.7%
Photovoltaic Offset	----	0.00	0.00	----
Compliance Energy Total	**32.05**	**32.38**	**-0.33**	**-1.0%**

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

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				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)

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			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
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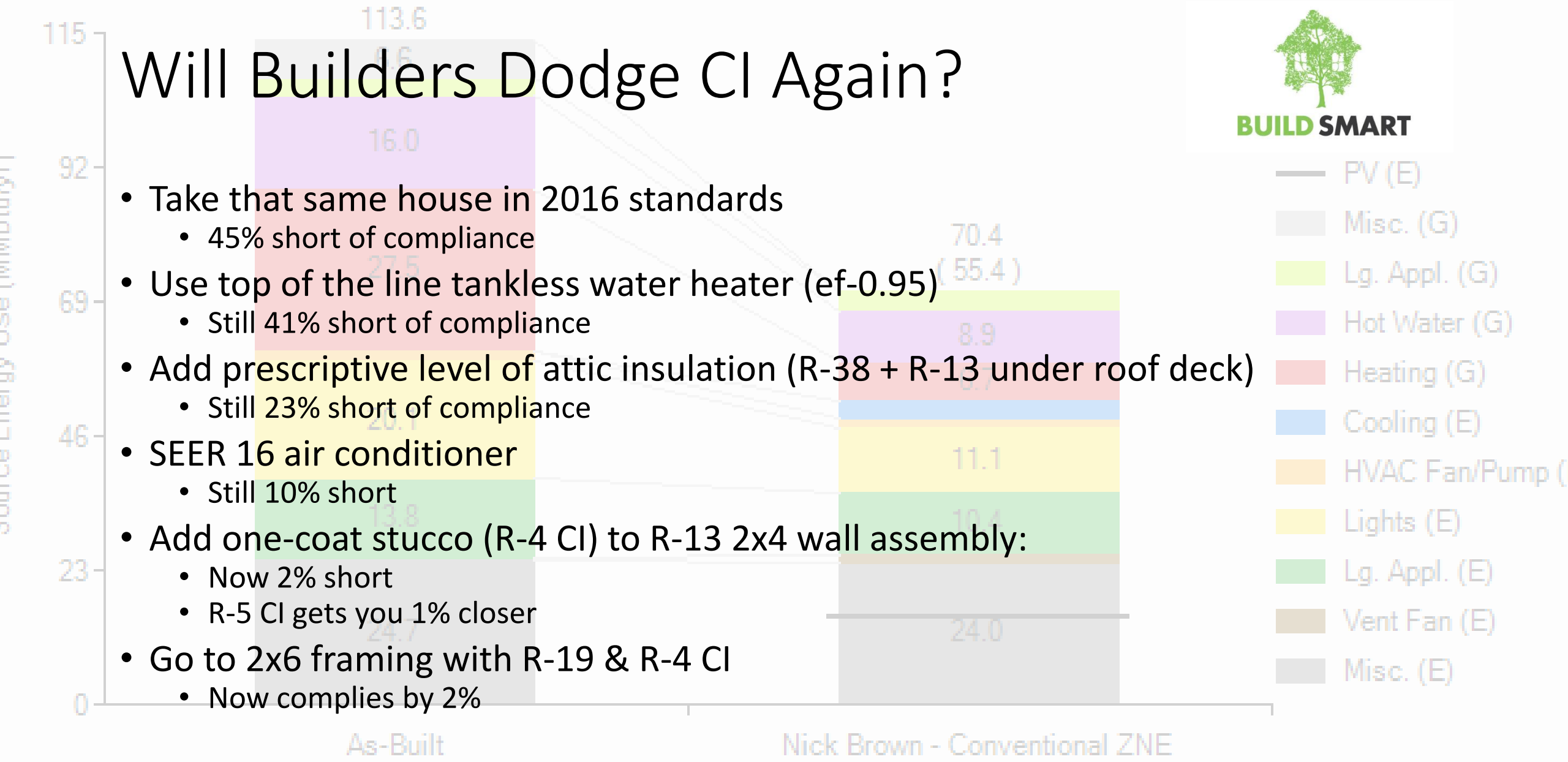
		Below Grade	Below Grade Interior[7]	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.070 R 13	U 0.066 R 15
			Below Grade Exterior[8]	U 0.200 R 5.0	U 0.200 R 5.0	U 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%



ENERGY USE SUMMARY

04	05	06	07	08
Energy Use (kTDV/ft^2-yr)	Standard Design	Proposed Design	Compliance Margin	Percent Improvement
Space Heating	2.44	3.91	-1.47	-60.2%
Space Cooling	12.08	23.00	-10.92	-90.4%
IAQ Ventilation	1.63	1.63	0.00	0.0%
Water Heating	10.30	9.90	0.40	3.9%
Photovoltaic Offset	----	0.00	0.00	----
Compliance Energy Total	**26.45**	**38.44**	**-11.99**	**-45.3%**

ENERGY USE SUMMARY

04	05	06	07	08
Energy Use (kTDV/ft^2-yr)	Standard Design	Proposed Design	Compliance Margin	Percent Improvement
Space Heating	2.44	3.91	-1.47	-60.2%
Space Cooling	12.08	23.00	-10.92	-90.4%
IAQ Ventilation	1.63	1.63	0.00	0.0%
Water Heating	10.30	8.76	1.54	15.0%
Photovoltaic Offset	----	0.00	0.00	----
Compliance Energy Total	**26.45**	**37.30**	**-10.85**	**-41.0%**

ENERGY USE SUMMARY

04	05	06	07	08
Energy Use (kTDV/ft^2-yr)	Standard Design	Proposed Design	Compliance Margin	Percent Improvement
Space Heating	2.44	3.44	-1.00	-41.0%
Space Cooling	12.09	18.70	-6.61	-54.7%
IAQ Ventilation	1.63	1.63	0.00	0.0%
Water Heating	10.30	8.76	1.54	15.0%
Photovoltaic Offset	----	0.00	0.00	----

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04	05	06	07	08
Energy Use (kTDV/ft^2-yr)	Standard Design	Proposed Design	Compliance Margin	Percent Improvement
Space Heating	2.44	3.44	-1.00	-41.0%
Space Cooling	12.09	15.24	-3.15	-26.1%
IAQ Ventilation	1.63	1.63	0.00	0.0%
Water Heating	10.30	8.76	1.54	15.0%
Photovoltaic Offset	----	0.00	0.00	----
Compliance Energy Total	**26.46**	**29.07**	**-2.61**	**-9.9%**

ENERGY USE SUMMARY				
04	05	06	07	08
Energy Use (kTDV/ft^2-yr)	Standard Design	Proposed Design	Compliance Margin	Percent Improvement
Space Heating	2.44	2.30	0.14	5.7%
Space Cooling	12.09	14.17	-2.08	-17.2%
IAQ Ventilation	1.63	1.63	0.00	0.0%
Water Heating	10.30	8.76	1.54	15.0%
Photovoltaic Offset	----	0.00	0.00	----
Compliance Energy Total	**26.46**	**26.86**	**-0.40**	**-1.5%**

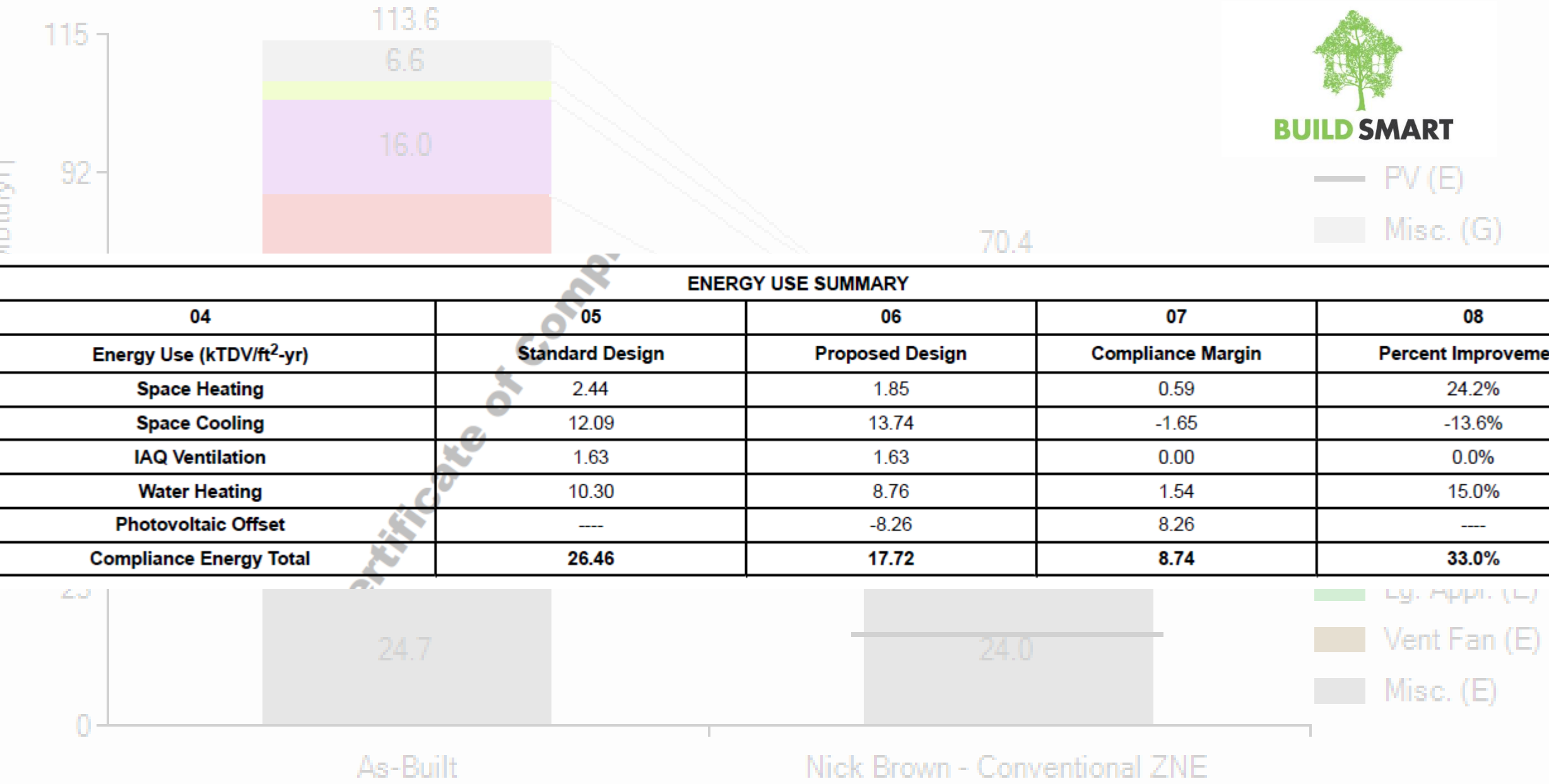
ENERGY USE SUMMARY				
04	05	06	07	08
Energy Use (kTDV/ft^2-yr)	Standard Design	Proposed Design	Compliance Margin	Percent Improvement
Space Heating	2.44	1.85	0.59	24.2%
Space Cooling	12.09	13.74	-1.65	-13.6%
IAQ Ventilation	1.63	1.63	0.00	0.0%
Water Heating	10.30	8.76	1.54	15.0%
Photovoltaic Offset	----	0.00	0.00	----
Compliance Energy Total	**26.46**	**25.98**	**0.48**	**1.8%**

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 (8 panels)
- Cost ~ $5,000-$6,000
- Not available in Coastal SoCal (CZ 6&7)



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ENERGY USE SUMMARY

04	05	06	07	08
Energy Use (kTDV/ft^2-yr)	**Standard Design**	**Proposed Design**	**Compliance Margin**	**Percent Improvement**
Space Heating	2.44	1.85	0.59	24.2%
Space Cooling	12.09	13.74	-1.65	-13.6%
IAQ Ventilation	1.63	1.63	0.00	0.0%
Water Heating	10.30	8.76	1.54	15.0%
Photovoltaic Offset	----	-8.26	8.26	----
Compliance Energy Total	**26.46**	**17.72**	**8.74**	**33.0%**

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?

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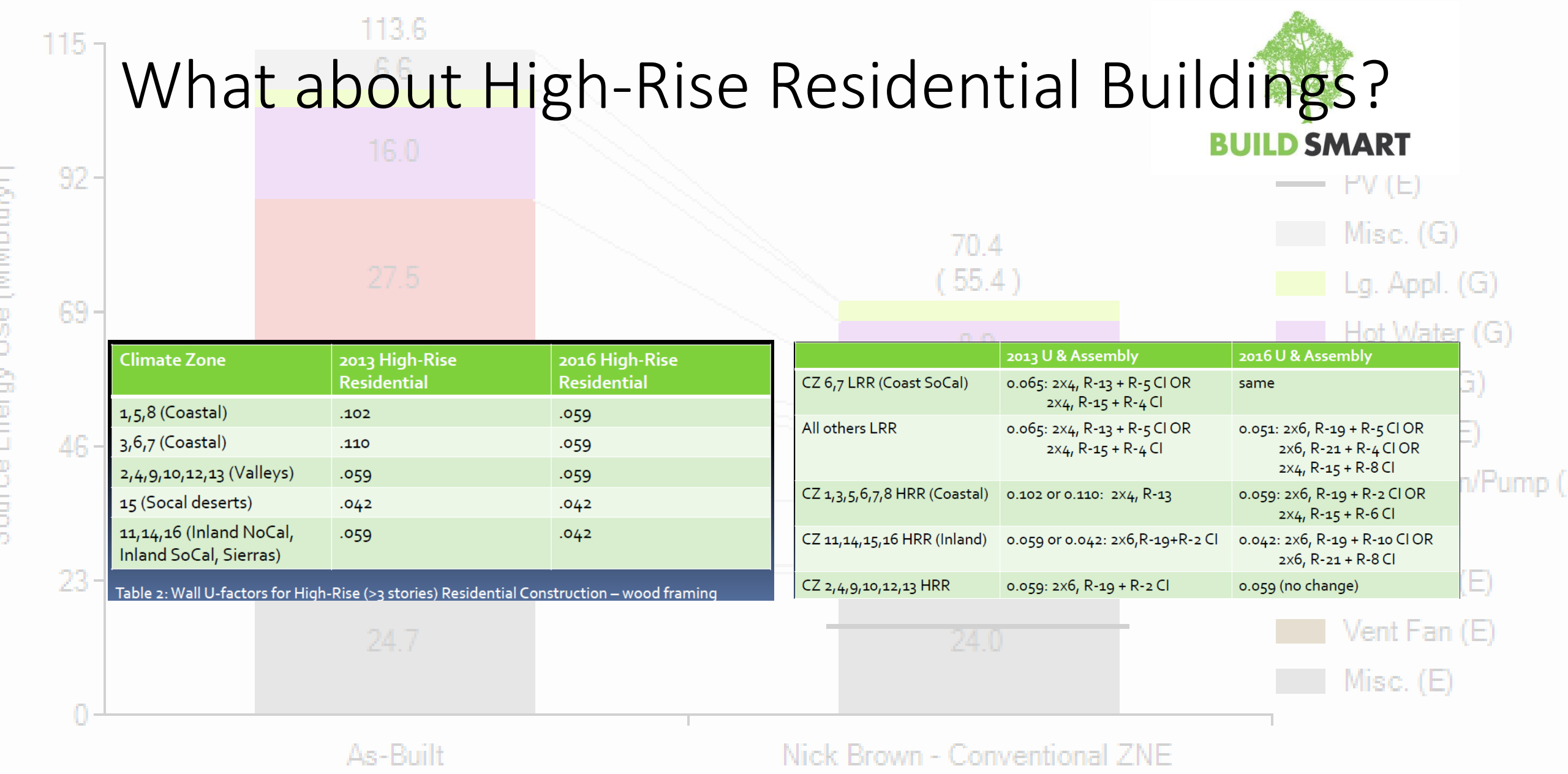

Climate Zone	2013 High-Rise Residential	2016 High-Rise Residential
1,5,8 (Coastal)	.102	.059
3,6,7 (Coastal)	.110	.059
2,4,9,10,12,13 (Valleys)	.059	.059
15 (Socal deserts)	.042	.042
11,14,16 (Inland NoCal, Inland SoCal, Sierras)	.059	.042

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)

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

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?

3-coat plaster over CI foam

- It’s coming in 2016 CBC/CRC effective January 1, 2017
- Also in 2015 IBC/IRC, which will gradually be adopted in other states
- Provides for direct/furred application of lath and plaster over foam board
- Thickness up to 4”
- Now 3 options for CI stucco: EIFS, One-coat, and Three-coat

TABLE R703.15.1
CLADDING MINIMUM FASTENING REQUIREMENTS FOR DIRECT ATTACHMENT OVER FOAM PLASTIC SHEATHING TO SUPPORT CLADDING WEIGHT[a]

CLADDING FASTENER THROUGH FOAD SHEATHING	CLADDING FASTENER TYPE AND MINIMUM SIZE[b]	CLADDING FASTENER VERTICAL SPACING (inches)	MAXIMUM THICKNESS OF FOAM SHEATHING[c] (inches)					
			16″ o.c. Fastener Horizontal Spacing			24″ o.c. Fastener Horizontal Spacing		
			Cladding Weight:			Cladding Weight:		
			3 psf	11 psf	25 psf	3 psf	11 psf	25 psf
Wood Framing (minimum $1^1/_4$-inch penetration)	0.113″ diameter nail	6	2	1	DR	2	0.75	DR
		8	2	1	DR	2	0.5	DR
		12	2	0.5	DR	2	DR	DR
	0.120″ diameter nail	6	3	1.5	0.5	3	0.75	DR
		8	3	1	DR	3	0.5	DR
		12	3	0.5	DR	2	DR	DR
	0.131″ diameter nail	6	4	2	0.75	4	1	DR
		8	4	1.5	0.5	4	0.75	DR
		12	4	0.75	DR	2	0.5	DR
	0.162″ diameter nail	6	4	4	1.5	4	2	1
		8	4	3	1	4	1.5	0.75
		12	4	2	0.75	4	1	DR

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 0.0479 kPa, 1 pound per square inch = 6.895 kPa.

DR = Design required.

o.c. = on center

a. Wood framing shall be Spruce-pine-fir or any wood species with a specific gravity of 0.42 or greater in accordance with AWC NDS.

b. Nail fasteners shall comply with ASTM F1667, except nail length shall be permitted to exceed ASTM F1667 standard lengths.

c. Foam sheathing shall have a minimum compressive strength of 15 psi in accordance with ASTM C578 or ASTM C1289.

Looking Ahead to 2020

- Expect another 20% more stringent code
- Expect PV credit to disappear, forcing HPW&HPA
- Define Net-zero for me!
  - ZNE or ZNE ready or TDV ZNE
- Bottom line in 2020:
  - 20% Lower load for buildings
  - Solar requirement TBD

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2020 RESIDENTIAL ZNE