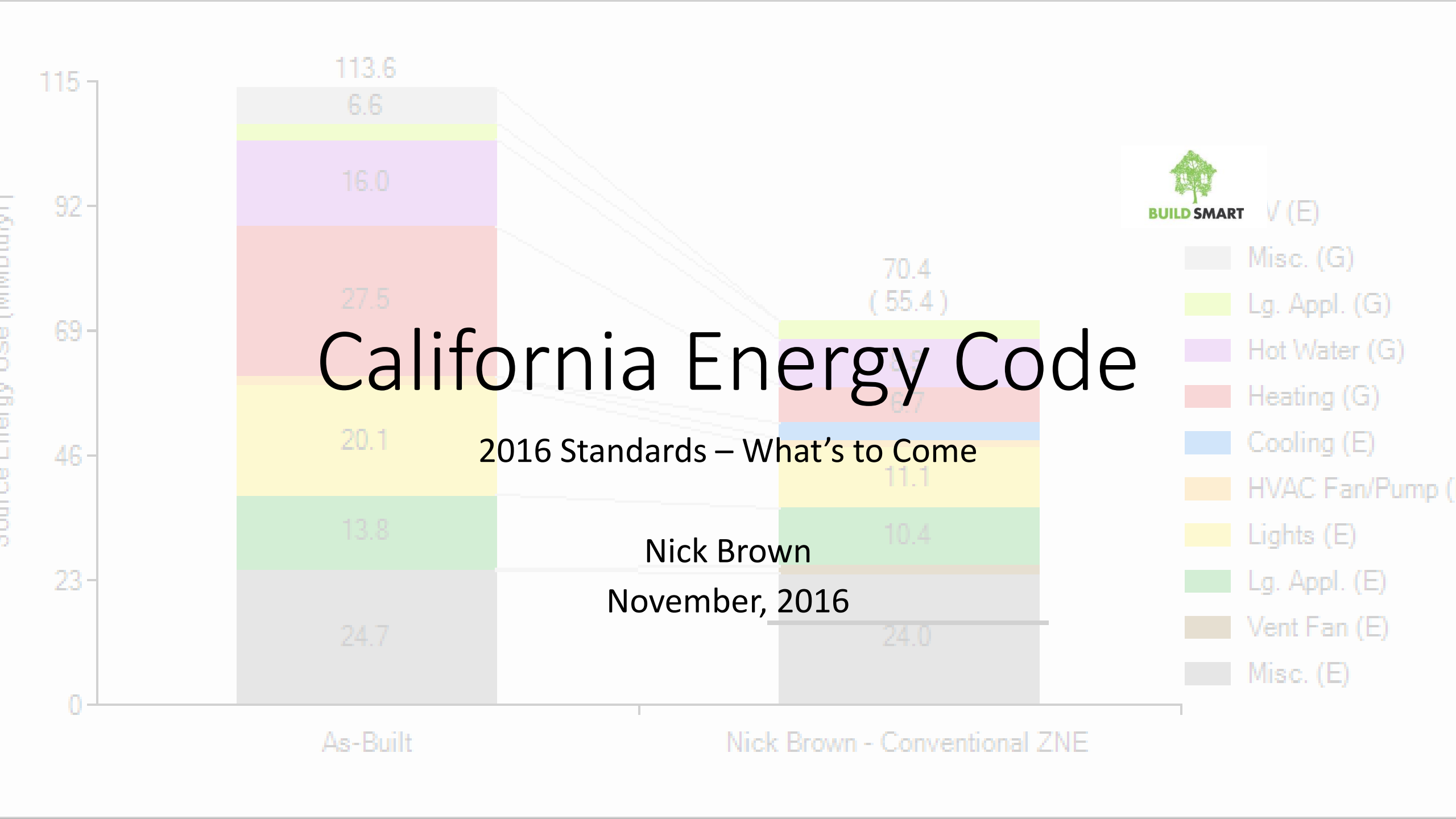


California Energy Code

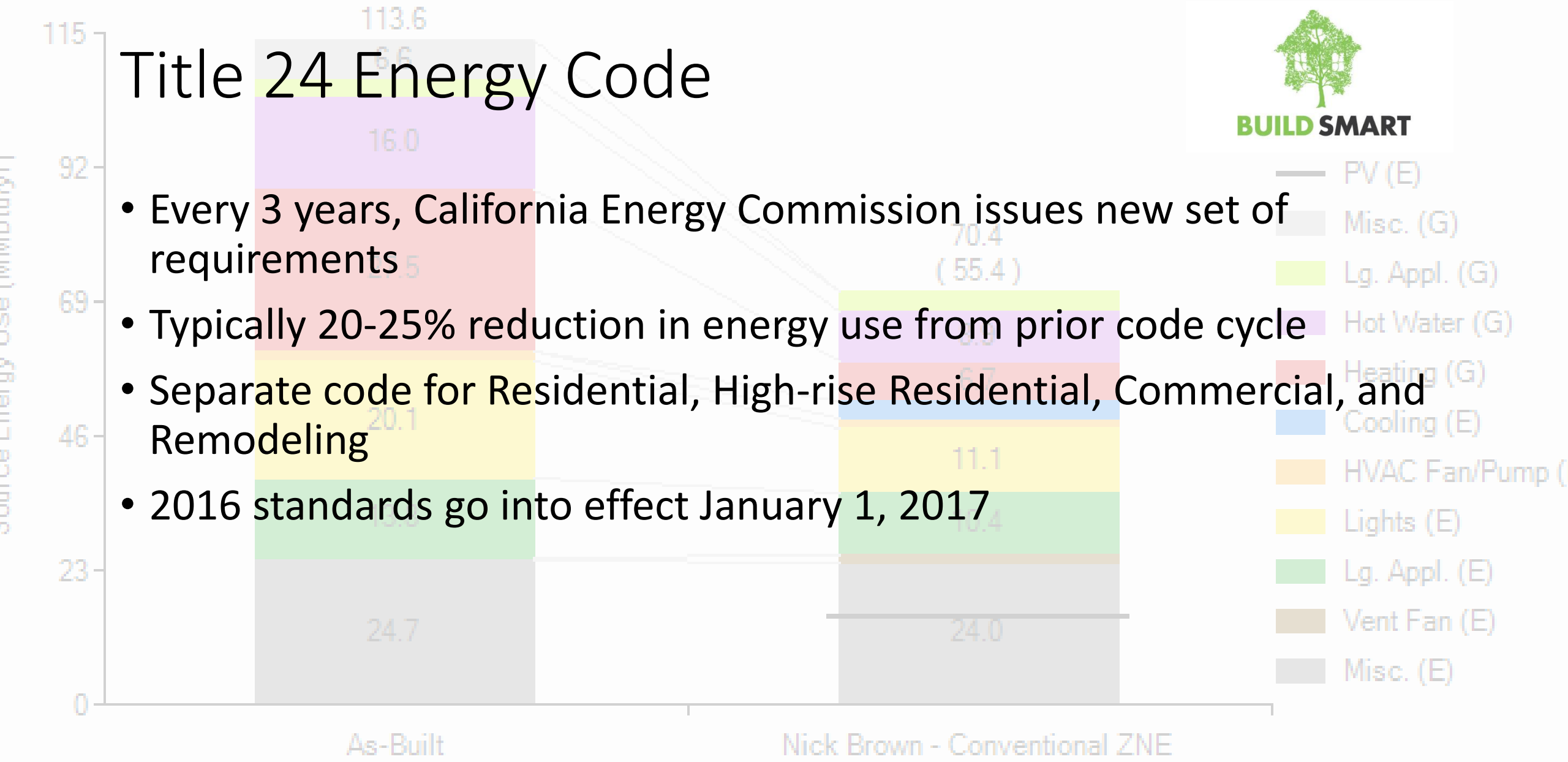
2016 Standards – What's to Come

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,

ENERGY USE SUMMARY

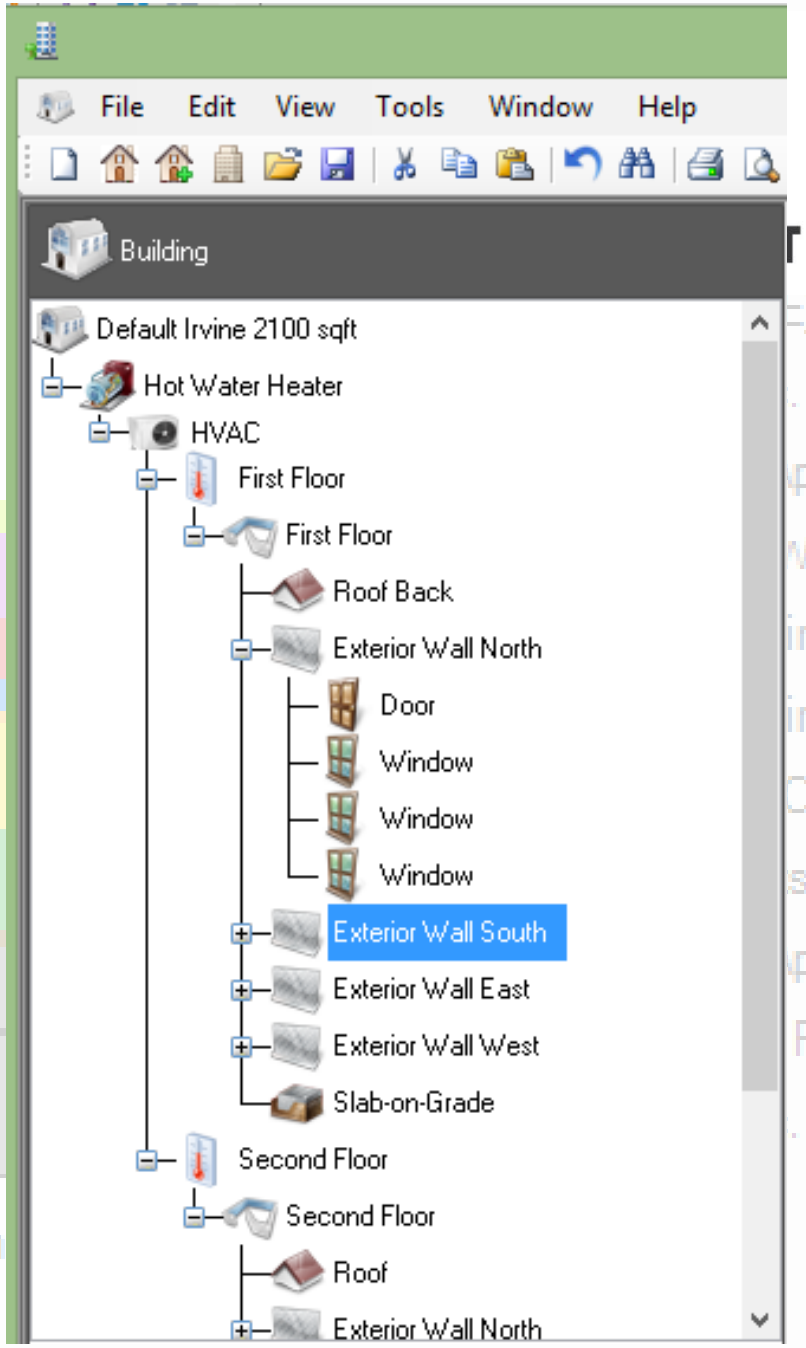
04	05	06	07	08
Energy Use (kTDV/ft^2-yr)	Standard Design	Proposed Design	Compliance Margin	Percent Improvement
Space Heating	3.59	3.75	-0.16	-4.5%
Space Cooling	13.91	18.58	-4.67	-33.6%
IAQ Ventilation	1.58	1.58	0.00	0.0%
Water Heating	12.97	12.27	0.70	5.4%
Photovoltaic Offset	----	0.00	0.00	----
Compliance 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

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

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%**

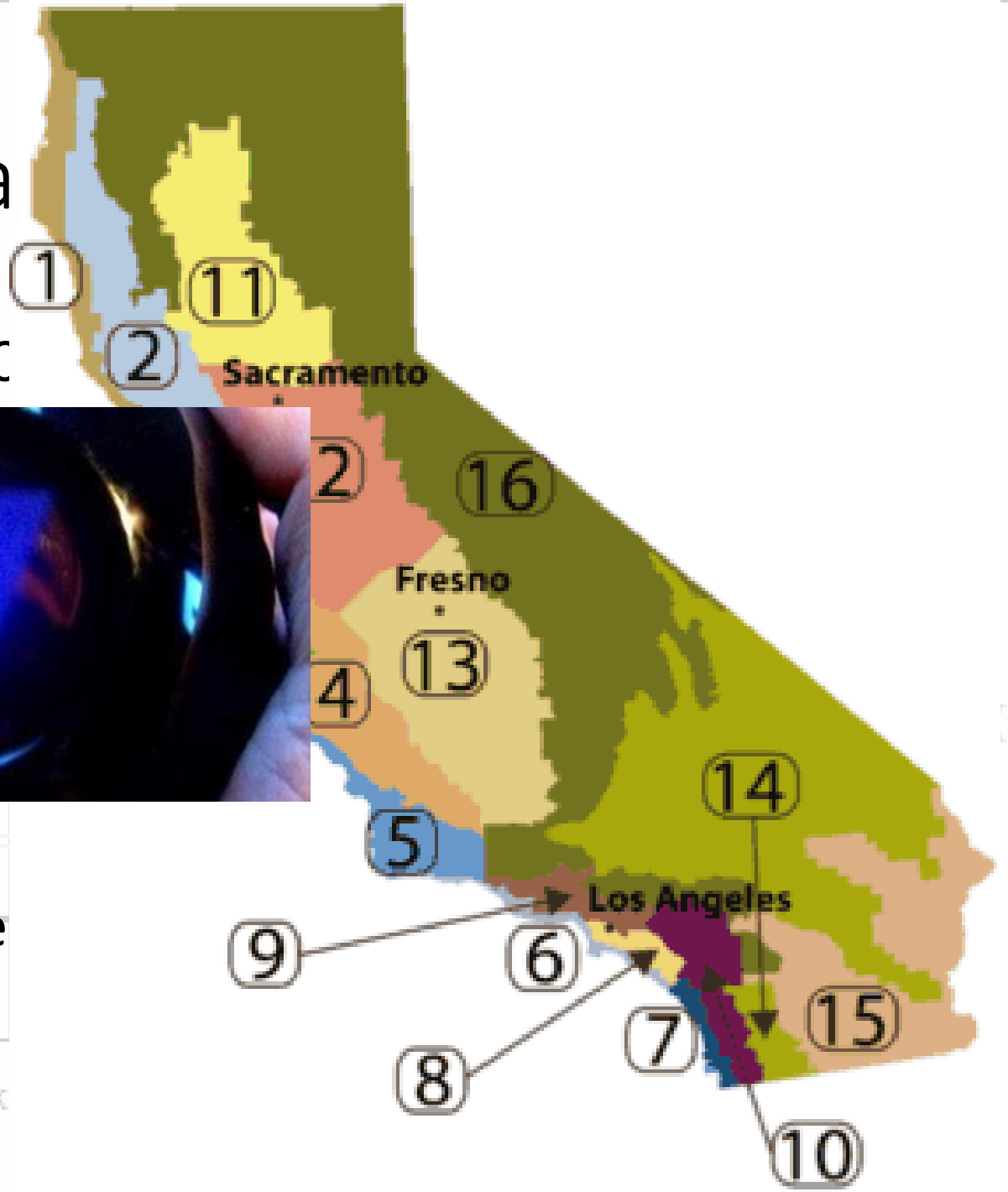
95% of all buildings are using energy modeling to comply with

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%**

11.00 x 8.50 in

2016 Residential Wall Sta

- Wall standard U-factor going from 0.0
  side of 405 – CZ 6&
    - 2x6, R-19 + R-5 CI
- Will 2016 be differe
- Compliance credit f
- Attic insulation stan
  performance attics" in CZ 4,8-16)
- Running out of easier options to save



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 0.031 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 0.053 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	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 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 13+4 or R 13+5	U 0.065 R 13+4 or R 13+5	U 0.065 R 13+4 or R 13+5	U 0.065 R 13+4 or R 13+5	U 0.065 R 13+4 or R 13+5	U 0.065 R 13+4 or R 13+5	U 0.065 R 13+4 or R 13+5	U 0.065 R 13+4 or R 13+5	U 0.065 R 13+4 or R 13+5	U 0.065 R 13+4 or R 13+5	U 0.065 R 13+4 or R 13+5	U 0.065 R 13+4 or R 13+5	U 0.065 R 13+4 or R 13+5	U 0.065 R 13+4 or R 13+5	U 0.065 R 13+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 0.055 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
			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 Envelope Standards-Residential

BUILD SMART

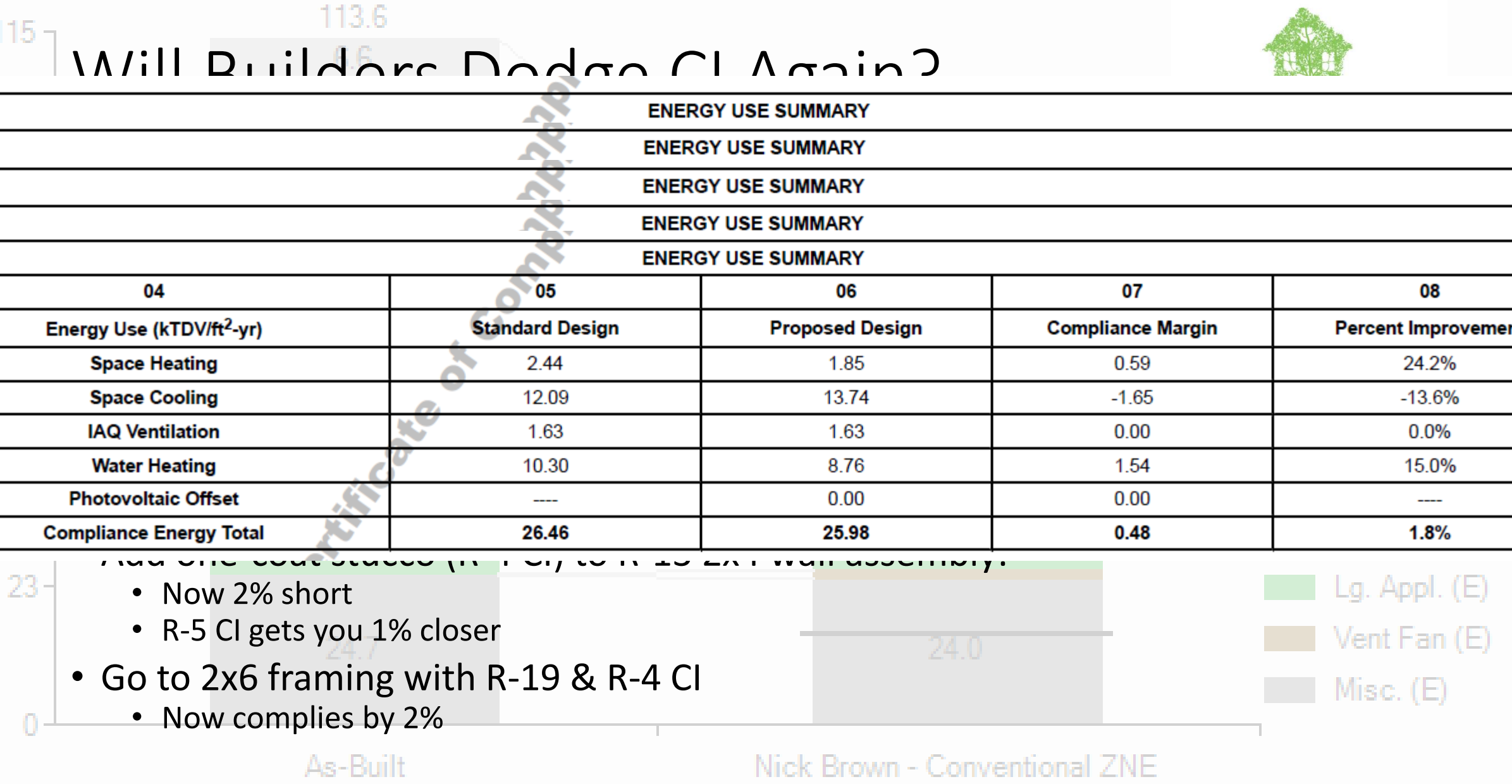
TABLE 150.1-A COMPONENT PACKAGE-A STANDARD BUILDING DESIGN (CONTINUED)

				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?

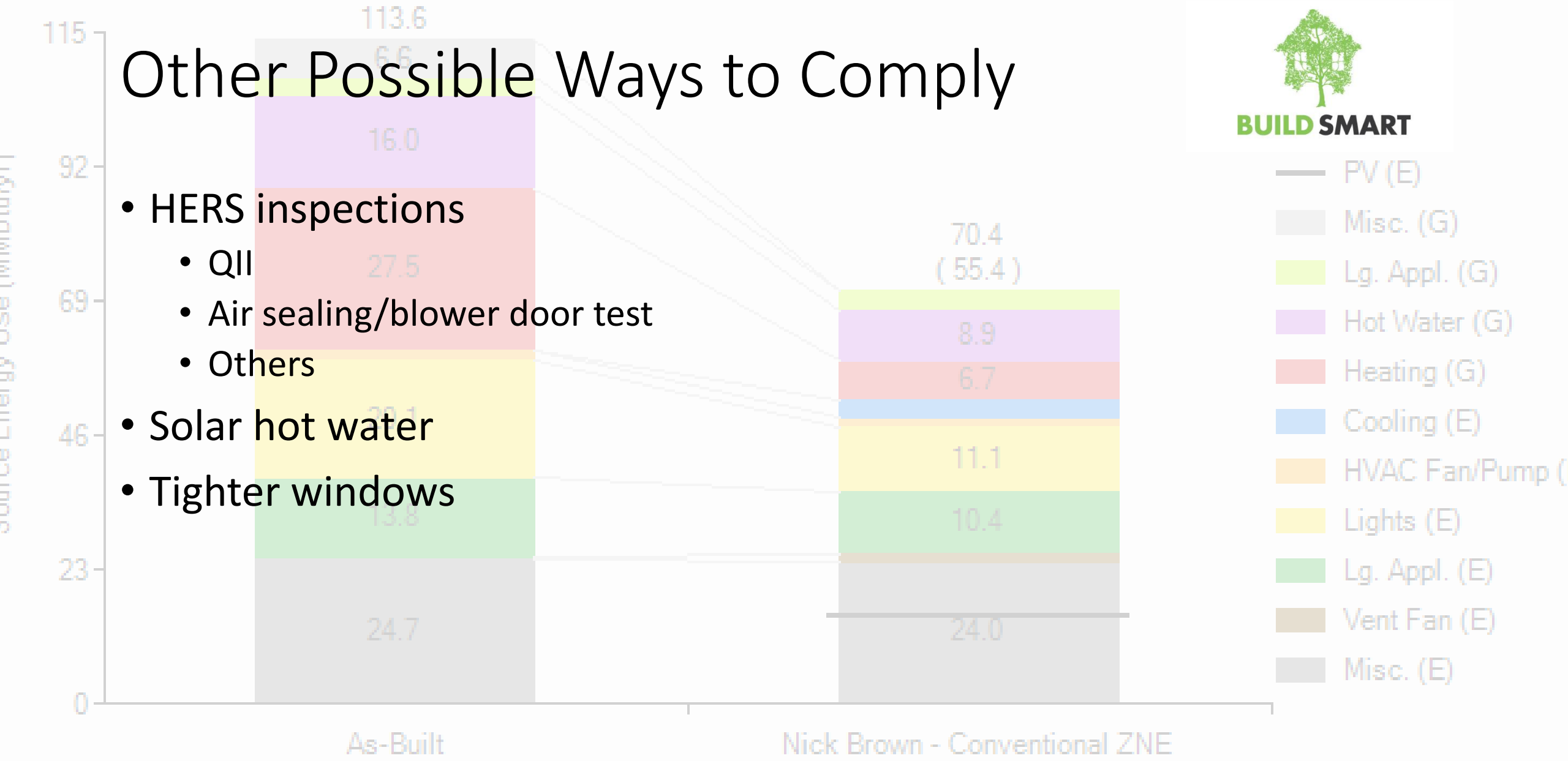
ENERGY USE SUMMARY				
ENERGY USE SUMMARY				
ENERGY USE SUMMARY				
ENERGY USE SUMMARY				
ENERGY USE SUMMARY				
04	**05**	**06**	**07**	**08**
Energy Use (kTDV/ft^2-yr)	**Standard Design**	**Proposed Design**	**Compliance Margin**	**Percent Improvement**
Space Heating	2.44	1.85	0.59	24.2%
Space Cooling	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%**

- Add one coat stucco (R-4 CI) to R-19 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

BUILD SMART

- Concerns around HPW&HPA and

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%**

- Cost ~ $5,000-$6,000 for 2 kW system
- Not available in Coastal SoCal (CZ 6&7)

Ke

- All
- Hig
  -
  -
  -
- Tar

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?

BUILD SMART

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

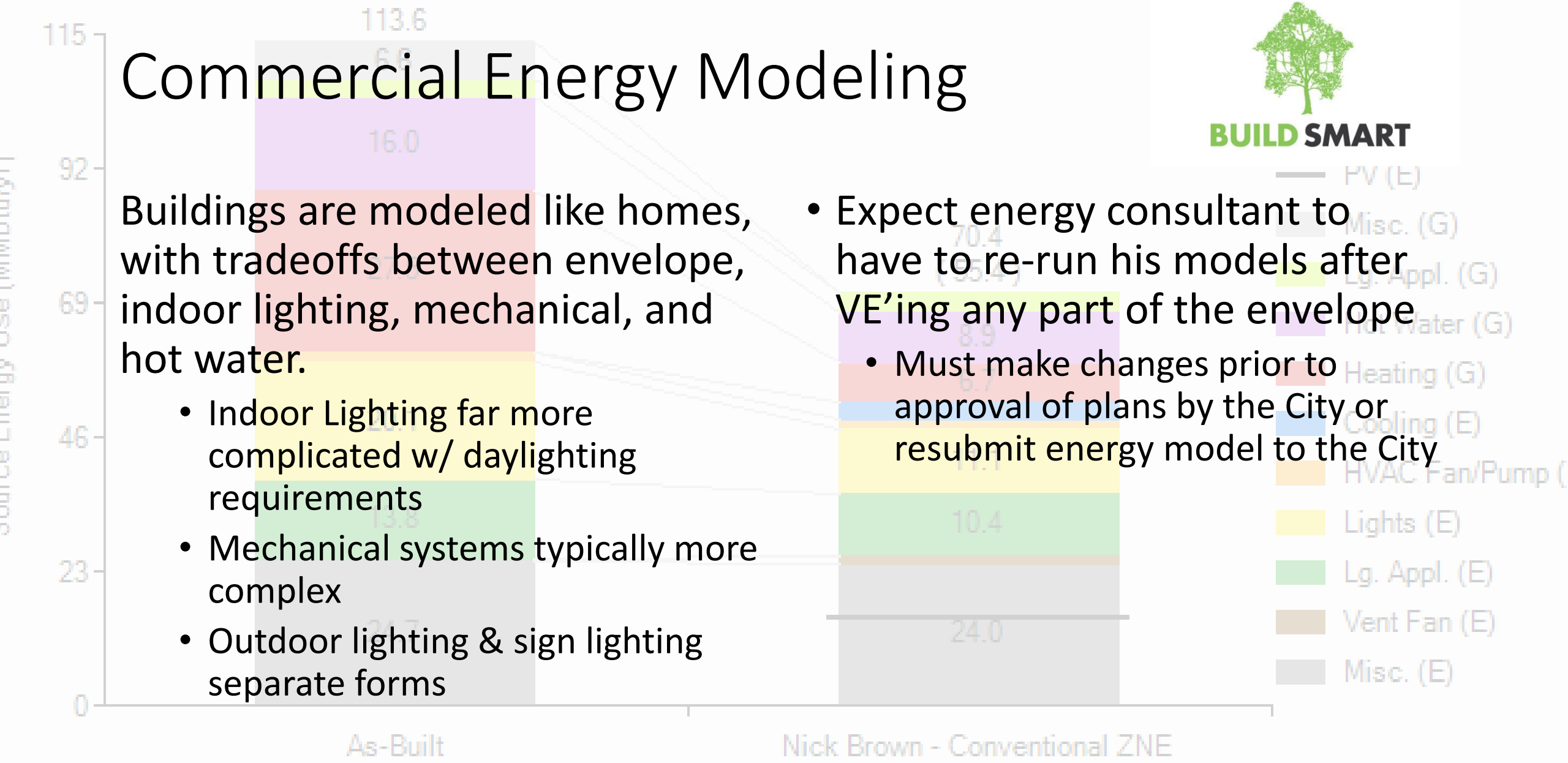
Climate Zones	U-factor	Assembly
16	0.037	Concrete + R-25 CI
1,2,14	0.045	Concrete + R-20 CI
3,4,5,11,12,13,15	0.058	Concrete + R-15 CI
6,10	0.069	Concrete + R-12 CI
7,8,9	0.092	Concrete + R-8 CI

Commercial Energy Modeling

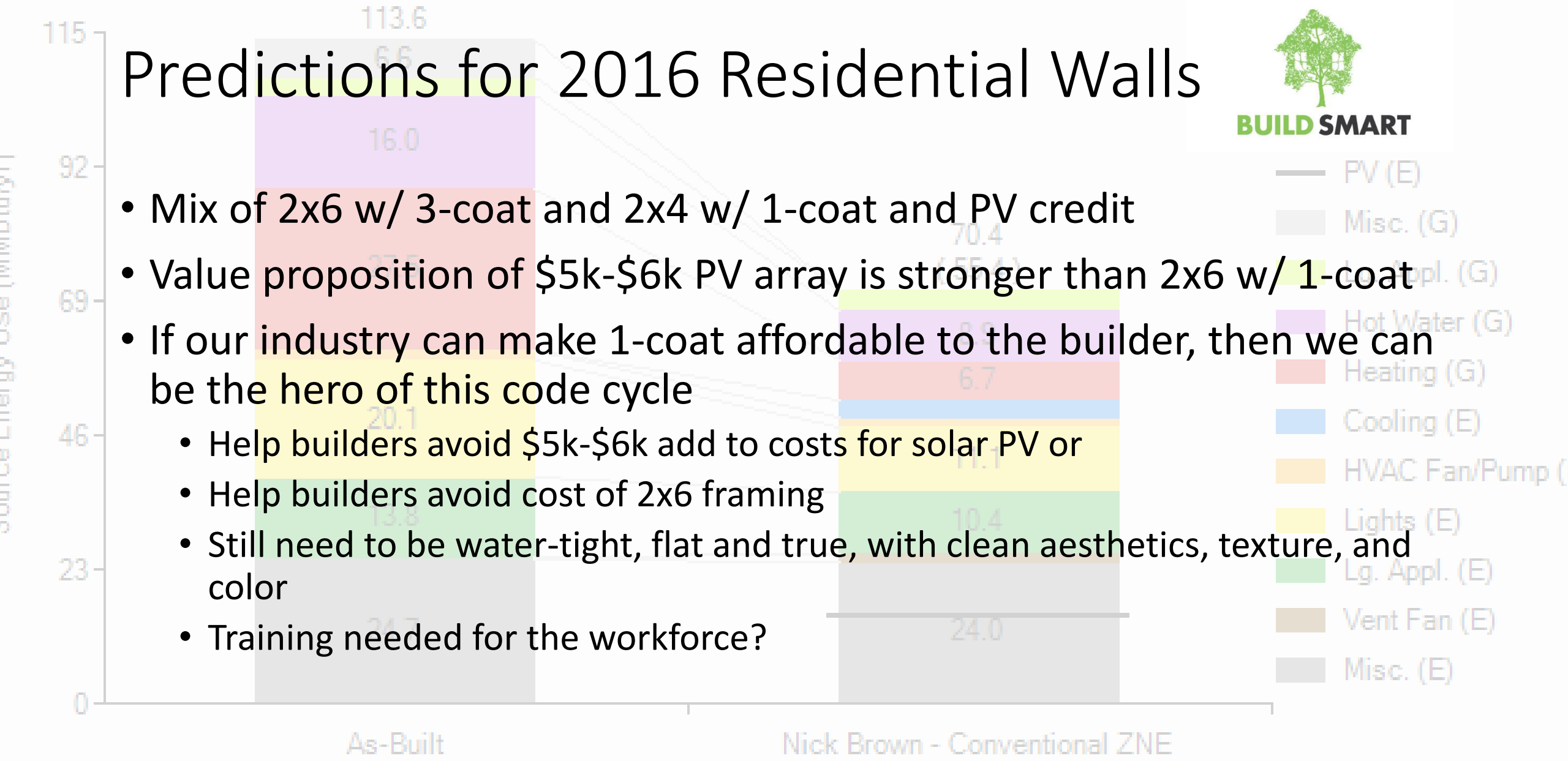
Buildings are modeled like homes, with tradeoffs between envelope, indoor lighting, mechanical, and hot water.

- 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



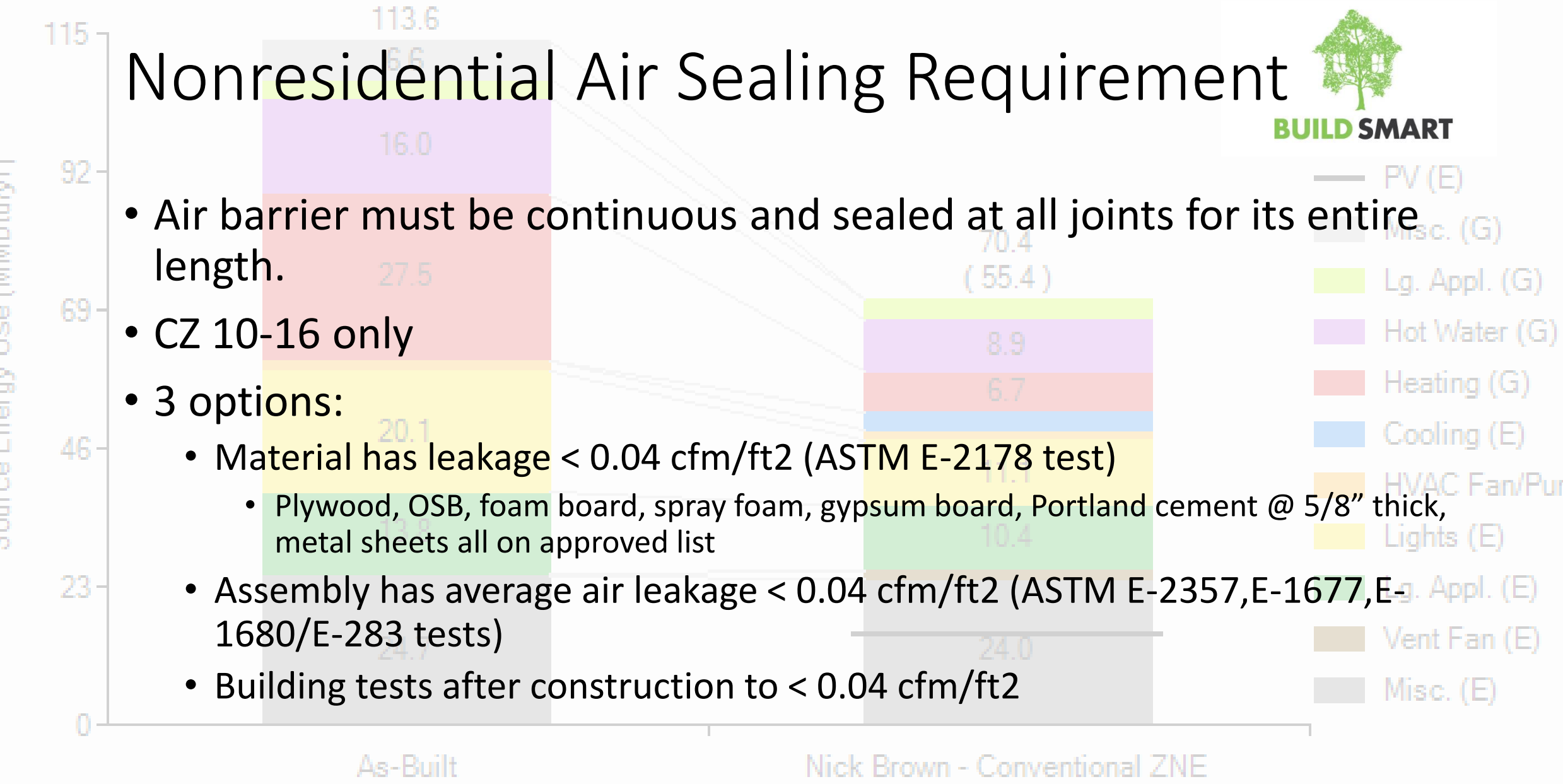
Predictions for 2016 Residential Walls



- 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

i. Concrete masonry walls that have at least two coatings of paint or at least two coatings of sealer coating.

ii. Concrete masonry walls with integral rigid board insulation.

iii. Structurally Insulated Panels.

iv. Portland cement or Portland sand parge, or stucco, or a gypsum plaster, each with min. 1/2 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 Sto

IBC added NFPA-285 test rec
WRBs were not considered.

- Foam insulation and nearl
- Combustible materials req
  - Only if >40’ high and Type I
  - Each assembly must be tes
  - Exception 1: if WRB is only (3-coat Stucco)
  - Exception 2: windows, doo
  - Exception 3: if WRB is only 84 & E-1354
- Judgment letter from engi
  - Must be clear substitution

“It seems that these newer developments were, in part, driven by increasing concerns about life safety issues in high-rise structures. For example, according to NFPA research, from 2005 to 2009, an estimated 15,700 annually reported fires in high-rise buildings resulted in an average of 53 civilian deaths, 546 civilian injuries, and $235 million in direct property damage per year.
In addition, a number of building fires in the U.S. and China in 2010 proved that a small ignition source can rapidly spread to engulf the entire exterior of a building. Of course, this is particularly dangerous in high-rise buildings with limited rescue and evacuation capabilities.”

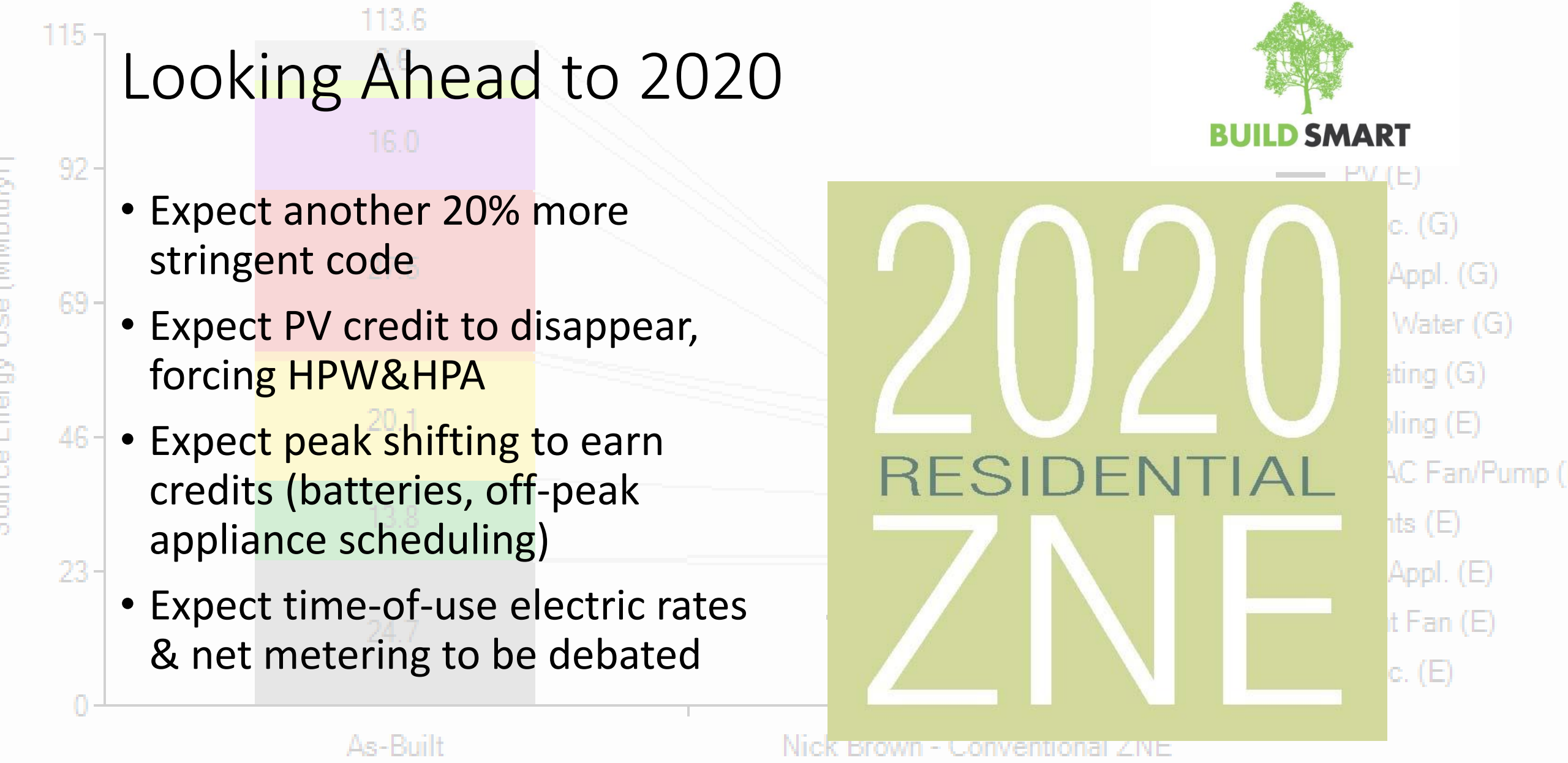
- “Navigating Wall Assembly Fire Testing,” Architectural Record, March 2013

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

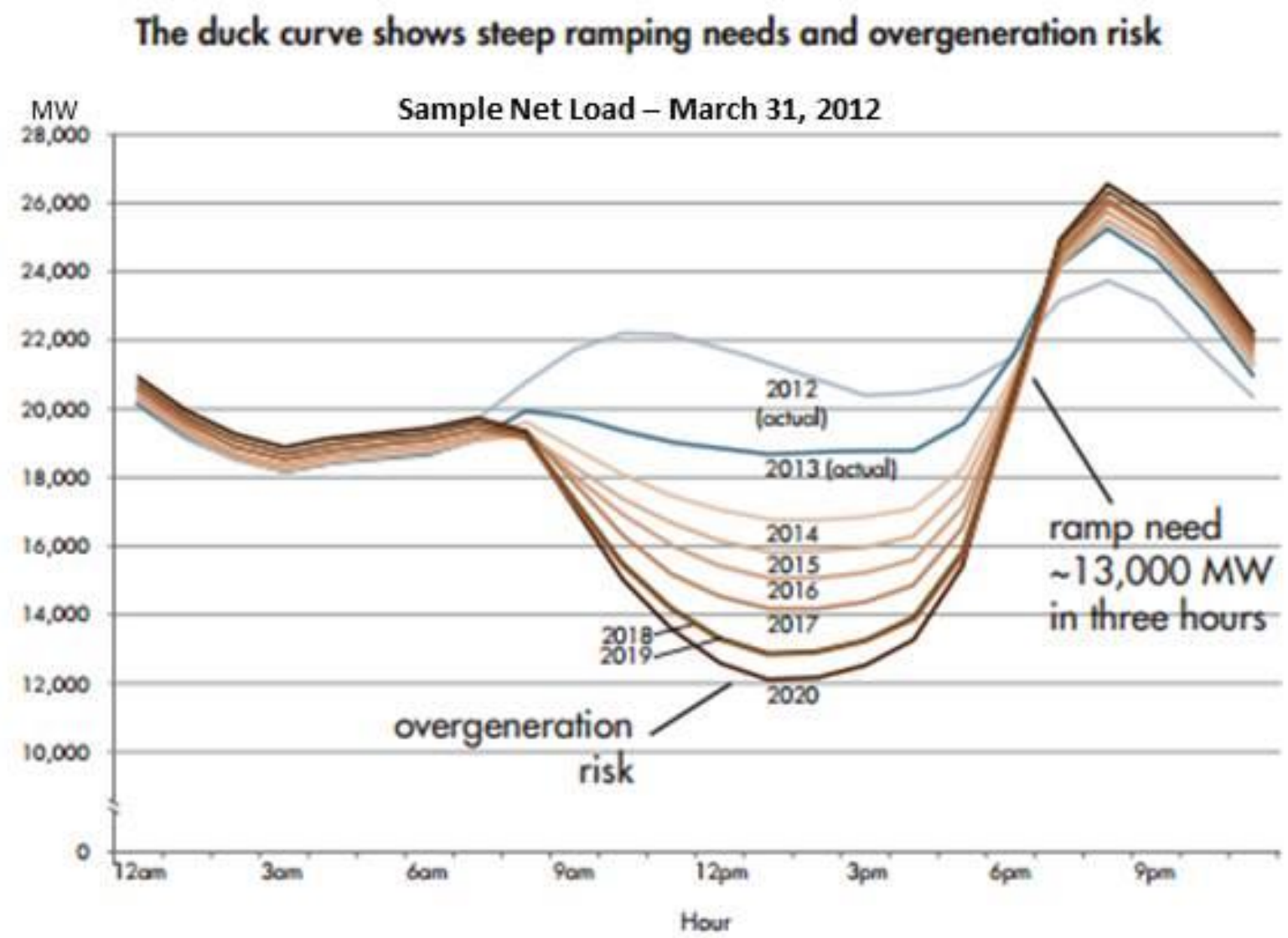
BUILD SMART

2020 RESIDENTIAL ZNE



Duck Curve

- Bigg
- Limit
- Big c
  ever
  - A
- Batt
- Wha



(from the California Independent System Operator)

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r work?

BUILD SMART