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LIGHTING THE FUTURE

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BUILDING CONTROL SYSTEMS

Lighting Source Efficacy (generalities)

Source Type	Wattage	Luminous Efficacy
LED	13 W	85 lm/W
CLF	18 W	65 lm/W
Halogen	53 W	20 lm/W
Incandescent	75 W	15 lm/W

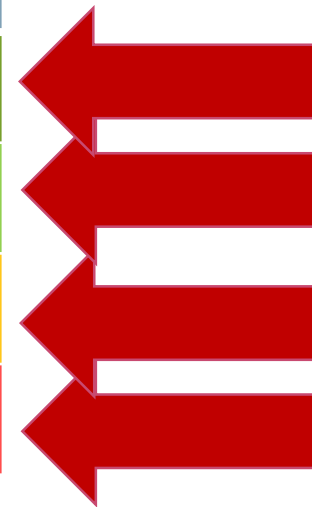


Image source: www.led.com

Residential Efficacy Requirements

HIGH EFFICACY LAMPS (2018 IECC Definition)

Compact fluorescent lamps, light-emitting diode(LED) lamps, T-8 or smaller diameter linear fluorescent lamps, or other lamps with an efficacy of not less than the following:

1. 60 lm/W for lamps over 40 watts
2. 50 lm/W for lamps over 15 to 40 watts
3. 40 lm/W for lamps 15 watts or less

	2009 IECC	2012/15 IECC	2018 IECC
HE Lamps %	50%	75%	90%

Lighting Efficacy Bar, 2009-2018 IECC

Source Type	Wattage	Luminous Efficacy
LED	13 W	85 lm/W
CLF	18 W	65 lm/W
Halogen	53 W	20 lm/W
Incandescent	75 W	15 lm/W

Compliant

Not Compliant

Bar

	2009 IECC	2012/15 IECC	2018 IECC
HE Lamps %	50%	75%	90%

2018 Illinois Energy Conservation Code (effective March 1, 2019)

HIGH-EFFICACY LAMPS

Means compact fluorescent lamps, light-emitting diode(LED) lamps, T-8 or smaller diameter linear fluorescent lamps, or other lamps with an efficacy of not less than **65 lumens per watt, or luminaires with an efficacy of not less than 55 lumens per watt.**

	'09 IECC	'12/'15 IECC	'18 IECC	2018 Illinois ECC
HE Lamps	50%	75%	90%	90%

Illinois **Lamp** Efficacy Bar

Source Type	Wattage	Luminous Efficacy
LED	13 W	85 lm/W
CLF	18 W	65 lm/W
Halogen	53 W	20 lm/W
Incandescent	75 W	15 lm/W



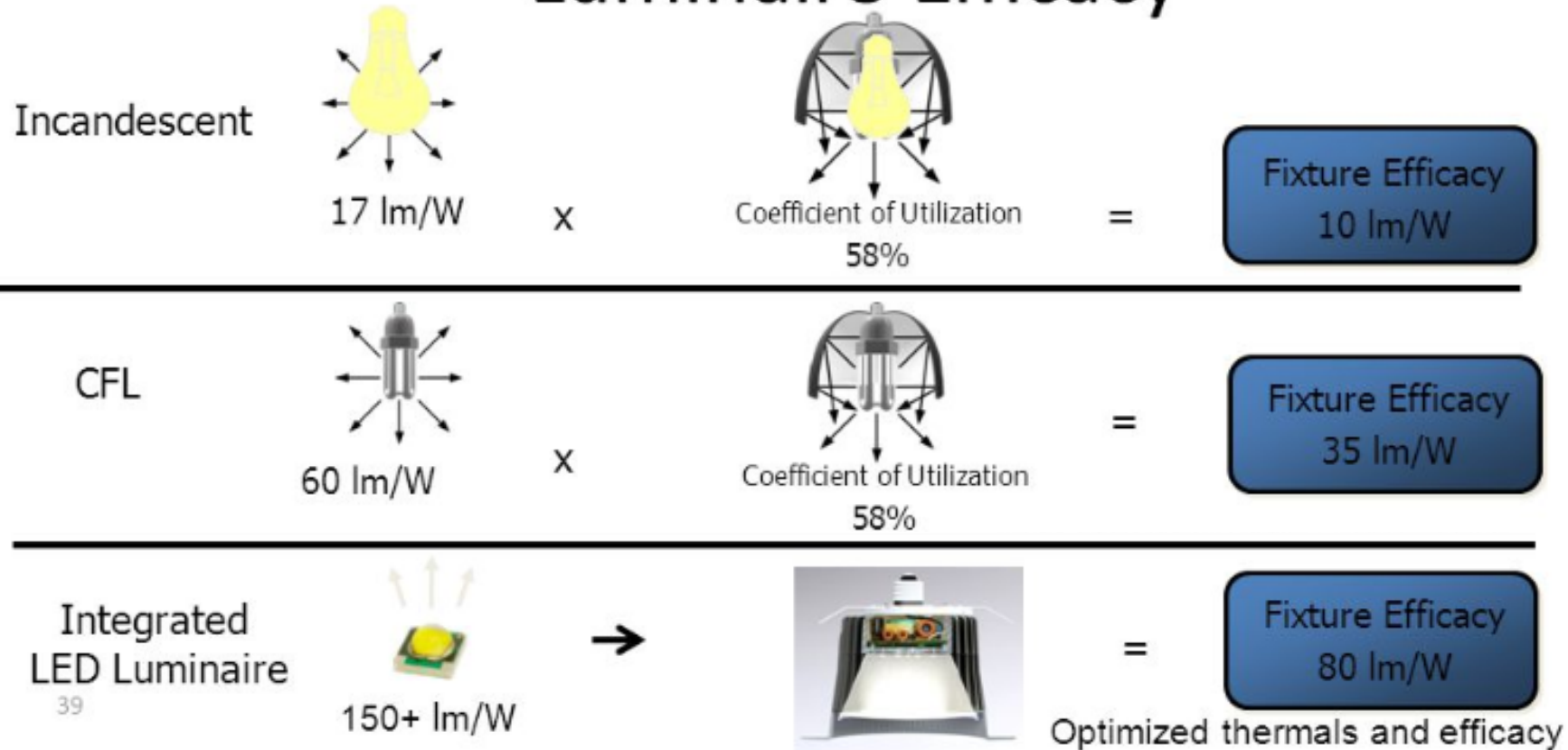
Image Source: lowes.com

Compliant

Not Compliant

Bar

Contrasting Lamp, Fixture, and Luminaire Efficacy



Source: Lighting Technologies Applications
Energy Consumption MAE 406/589 Oct 15, 2013

Illinois **Luminaire** Efficacy Bar

Luminaire Source Type	Luminous Efficacy
LED	80 lm/W
CLF	35 lm/W
Halogen	17 lm/W
Incandescent	10 lm/W

C

Not



61 lm/W
\$9.28



Image Source: homedepot.com

2018 Illinois Energy Conservation Code (effective March 1, 2019)

SECTION C405 – Commercial Code, Dwelling Unit Lighting

No less than 90% of the permanently installed lighting serving dwelling units shall be provided by lamps with an efficacy of not less than 65 lm/W or light fixtures with an efficacy of not less than 55 lm/W.

Proposal 1a Residential Efficacy Change (2021 IECC)

R404.1 Lighting equipment (Mandatory)

Not less than 90% of the permanently installed luminaires shall utilize lamps with an efficacy of at least **65 lumens-per-watt**, or have a luminaire efficacy of at least **45 lumens-per-watt**.

(eliminate “**High Efficacy Lamp**” definition altogether)

	'09 IECC	'12/'15 IECC	'18 IECC	PROPOSED '21 IECC
HE Lamps	50%	75%	90%	90%

Proposal 1b Residential Efficacy Change (2021 IECC)

HIGH EFFICACY LIGHT SOURCES

Compact fluorescent lamps, light-emitting diode(LED) lamps, T-8 or smaller diameter linear fluorescent lamps, or other lamps with an efficacy of not less than 65 lumens per watt, or luminaires with an efficacy of not less than 45 lumens per watt.

	'09 IECC	'12/'15 IECC	'18 IECC	PROPOSED '21 IECC
HE Lamps	50%	75%	90%	90%

California Residential Efficacy Requirements

WHAT'S NEW IN THE 2019 CODE?

RESIDENTIAL LIGHTING

*Changes to mandatory lighting requirements in
California's 2019 Building Energy Efficiency Standards*

JA8 COMPLIANT LAMPS & LUMINAIRES

The 2019 JA8 efficacy requirements now state that the luminous efficacy of the light source be equal to or greater than the highest of:

1. Title 20 requirements for the lamp type
2. Federal appliance efficiency standard for the lamp type, or
3. 45 lumens per Watt.

Source: energycodeace.com



Commercial Building Lighting Power Allowance

Building Area Method (W/SqFt)

BUILDING TYPE	'09 IECC '07 ASHRAE
Office	1.0
Retail	1.5
School	1.2
Warehouse	0.8
Parking Garage	0.3

Commercial Building Lighting Power Allowance

Building Area Method (W/SqFt)

BUILDING TYPE	'09 IECC '07 ASHRAE	'15 IECC '13 ASHRAE
Office	1.0	0.82
Retail	1.5	1.26
School	1.2	0.87
Warehouse	0.8	0.66
Parking Garage	0.3	0.21

Commercial Building Lighting Power Allowance

Building Area Method (W/SqFt)

~75% LED

BUILDING TYPE	'09 IECC '07 ASHRAE	'15 IECC '13 ASHRAE	'18 IECC '16 ASHRAE
Office	1.0	0.82	0.79
Retail	1.5	1.26	1.06
School	1.2	0.87	0.81
Warehouse	0.8	0.66	0.48
Parking Garage	0.3	0.21	0.15

Commercial Building Lighting Power Allowance

Building Area Method (W/SqFt)

100% LED

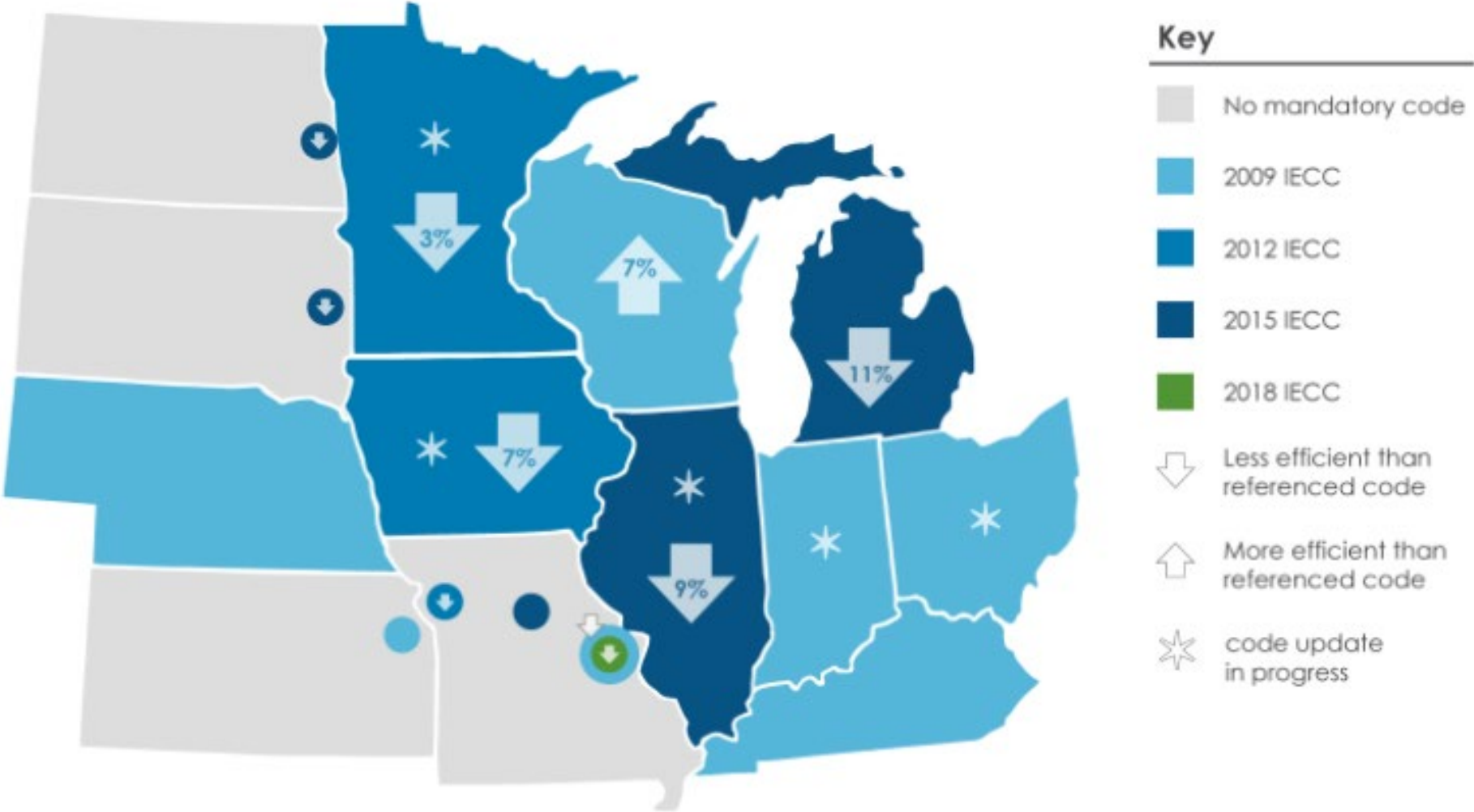
BUILDING TYPE	'09 IECC '07 ASHRAE	'15 IECC '13 ASHRAE	'18 IECC '16 ASHRAE	PROPOSED '21 IECC '19 ASHRAE
Office	1.0	0.82	0.79	0.66
Retail	1.5	1.26	1.06	0.85
School	1.2	0.87	0.81	0.74
Warehouse	0.8	0.66	0.48	0.46
Parking Garage	0.3	0.21	0.15	0.15

Commercial Building Lighting Power Allowance

Building Area Method (W/SqFt)

BUILDING TYPE	'09 IECC '07 ASHRAE	'15 IECC '13 ASHRAE	'18 IECC '16 ASHRAE	PROPOSED '21 IECC '19 ASHRAE	'19 CA Title 24
Office	1.0	0.82	0.79	0.66	0.65
Retail	1.5	1.26	1.06	0.85	0.90
School	1.2	0.87	0.81	0.74	0.65
Warehouse	0.8	0.66	0.48	0.46	0.40
Parking Garage	0.3	0.21	0.15	0.15	0.13

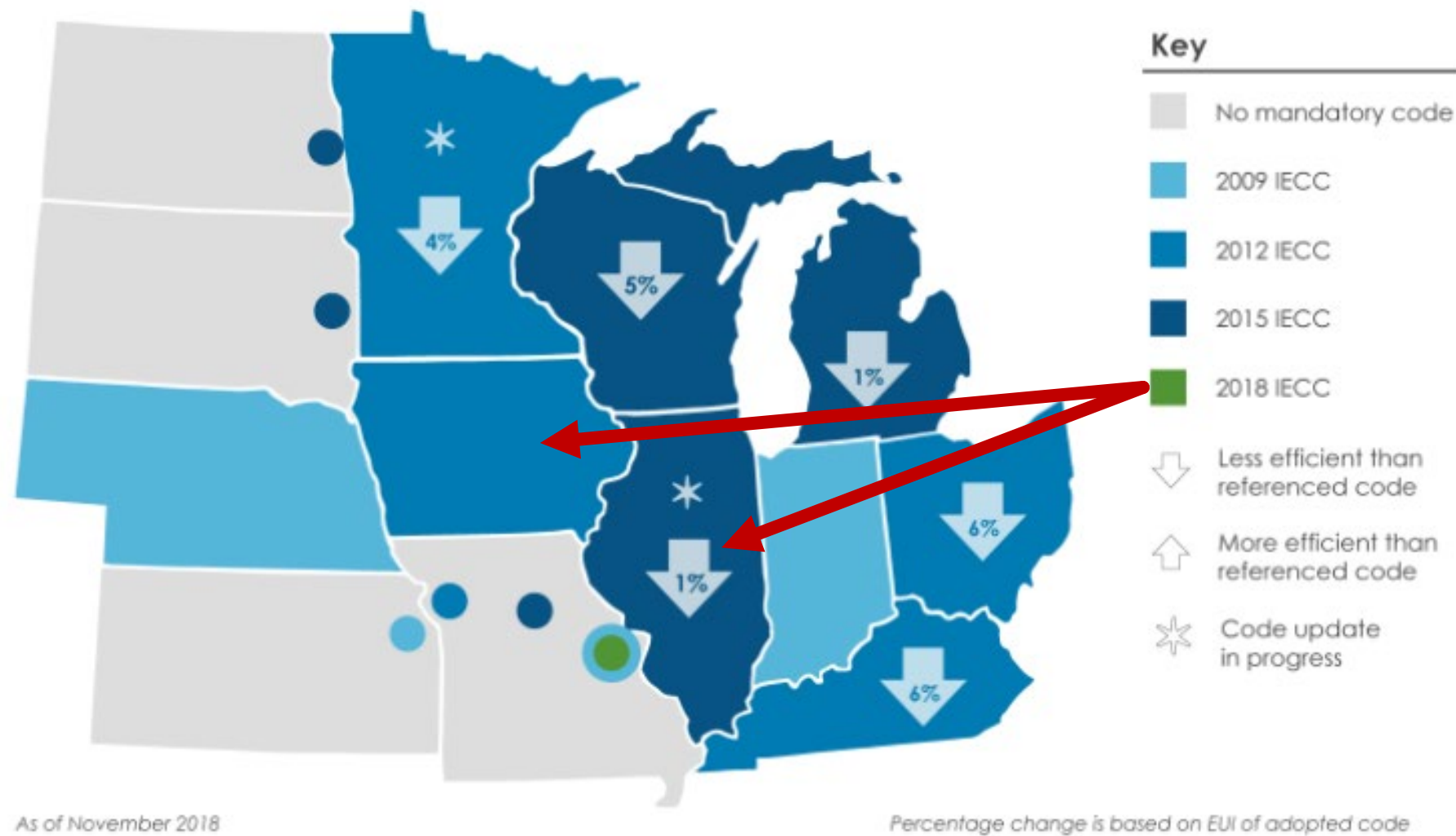
Residential Building Energy Code Adoption



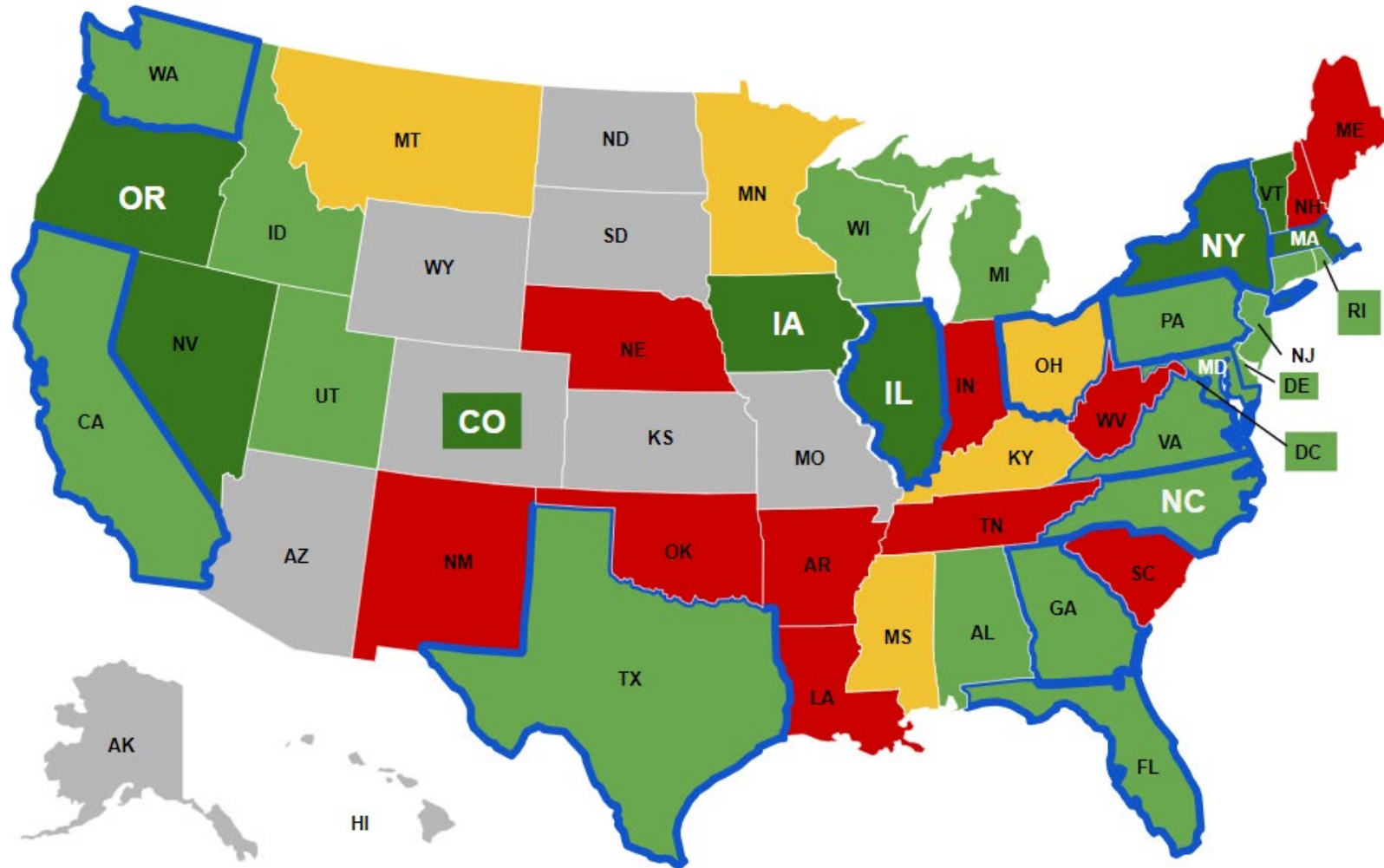
As of November 2018

Percentage change is based on EUI of adopted code

Commercial Building Energy Code Adoption



2019 National Adoption Prognosis (commercial)



What About Compliance?

- Kentucky field compliance study
- August 2015
- 2009 IECC

31% Compliance

3.1.1.6 Lighting

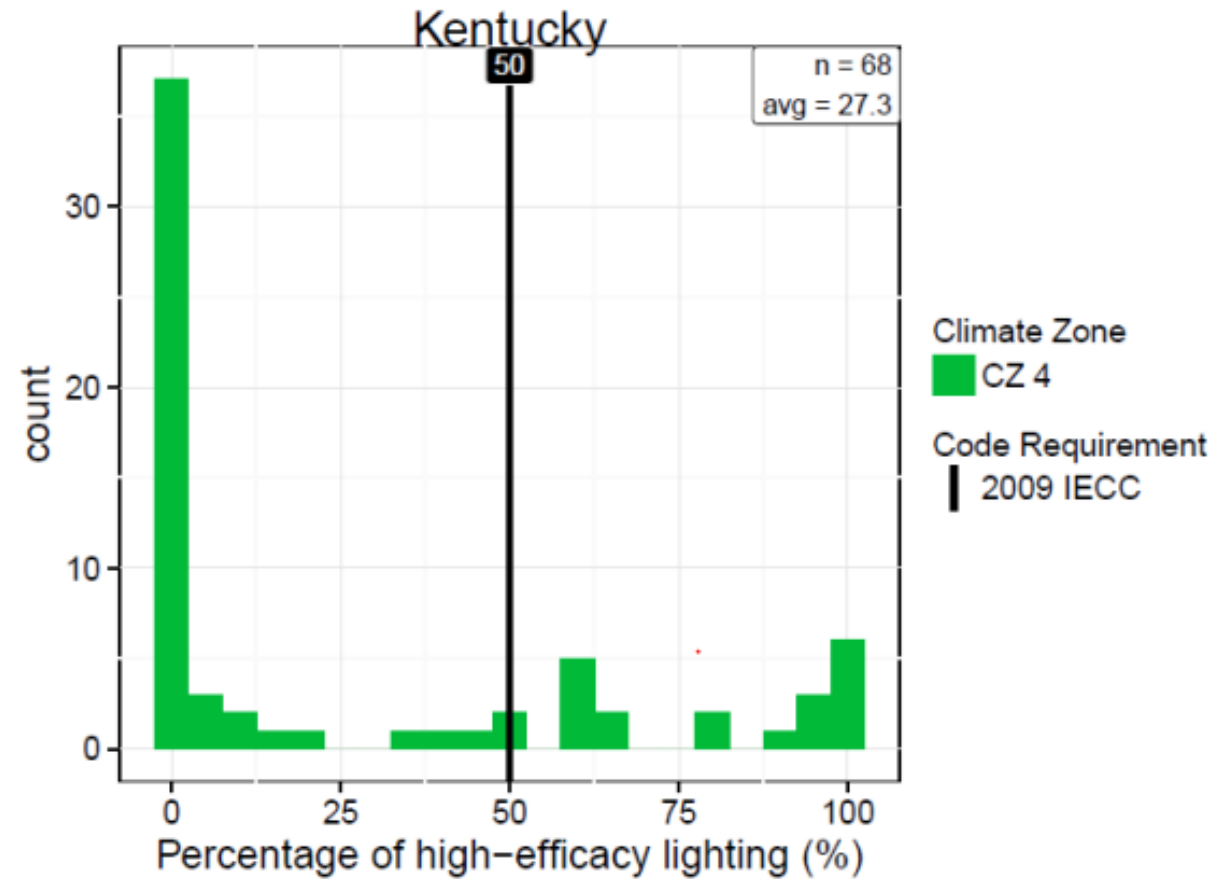


Figure 3.8. High-efficacy Lighting Percentage

Source: https://www.energycodes.gov/sites/default/files/documents/Kentucky_Residential_Field_Study.pdf

What About Compliance?

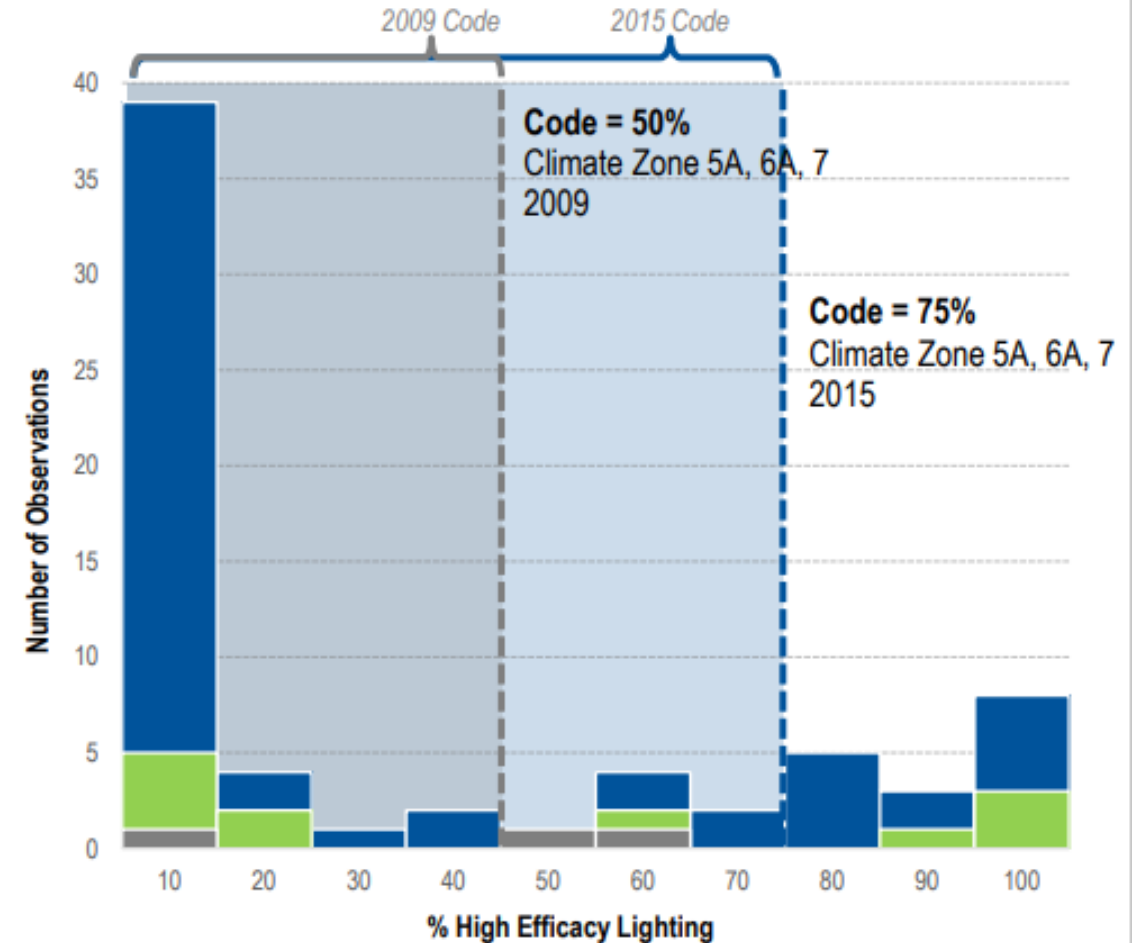
- Michigan field compliance study
- September 2015
- 2009 IECC

35% Compliance

Figure 1.2: % High Efficacy Lighting

Climate Zone 5A, 6A, 7

Shaded areas represent non-performance



What About Compliance?

61% Compliance

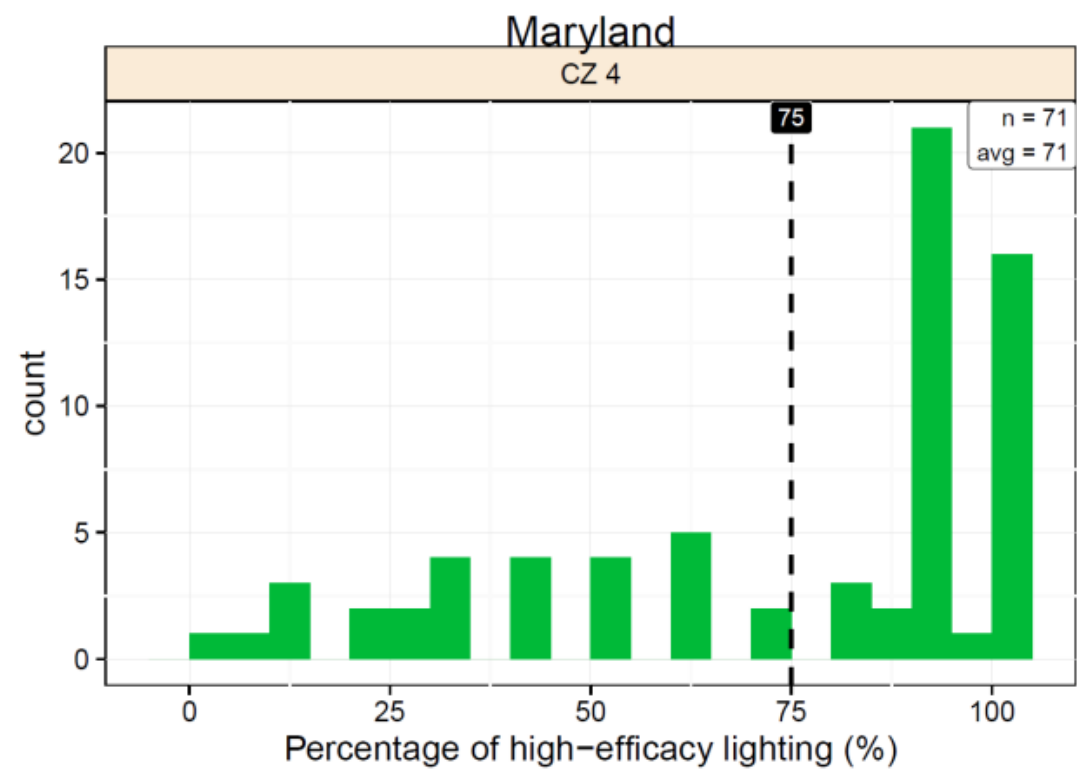


Figure 3.6. High-Efficiency Lighting Percentage

Source: https://www.energycodes.gov/sites/default/files/documents/Maryland_Residential_Field_Study.pdf

57% Compliance

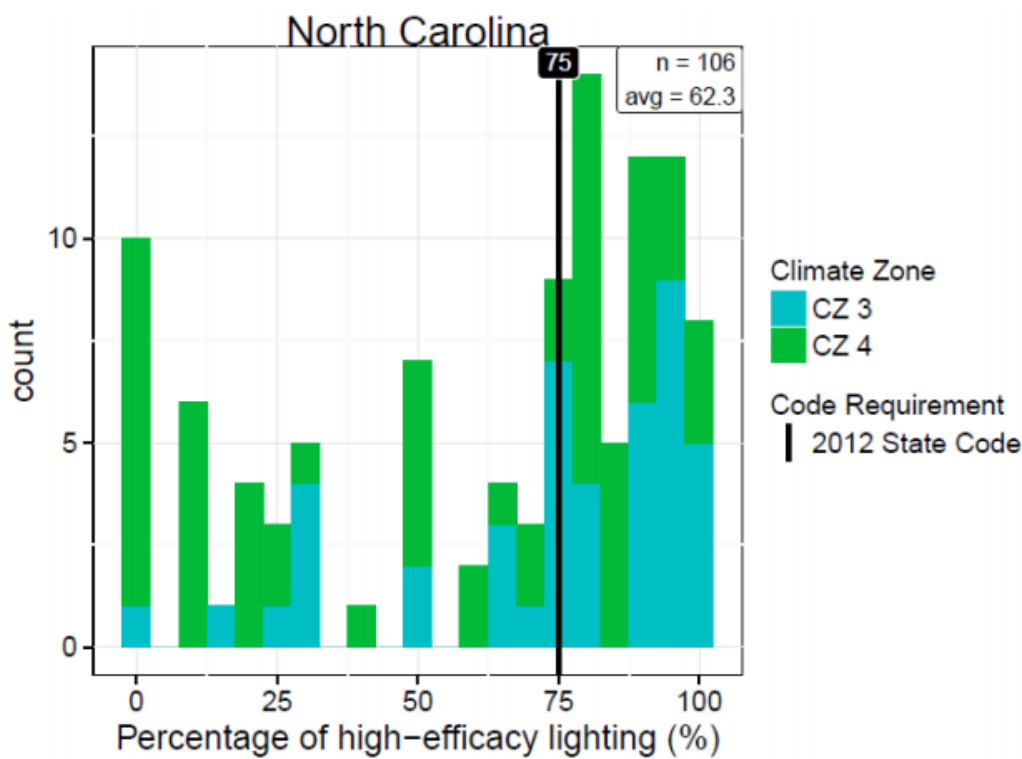


Figure 3.9. High-efficiency Lighting Percentage

Source: https://www.energycodes.gov/sites/default/files/documents/North_Carolina_Residential_Field_Study.pdf

Perspectives

- Codes forge ahead in efficiency, but lag lighting technology
 - Residential energy codes leave 10% to accommodate LED conversion
 - Commercial codes move to 100% LED baseline
- Adoption and compliance significant barriers
- Manufacturers departing low efficacy source marketplace
- Luminaire and lamp market conversion to LED is forcing high efficacy hand



Thank you.

Questions welcomed.

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