



# Solar PV and the ERI Compliance Path

An Analysis of Trade-offs and  
Potential Impacts

Prepared for:

**DOE Energy Codes Conference**

**March 22, 2016**

## Agenda

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- **2015 IECC ERI Path envelope trade-off potential.**
- **Effect on achieving net zero energy.**
- **Cost of ownership from the homeowner perspective.**

# ERI Path Envelope Trade-off Potential

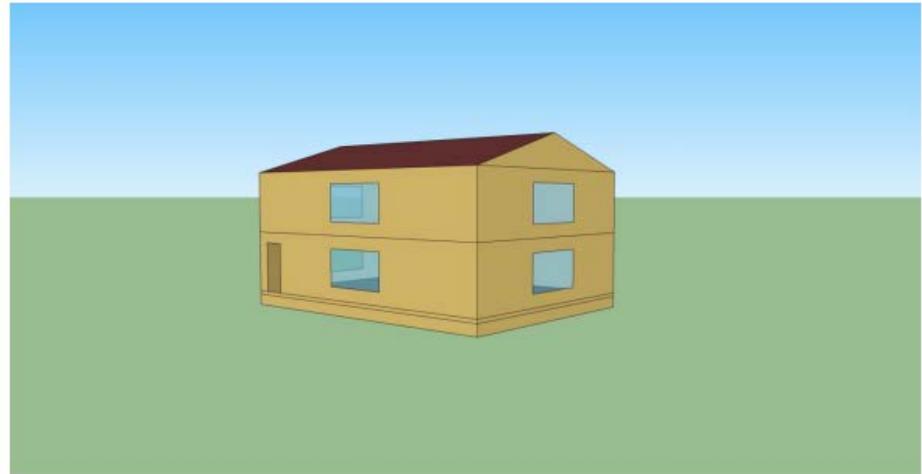
*Just how far can the envelope be traded-off for a typical PV system?*

## Trade-off Analysis Assumptions

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### ■ Home configuration

- U.S. DOE Residential Code Change Methodology housing characteristics (selected)
  - 2,400 sq.ft.
  - Two Stories
  - 15% window area
  - Gas Furnace with Central AC
  - Gas DHW



### ■ Scenarios Reviewed

- 2015 IECC ERI Path with no backstop included
- 2015 IECC ERI Path with mandatory minimums (i.e 2009 IECC envelope, federal min mechanical systems and appliances, 75% high efficacy lighting)

## Trade-off with No Backstop in Place

- Installing a 5 kW PV system - without the 2009 IECC backstop in place:

Climate Zone	2015 IECC Path	Wall R-value	Ceiling R-value	Window U-factor / SHGC	Thermal Envelope Criteria Comparative Code Version
1	ERI	0	0	1.20 / 0.25	Pre-Energy Code
	Prescriptive	13	30	0.50 / 0.25	
2	ERI	0	0	1.20 / 0.25	Pre-Energy Code
	Prescriptive	13	38	0.40 / 0.25	
3	ERI	0	0	1.20 / 0.25	Pre-Energy Code
	Prescriptive	20	38	0.35 / 0.25	
4	ERI	4	5	1.20 / 0.40	Pre-Energy Code
	Prescriptive	20	49	0.35 / 0.40	
5	ERI	11	13	1.20 / NR	~MEC 1992
	Prescriptive	20	49	0.32 / NR	
6	ERI	11	11	0.60 / NR	~MEC 1992
	Prescriptive	20+5	49	0.32 / NR	
7	ERI	13	11	0.60 / NR	~MEC 1992
	Prescriptive	20+5	49	0.32 / NR	
8	ERI	13	15	0.32 / NR	~IECC 2006
	Prescriptive	20+5	49	0.32 / NR	

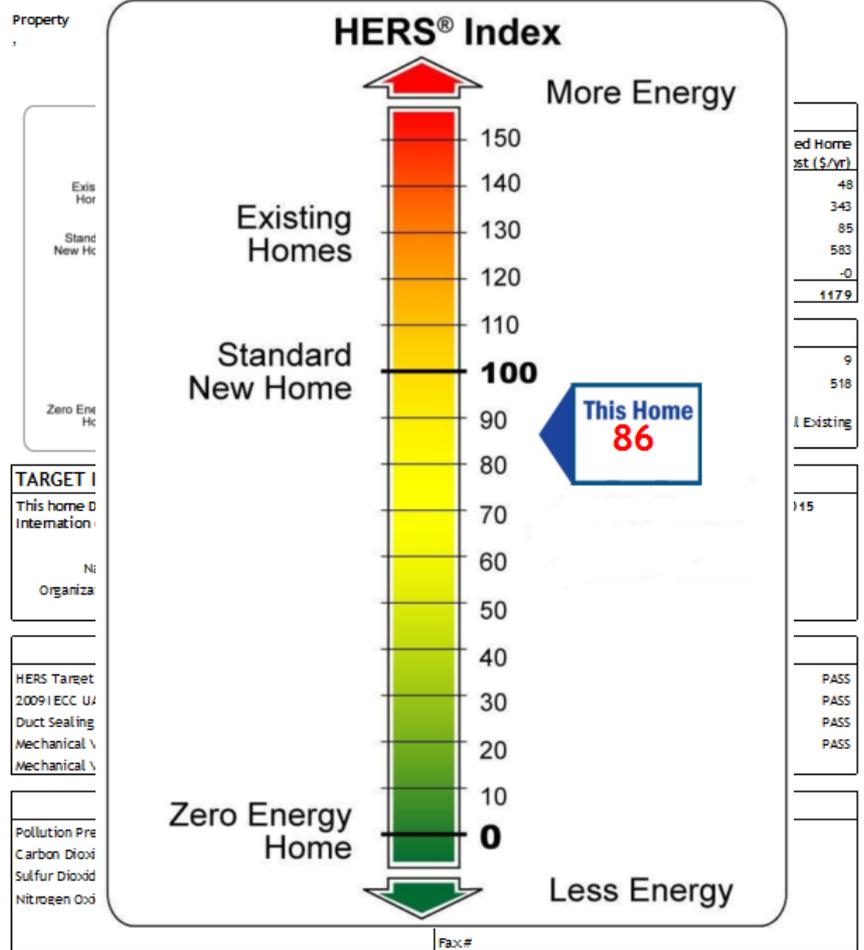
# Trade-off with 2009 IECC Backstop in Place

## 2015 IECC Report in REM/Rate

- Configured home to minimum mandatory requirements of 2015 IECC
  - 2009 IECC insulation levels.
  - Federal minimum efficiency HVAC and DHW equipment
  - 75% mandatory high efficacy lighting
- Climate Zone 2

**Without 5kW PV System**

## 2015 IECC ENERGY RATING INDEX REPORT



REM/Rate - Residential Energy Analysis and Rating Software v14.6.1 Northwest  
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# Trade-off with 2009 IECC Backstop in Place

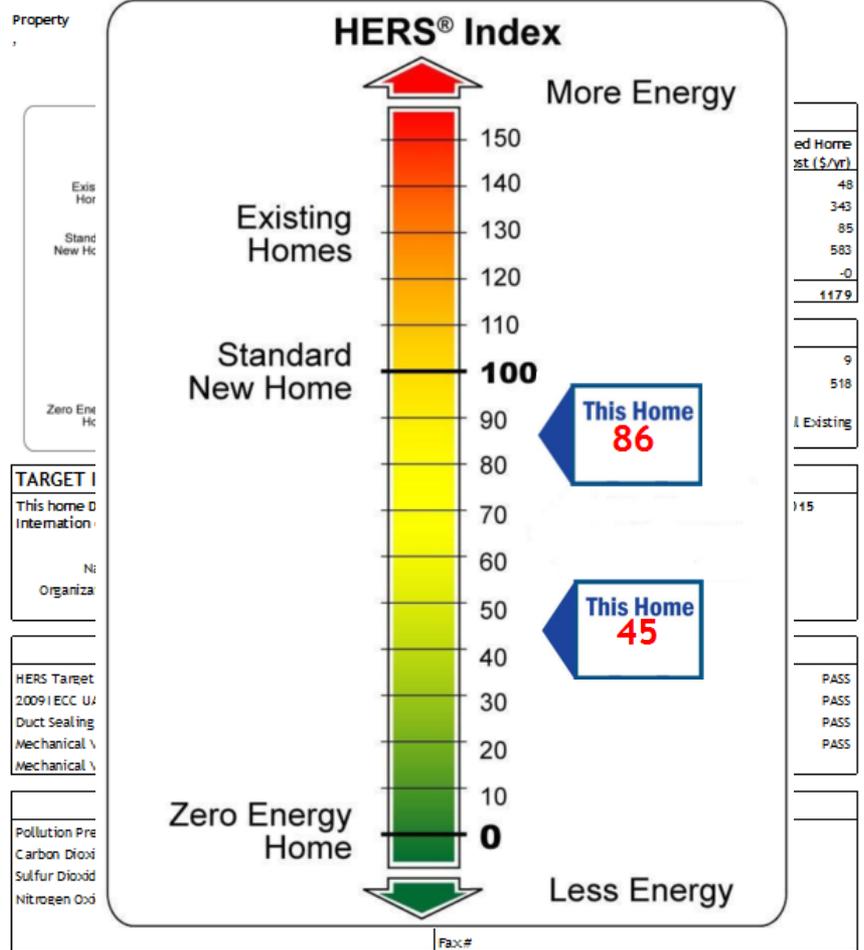
## 2015 IECC Report in REM/Rate

- Same home as before, but now includes a 5kW PV system.
- Climate Zone 2

**With 5kW PV System**

- Moves home below the ERI Target for CZ 2 of **52**

## 2015 IECC ENERGY RATING INDEX REPORT



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## Trade-off with No Backstop in Place

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### ■ Key Takeaways

- Not including a backstop or reducing the threshold contained in a backstop can potentially set back all progress on building energy efficiency codes to date.
- In several Climate Zones, requirements for cavity insulation levels at all relevant locations could move to zero.
  - (not a likely scenario), but it trades-off all minimums for a given insulation location.
  - These trade-off scenarios were calculated for 5 kW PV system. Larger systems could set back progress further in colder Climate Zones.

# Effect on Achieving Zero Net Energy

*Does the trade-off set you back?*

## How much further are you from net zero?

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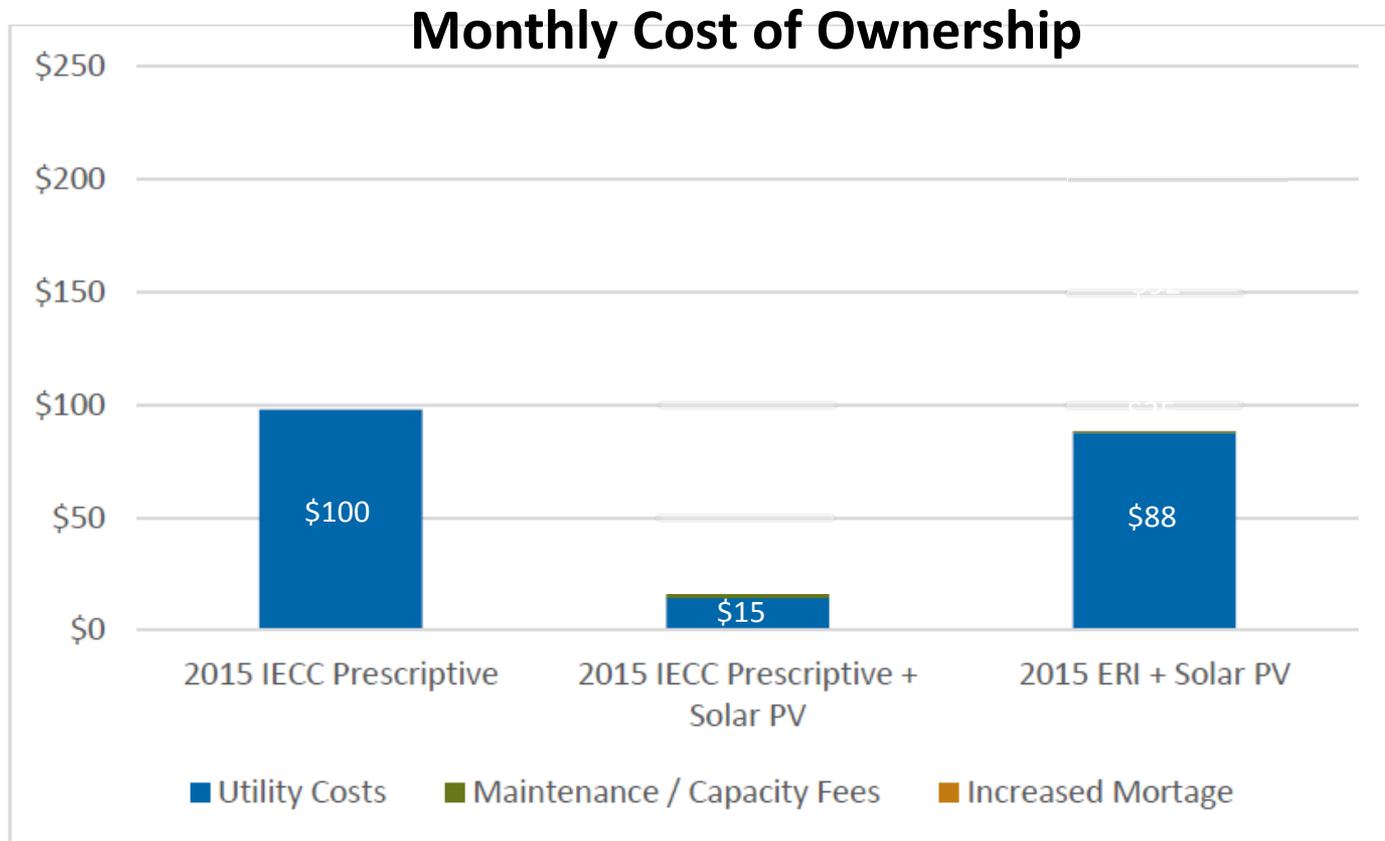
- **2015 IECC Prescriptive Path + Solar**
  - 10 kW for CZ 2
  - 11.5 kW for CZ 3
  
- **With 2009 IECC thermal envelope and federal minimum efficacy HVAC/DHW**
  - + 0.5 kW additional for CZ 2
  - + 1.5 kW additional for CZ 3
  
- **Without any backstops on the thermal envelope**
  - + 4 kW additional for CZ 2
  - + 4.5 kW additional for CZ 3

# Cost of Ownership – Homeowner Perspective

*How much more does this cost the consumer, if anything?*

## Monthly Cost of Ownership Breakdown

- A home in Climate Zone 3 that has added 5 kW of Solar PV
  - 2015 IECC Prescriptive home vs. a 2015 IECC ERI home with no backstops



# Questions?



## Assumptions for Present Value Cashflow Analysis

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Component	Useful life (years)
Insulation	100
Windows	30
HVAC	15
Solar PV Array	25
Solar PV Maintenance	1
Solar PV Net Metering Fees	1
Solar PV inverter	10

Component	Cost	Source
PV capacity charge	\$60	ICF; \$5 month (typically \$5-20/month); also referred to as a net metering fee
PV Maintenance	\$20	<a href="http://www.nrel.gov/analysis/tech_lcoe_re_cost_est.html">http://www.nrel.gov/analysis/tech_lcoe_re_cost_est.html</a>
Solar PV inverter	\$1,603	BEOpt software; 5kW system