



# Energy Rating Index Performance Path

## Cost Effectiveness of Using the ERI to Comply with the 2015 IECC

The Energy Rating Index (ERI) performance path gives builders yet another option for complying with the International Energy Conservation Code (IECC). In addition to the prescriptive and performance paths of previous versions of the IECC, builders now have the option of meeting a target ERI score through a wide range of performance options to demonstrate compliance. The ERI performance path also requires builders to meet the mandatory code requirements of the IECC, including piping provisions for water heating, as well as comply with the minimum insulation and window envelope prescriptive requirements of the 2009 IECC.

The ERI performance path allows a state or jurisdiction adopting the IECC to specify which qualifying Energy Rating Index method it will use. The Residential Energy Services Network's (RESNET) Home Energy Rating System (HERS) Index, based on ANSI RESNET Standard 301-2014, is the existing compliant ERI method and is nationally recognized for inspecting and calculating a home's energy performance. To date, over 1.5 million homes have been rated in the U.S. under the RESNET standards and in 2013, half of all new homes were rated and issued a HERS Index Score.

RESNET contracted with the Florida Solar Energy Center (FSEC) to conduct cost-effectiveness analysis of new homes configured to comply with the ERI performance path provisions of the 2015 IECC<sup>1</sup> compared to homes configured to comply with the 2012 IECC. The analysis was conducted across all IECC Climate Zones with national averages weighted using new home construction starts. The study found that in all cases, compliance with the ERI performance path of the 2015 IECC is cost-effective.

- Annual savings of the 2015 IECC ERI performance path, averaged across climate zones, is \$468.
- Life-cycle cost savings, averaged across climate zones, is \$12,784 for the 2015 IECC ERI performance path.
- The Savings-to-investment ratio (SIR), averaged across climate zones, is 1.69
- The Net Present Value (NPV) averaged across climate zones, is \$5,219

### COST-EFFECTIVENESS METHODOLOGY

The 64 homes used as the basis for the analysis were one-story, three-bedroom, 2000 ft<sup>2</sup> homes and two-story, three-bedroom, 2400 ft<sup>2</sup> homes configured to simulate the 2012 IECC *Standard Reference Design* (SRD) in sixteen representative cities across the eight IECC climate regions of the United States. HERS simulations for each home were conducted for both a *best case* home orientation and a *worst case* home orientation.<sup>2</sup> Improvements were made to the 2012 IECC SRD homes such that an additional 64 homes had HERS index scores at or below the ERI performance path criteria of the 2015 IECC.

The energy use of the homes configured to comply with the 2012 IECC was compared with the energy use of homes complying with the ERI performance path of the 2015 IECC using EnergyGauge® USA ( v.3.1.02), a RESNET-accredited HERS software tool.

### 2015 IECC IMPROVEMENT COSTS

The incremental cost of improving the 2012 IECC SRD homes to comply with the 2015 IECC ERI performance path criteria was determined using the methodology used to evaluate the cost effectiveness of retrofits for the U.S. Department of Energy's Building America program.<sup>3</sup> In most cases, improvement costs used in the analysis parallel those available from the National Renewable Energy Laboratory's (NREL) National Residential Efficiency Measure Database.<sup>4</sup>

The most common efficiency improvements employed in this study comprised 100% high-efficiency lighting, higher efficiency heating, cooling and water heating equipment, interior, leak-free duct systems, enhanced envelope efficiencies and energy star refrigerators, dishwashers and clothes washers.

### ECONOMIC ANALYSIS

Economic analysis is based on a 30 year life-cycle-cost analysis using the methodology specified by Section 4.6, ANSI/RESNET 301-2014. The economic parameter values published on the RESNET web site for 2014<sup>5</sup> as augmented by an effective income tax rate of 25%, a property tax rate of 4% and a property assessment ratio of 80% were used in the analysis.

# Energy Ratings Index Performance Path



The life-cycle-cost analysis includes replacement costs (escalated at the general inflation rate) for measures lasting less than the full analysis period (standard residential mortgage period of 30 years in this case). For example, HVAC equipment, with an assumed service life of 15 years, would be replaced in year 16 and high efficiency CFL lighting, with an assumed service life of 5 years, would be replaced five times during the analysis period. Where incremental maintenance is required, a maintenance fraction is also included in the analysis.

Energy prices used in the analysis are the most recently published (2012) average annual U.S. prices for residential electricity and residential natural gas as provided by the U.S. Energy Information Administration.<sup>6</sup> The prices used are \$0.1177/kWh of electricity consumption and \$1.045/therm of natural gas consumption. Energy prices are not varied in the analysis by location.

## FINDINGS

For the purposes of the analysis conducted by FSEC, 'cost effective' is defined as the case in which the present value of the life-cycle savings (the benefits) exceeds the present value of the life-cycle investment costs. The ratio of these two present values (Savings / Investment) is referred to as the savings-to-investment ratio or SIR. If the SIR is greater than unity, there is a net financial benefit derived from making the investment. The net present value (NPV) of the improvements was also calculated, where NPV equals the present value of the life-cycle energy cost savings minus the present value of the life-cycle improvement costs.

The study found that in all 64 cases, compliance with the ERI criteria of the 2015 IECC is cost-effective, including homes in worst case configurations.

**Table 1: Summary of Life-Cycle-Cost Analysis Results**

Climate Zone	IECC ERI	Avg. HERS	Avg. 1st Cost	Avg. LC Cost	Avg. Annual Savings	Avg. LC Save	SIR	NPV	CZ Weights
1	52	50	\$3,435	\$7,725	\$532	\$14,543	1.88	\$6,818	0.96%
2	52	51	\$4,009	\$9,181	\$498	\$13,606	1.48	\$4,425	21.43%
3	51	50	\$3,302	\$7,423	\$465	\$12,707	1.71	\$5,284	25.77%
4	54	53	\$2,951	\$6,647	\$460	\$12,569	1.89	\$5,922	22.76%
5	55	54	\$3,356	\$7,617	\$442	\$12,072	1.58	\$4,455	21.03%
6	54	53	\$2,695	\$6,134	\$461	\$12,602	2.05	\$6,467	6.79%
7	53	51	\$2,813	\$6,417	\$503	\$13,734	2.14	\$7,317	0.75%
8	53	52	\$2,727	\$6,211	\$700	\$19,143	3.08	\$12,931	0.50%
Averages		52	\$3,263	\$7,399	\$488	\$13,347	1.80	\$5,948	—
Weighted Averages		52	\$3,338	\$7,565	\$468	\$12,784	1.69	\$5,219	—

1 <http://fsec.ucf.edu/en/publications/pdf/FSEC-CR-1981-14.pdf>

2 Windows were configured such that 35% of the total window area was located on the north and south faces of the home and 15% was located on the east and west faces. This allowed the simulations to examine a *best-case* orientation scenario with the front of the homes facing north and a *worst-case* scenario with the front facing east. The front of the homes also had a 20-foot adjoining garage wall. The foundation for the homes was varied by IECC climate zone with slab-on-grade foundations in zones 1 and 2, vented crawlspace foundations in zones 3 and 4 and with unfinished but conditioned basement foundations in zones 5 through 8.

3 "Cost Effectiveness of Home Energy Retrofits in Pre-Code Vintage Homes in the United States" <http://www.fsec.ucf.edu/en/publications/pdf/FSEC-CR-1939-12.pdf>

4 [www.nrel.gov/ap/retrofits/index.cfm](http://www.nrel.gov/ap/retrofits/index.cfm)

5 <http://www.resnet.us/professional/standards/mortgage>

6 <http://www.eia.gov/>