



## **Standard 90.2: The Path to Performance**

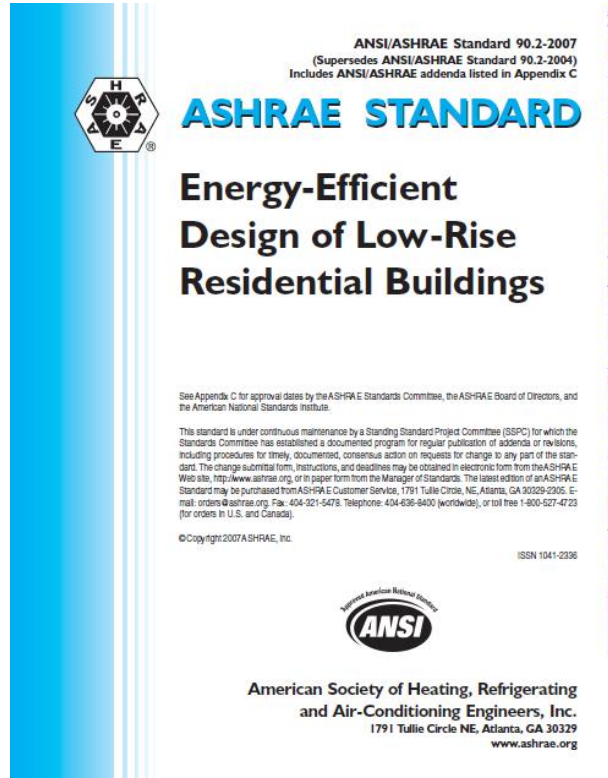
8th Annual Midwest Building Energy Codes Conference

Ann Arbor, MI

November 16, 2017

Theresa Weston, PhD.  
DuPont Protection Solutions

# 90.2 2007 Energy-Efficient Design of Low-Rise Residential Buildings

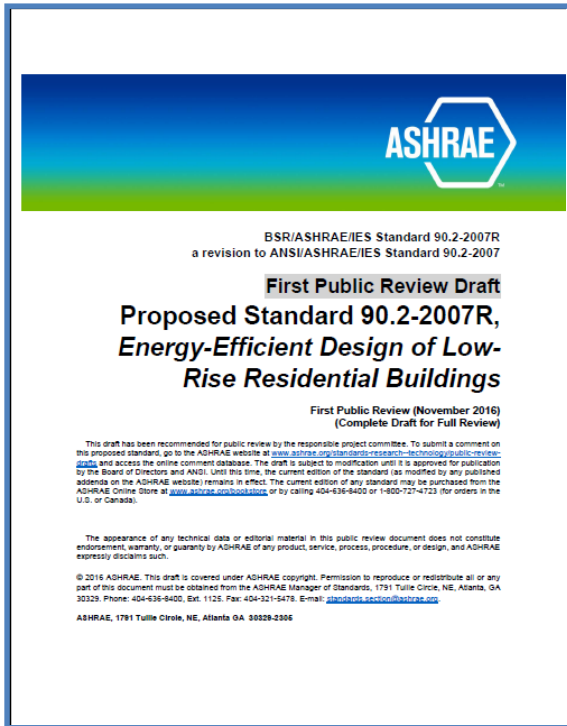


1. Purpose
2. Scope
3. Definitions, Abbreviations, and Acronyms
4. Compliance
5. Building Envelope Requirements
6. Heating, Ventilating and Air-Conditioning (HVAC) Systems and Equipment
7. Service Water Heating

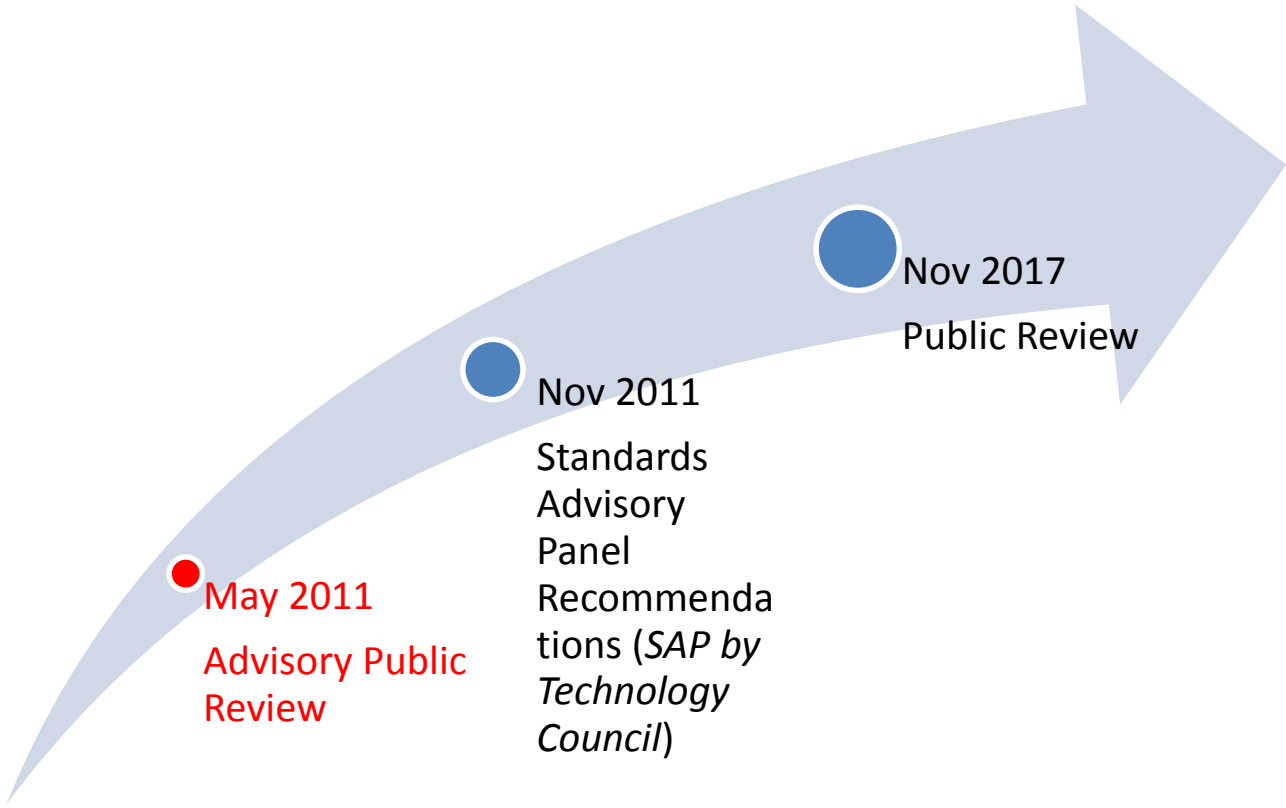
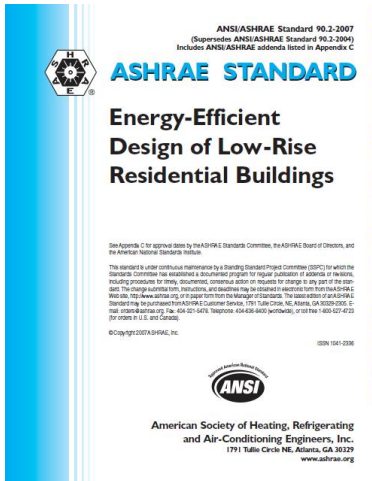
## 4. COMPLIANCE

**4.1 General.** This standard provides different methods by which compliance can be determined for low-rise residential buildings—prescriptive or performance path methods (Sections 5, 6, and 7) or an annual energy cost method (Section 8).

# 90.2-2007R First Public Review Draft Contents



- Section 1 Purpose
- Section 2 Scope
- Section 3 Definitions, Abbreviations, and Acronyms
- Section 4 Administration and Enforcement
- Section 5 Performance Requirements
- Section 6 Requirements
- Section 7 Verification
- Section 8 Reporting Requirements
- Annex 1: Reference Standard Reproduction
- Normative Appendix A: Software Requirements
- Normative Appendix B: Modeling Rule Set
- Normative Appendix C: Index Adjustment Factor
- Normative Appendix D: Air Leakage Testing
- Informative Appendix E: Procedures for Generating Prescriptive Paths
- Informative Appendix F: Example of NAECA Prescriptive Path
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- Informative Appendix J: Site Inspection Checklist
- Informative Appendix K: Framing Factors
- Referenced Standards



May 2011  
Advisory Public Review

Nov 2011  
Standards Advisory Panel Recommendations (SAP by Technology Council)

Nov 2017  
Public Review



ASHRAE/IES Standard 90.2-2007K

**Advisory  
Public Review  
Draft**

ASHRAE/IES Standard

Proposed Revision of Standard  
90.2-2007, *Energy-Efficient Design  
of Low-Rise Residential Buildings*

Advisory Public Review (May 2011)  
(Complete Draft for Advisory Review)

This draft has been recommended for an advisory public review by the responsible project committee. To submit a comment on this proposed addendum, go to the ASHRAE website at <http://www.ashrae.org/technical/standards/90.2> and access the online comment database. Comments submitted will provide input to the committee prior to issuing a formal public review draft. This draft document is not final and is subject to further modifications, a formal public review, and final approval by the ASHRAE Board of Directors. The current edition of any guideline or standard may be purchased from the ASHRAE Bookstore (<http://www.ashrae.org>) or by calling 604-636-0960 or 1-800-527-4753 (for orders in the U.S. or Canada).

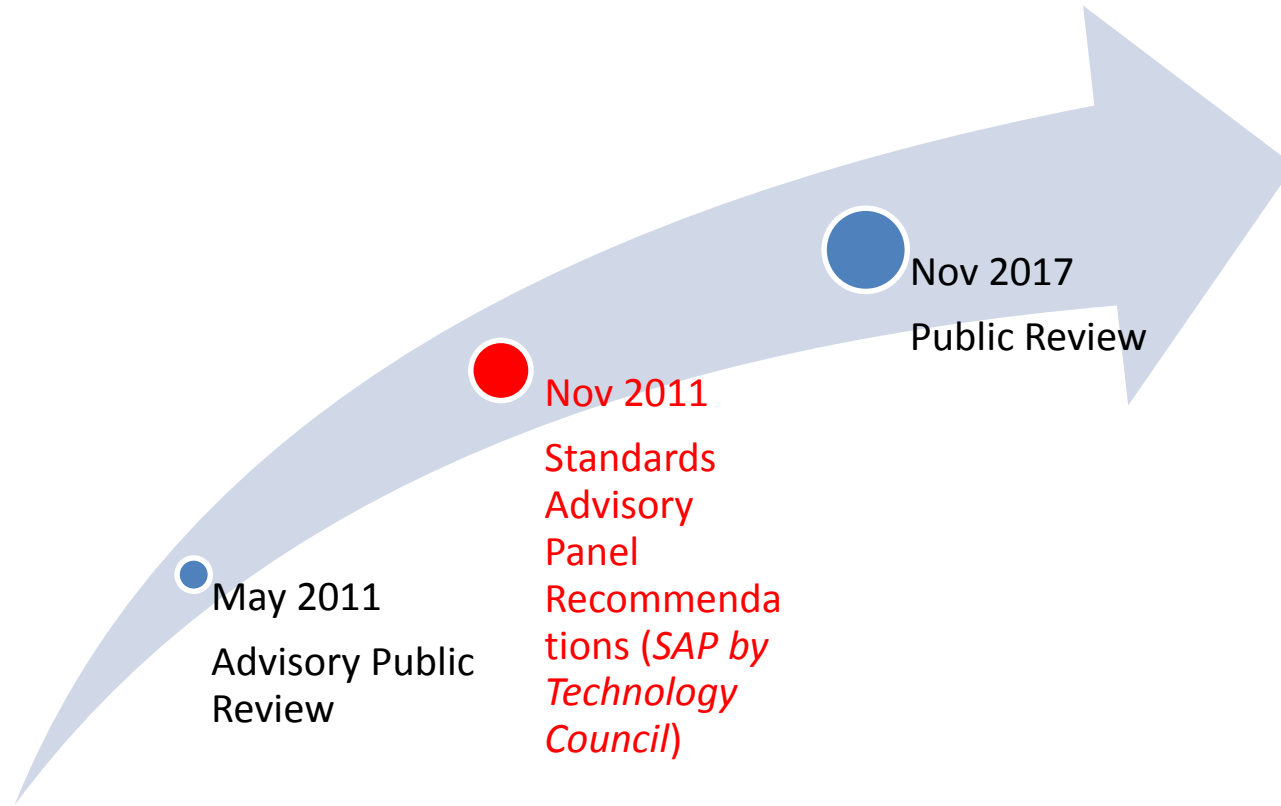
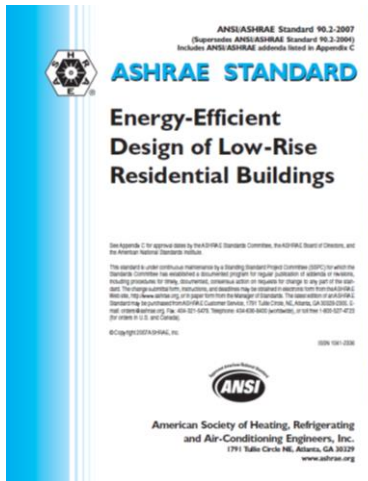
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AMERICAN SOCIETY OF HEATING, REFRIGERATING  
AND AIR-CONDITIONING ENGINEERS, INC.  
1791 Tullie Circle, NE Atlanta GA 30329-2295



1. Administration
  2. Normative References
  3. Definitions, Abbreviations, and Acronyms
  4. Prescriptive Method
  5. Performance Method
  6. Insulation for Opaque Assemblies
  7. Fenestration
  8. Air Leakage
  9. Heating, Ventilating and Air-Conditioning (HVAC) Systems and Equipment
  10. Potable Water Heating
  11. Lighting Systems
  12. Other Systems
- Normative Appendix A: Annual Energy Cost Method
- Normative Appendix B: Applications
- Normative Appendix C: Building Tightness Testing
- Normative Appendix D: Climate Zones



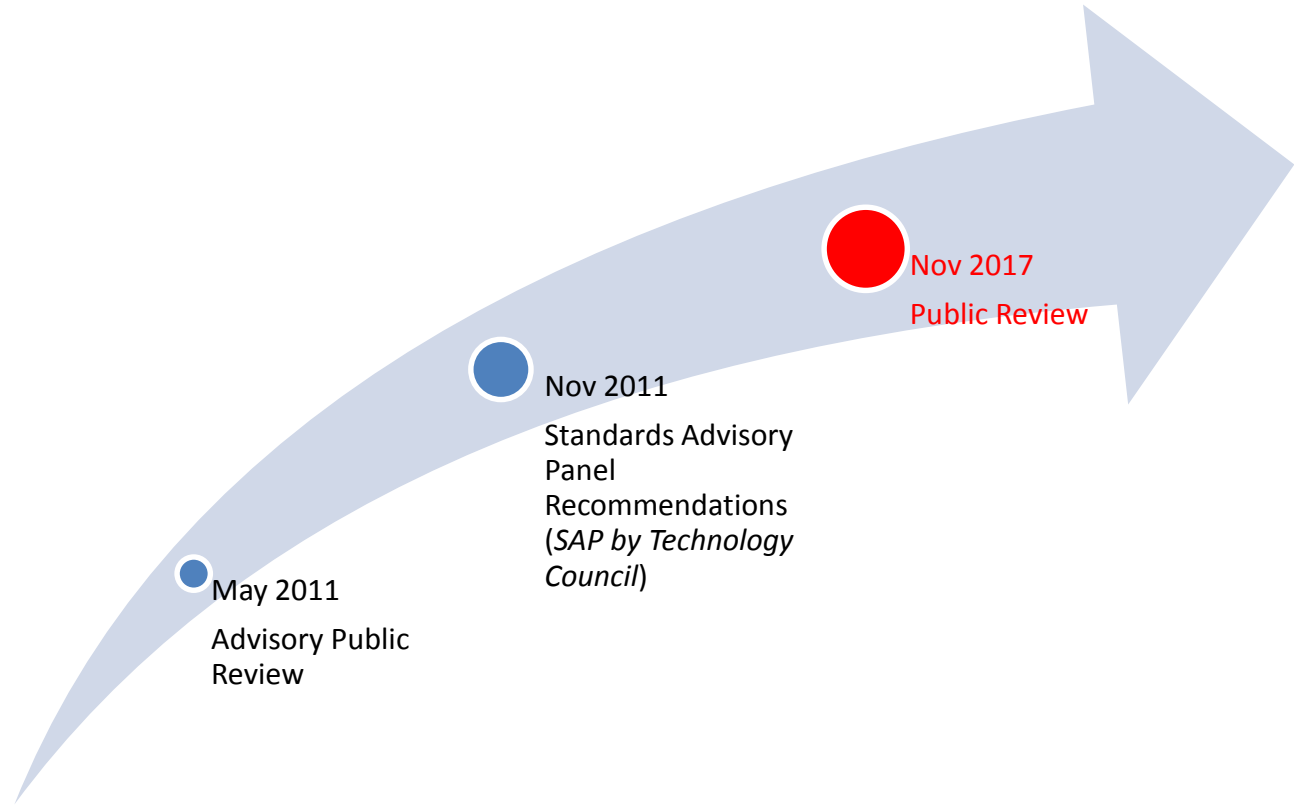
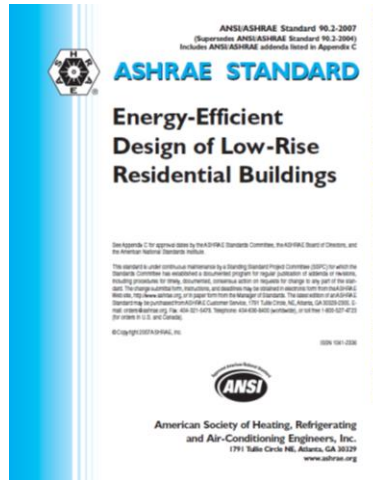


*"The recommendations by the 90.2 SAP are based on the following guiding principle: At the low end, 90.2 could simply echo the IECC minimum energy efficiency levels. This is of questionable value and does not address the concern of the lack of relevancy of 90.2 in the industry. At the high end, 90.2 could become a higher performance residential building standard similar to ASHRAE Standard 189.1 (which addresses broader aspects of sustainability). In part due to the need of organizations like DOE and NFPA to have a "minimum" energy efficiency standard suitable for code adoption, this was perceived as too far of a stretch for 90.2. Therefore, 90.2 should be in between these two degrees. This entails defining the "minimum" energy efficiency as more stringent than the IECC minimums, expanding the focus to include the energy aspects of providing comfort and indoor environmental quality, and striving to take appropriate steps toward the long-term (in the 2030 time frame) goals of higher performance and net-zero or near zero energy buildings."*

## Standards Advisory Panel Recommendations

1. International leadership standard
  2. On the path of supporting the ASHRAE Board of Directors vision for net zero or near zero energy buildings (NZEB) by 2030 → current revision 50% improvement relative to a 2006 IECC baseline
  3. Address the energy aspects related to indoor environmental quality including comfort, moisture control, and indoor air quality
  4. Should not generally address the broad subject of sustainability.
  5. Consider the energy aspects of meeting residential water needs
  6. Incorporate requirements that use cost effectiveness as a significant criterion
  7. Incorporate appropriate field performance metrics to measure compliance during construction
  8. Easy to use and easy to enforce
  9. Evaluate an alternate compliance path that considers the application of energy use intensity (EUI) as the energy criteria
  10. Evaluate the inclusion of plug and process loads
  11. Evaluate the use of renewable energy alternatives
- 
12. ASHRAE should pursue securing funding for determining the economic criteria and performing the analysis required for SSPC 90.2 to measure energy efficiency improvements.
  13. ASHRAE should consider establishing an AEDG working group to develop recommendations for Residential Buildings that go well beyond Standard 90.2 minimum performance requirements.

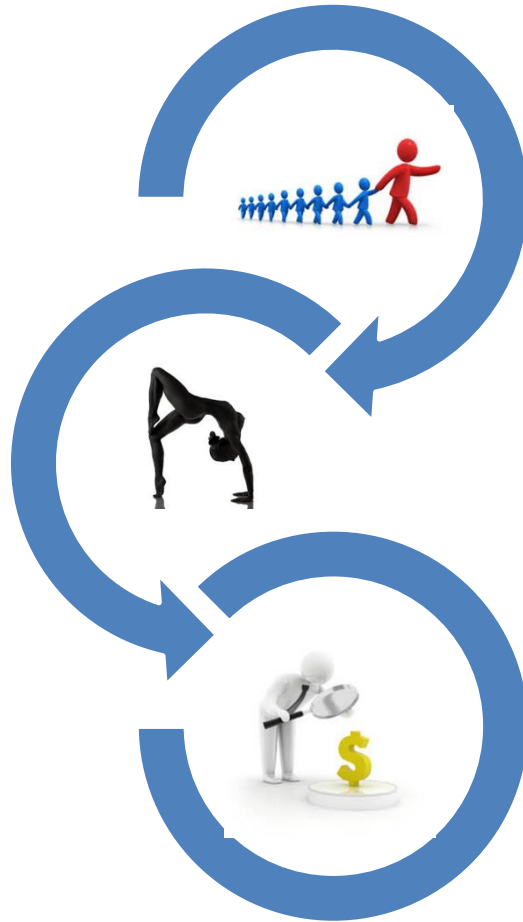





May 2011  
Advisory Public Review

Nov 2011  
Standards Advisory Panel Recommendations (SAP by Technology Council)

Nov 2017  
Public Review





BSR/ASHRAE/IES Standard 90.2-2007R  
a revision to ANSI/ASHRAE/IES Standard 90.2-2007

**First Public Review Draft**  
**Proposed Standard 90.2-2007R,**  
***Energy-Efficient Design of Low-Rise Residential Buildings***

**First Public Review (November 2016)**  
**(Complete Draft for Full Review)**

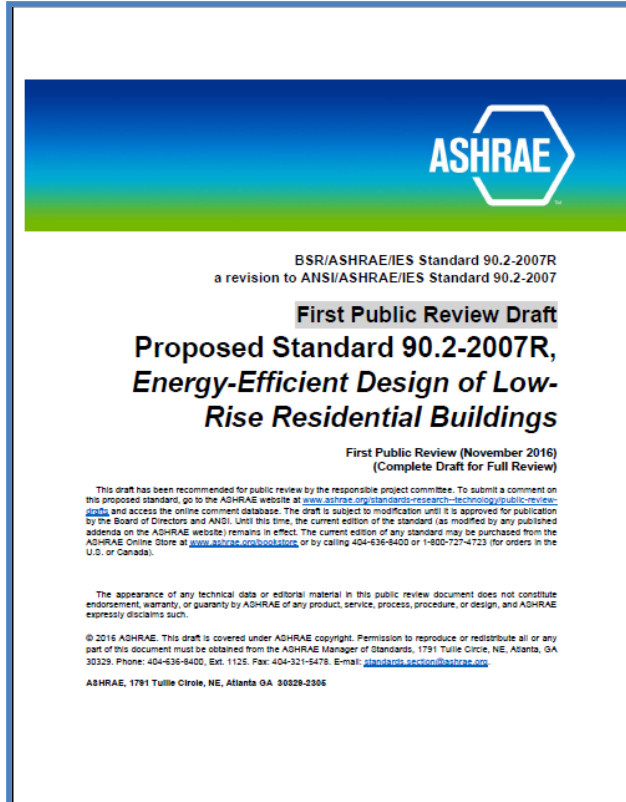
This draft has been recommended for public review by the responsible project committee. To submit a comment on this proposed standard, go to the ASHRAE website at [www.ashrae.org/standards-research-technology/public-review-drafts](http://www.ashrae.org/standards-research-technology/public-review-drafts) and access the online comment database. The draft is subject to modification until it is approved for publication by the Board of Directors and ANSI. Until this time, the current edition of the standard (as modified by any published addenda on the ASHRAE website) remains in effect. The current edition of any standard may be purchased from the ASHRAE Online Store at [www.ashrae.org/bookstore](http://www.ashrae.org/bookstore) or by calling 404-636-8400 or 1-800-727-4723 (for orders in the U.S. or Canada).

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ASHRAE, 1791 Tullie Circle, NE, Atlanta GA 30329-2306

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# 90.2 ANSI/ASHRAE 90.2-2007R Energy Efficient Design of Low Rise Buildings

Public Review completed December 2016 - Review Comments being considered by the Project Committee.

Key attributes of new Standard 90.2:

**Revised Title, Purpose and Scope –now covers manufactured housing**

**BSR/ASHRAE/IES Standard 90.2-2007R a revision to ANSI/ASHRAE/IES Standard 90.2-2007 - Energy-Efficient Design of Low-Rise Residential Buildings**

**Section 1 Purpose**

1. **Purpose.** The purpose of this standard is to establish the minimum whole-building energy performance requirements for energy efficient residential buildings.

**Section 2 Scope**

2. **Scope.** This standard provides the minimum design, construction and verification requirements for new residential buildings and their systems and new portions of existing residential buildings and their systems that use renewable and non-renewable forms of energy.

**2.1. Buildings and portions of buildings covered:**

- a. one- and two-family dwelling units, and
- b. multi-family structures of three stories or fewer above grade
- c. outbuildings

**2.2. Systems covered:**

- a. building envelope,
- b. HVAC and mechanical systems,
- c. service hot water systems,
- d. major appliances,
- e. lighting systems,
- f. snow and ice melt systems, and
- g. pools and spas

**2.3. Exemptions.** This standard does not apply to:

- a. specific procedures for the operation, maintenance, and use of residential buildings;
- b. “transient” housing, such as hotels, motels, nursing homes, jails, dormitories and barracks.

**2.4. Health, safety, and welfare.** This standard shall not be used to abridge any safety, health, or environmental requirements.

Proposed

# 90.2 ANSI/ASHRAE 90.2-2007R Energy Efficient Design of Low Rise Buildings

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Key attributes of new Standard 90.2:

Revised Title, Purpose and Scope –now covers manufactured housing

**Residential building energy performance that is at least 50% more efficient than the energy efficiency defined by the 2006 IECC.**

	IECC 2006	IECC 2009	IECC 2012	IECC 2015
<b>DOE Goal Improvement</b>	Baseline	17%	30%	50%
<b>DOE Actual Determination</b>	Baseline	14%	32%	34%

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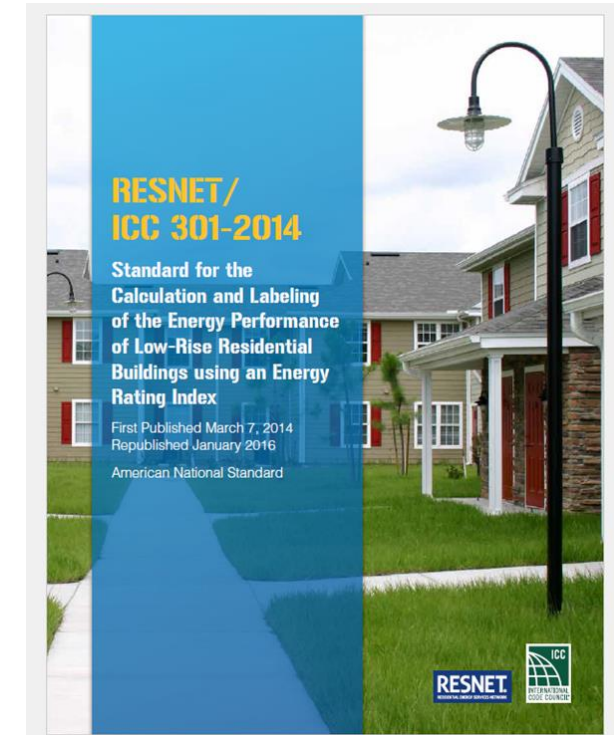
References both Standards 301 and 380

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**Performance based with a rule-set is based on ANSI/ICC/ RESNET 301 with specific exceptions and with adjustments for building size.**



# 90.2 ANSI/ASHRAE 90.2-2007R Energy Efficient Design of Low Rise Buildings

**Table 5.15-1: Maximum *Energy Rating Index* for Compliance with this Standard**

Climate Zone	<i>Energy Rating Index</i>
0	43
1	43
2	45
3	47
4	47
5	47
6	46
7	46
8	45

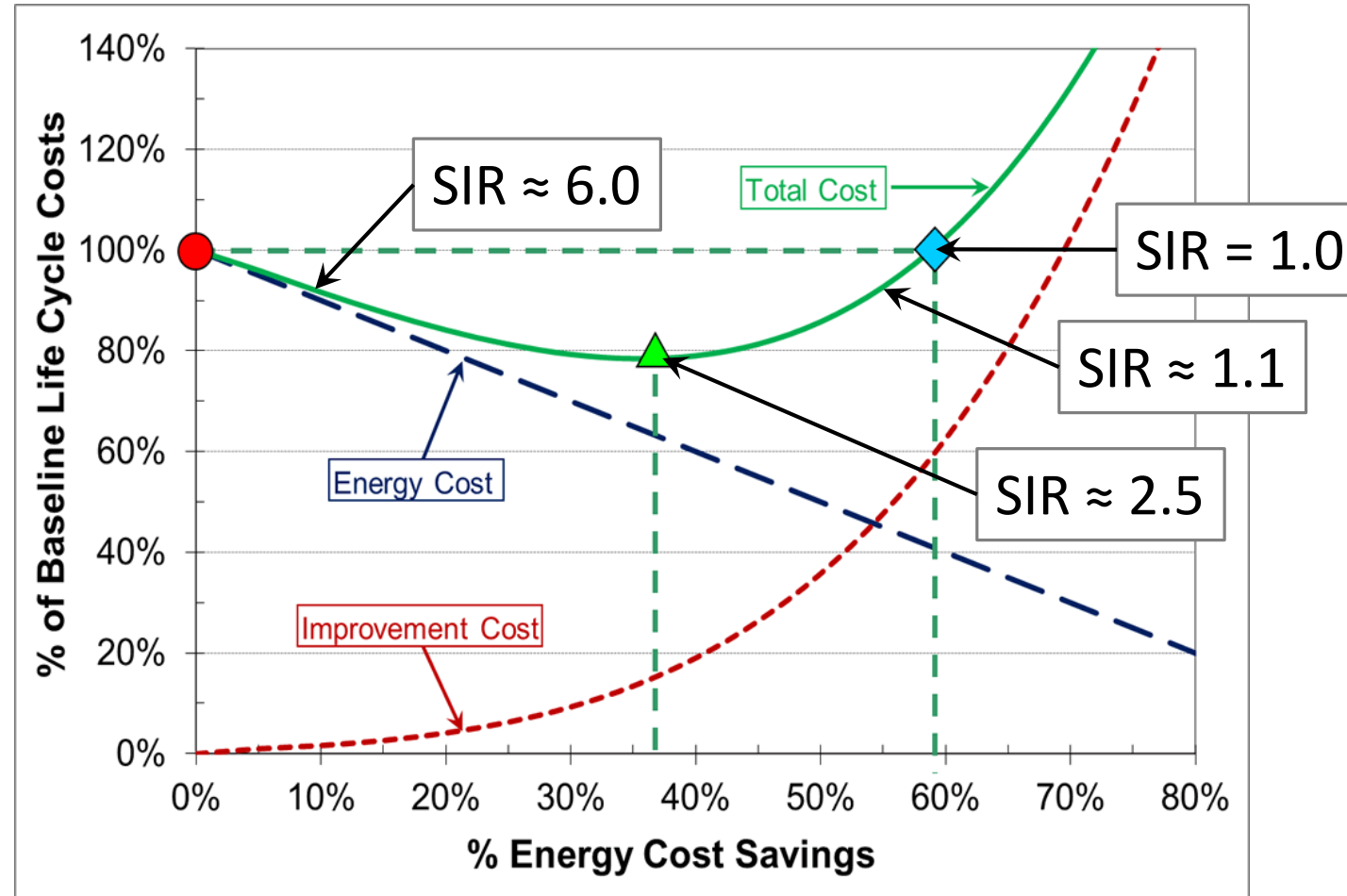
Proposed



## Goal: Maximize Energy Efficiency

- Using Life Cycle Cost (LCC) analysis, determine the maximum levels of energy efficiency that are cost effective to the consumer using:
  - SSPC 90.2-adopted economic parameters
  - SSPC 90.2-adopted national average energy prices
  - DOE *Building America* source energy multipliers
  - 30-year Life-Cycle Cost analysis using Duffie & Beckman P1,P2 method (Present Worth Factors)
- Whole-home LCC analysis (including lighting, appliances and miscellaneous energy use)
- Target LCC Savings/Investment Ratio (SIR): 1.0-1.1

# General Life Cycle Cost (LCC) Theory



Fairey, P. (2015), "Maximum Energy Efficiency Cost Effectiveness in New Home Construction." Report No. FSEC-RR-584-15, Florida Solar Energy Center, Cocoa, FL ([www.fsec.ucf.edu/en/publications/pdf/FSEC-RR-584-15.pdf](http://www.fsec.ucf.edu/en/publications/pdf/FSEC-RR-584-15.pdf))

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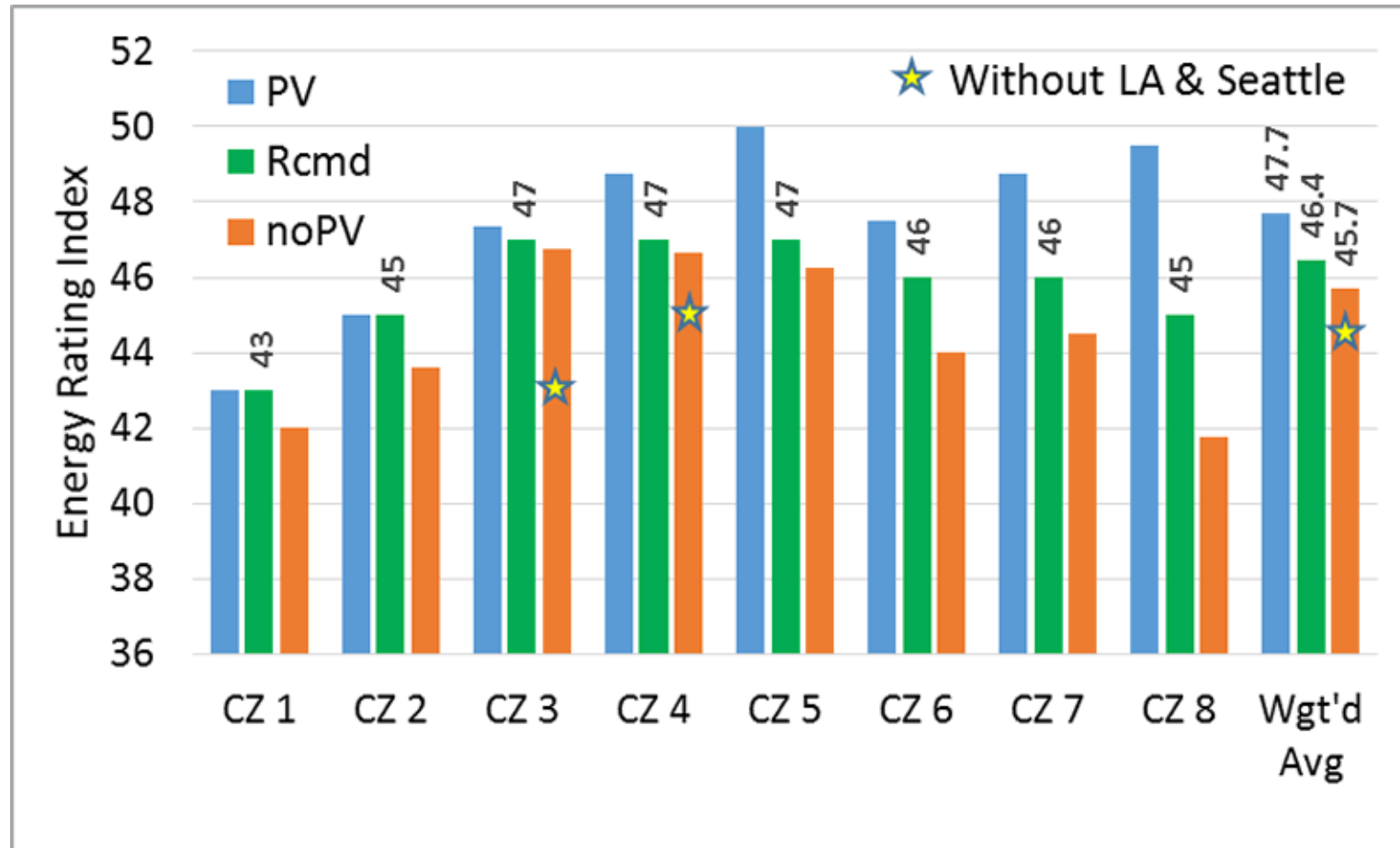
**Informative appendix on producing prescriptive paths**



## 90.2 ERI Compliance Analysis

- Two options evaluated:
  - NAECA Minimum heating, cooling and hot water equipment with on-site power production
  - Alternative Equipment (and improved envelope) without on-site power production
- Both options have additional requirements that significantly exceed the minimum requirements of the 2015 IECC.
- Both options seek to achieve energy cost savings of ~50% over the 90.2 Reference Design

# Recommended Compliance ERIs



# 90.2 ANSI/ASHRAE 90.2-2007R Energy Efficient Design of Low Rise Buildings

Key attributes of new Standard 90.2:

**Building envelope - Certified performance of insulation, fenestration and envelope air sealing are prioritized. Testing and verifying the envelope air leakage is mandatory.**

Mechanical systems –

- Proper sizing and verification of duct system performance, as well as having all ductwork within conditioned space are fundamental to these objectives.
- Plumbing system design, insulation levels and controls
- Requirements for HVAC system design, installation, commissioning and verification.

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## 90.2 ANSI/ASHRAE 90.2-2007R Energy Efficient Design of Low Rise Buildings

Key attributes of new Standard 90.2:

### **Lighting systems –**

- **Revised modeling rules for quantifying residential lighting energy,**
- **Credits for the use of vacancy sensors, dimmers and other control devices**
- **Revised lighting allowances for interior, exterior, garage and other residential lighting.**

On-site power systems – This Standard recognizes the important role of renewable energy and on-site power systems to help achieve the building performance targets. It emphasizes load minimization and HVAC performance strategies first so that any on-site power systems used can have maximum impact toward the overall building performance goals.



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# Acknowledgements

SSPC 90.2

Past Chairs of SSPC 90.2

- Merle McBride
- Phillip Fairey

ASHRAE Residential Building Committee



Thank you for your attention.



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