U.S. DEPARTMENT OF ENERGY

PNNL-20103

Prepared for the U.S. Department of Energy
under Contract DE-AC05-76RL01830

Comparison of the National Green Building Standard (ICC 700-2008) and LEED for Homes to the Residential Provisions of the 2009 IECC for the Delaware Green for Green Program

M Britt
E Makela

January 2011

Pacific Northwest
NATIONAL LABORATORY

Proudly Operated by Battelle *Since 1965*

DISCLAIMER

PACIFIC NORTHWEST NATIONAL LABORATORY
operated by
BATTELLE
for the
UNITED STATES DEPARTMENT OF ENERGY
under Contract DE-AC05-76RL01830

Printed in the United States of America

Available to DOE and DOE contractors from the
Office of Scientific and Technical Information,
P.O. Box 62, Oak Ridge, TN 37831-0062;
ph: (865) 576-8401
fax: (865) 576-5728
email: reports@adonis.osti.gov

Available to the public from the National Technical Information Service,
U.S. Department of Commerce, 5285 Port Royal Rd., Springfield, VA 22161
ph: (800) 553-6847
fax: (703) 605-6900
email: orders@ntis.fedworld.gov
online ordering: http://www.ntis.gov/ordering.htm


This document was printed on recycled paper.
(9/2003)

PNNL-20103

Comparison of the National Green Building Standard (ICC 700-2008) and LEED for Homes to the Residential Provisions of the 2009 IECC for the Delaware Green for Green Program

M Britt
E Makela

January 2011

Prepared for
U.S. Department of Energy
Energy Efficiency and Renewable Energy
Office of Weatherization and Intergovernmental Projects
Technical Assistance Program
under Contract DE-AC05-76RL01830

Pacific Northwest National Laboratory
Richland, Washington 99352

Summary

Adhering to Delaware's Green for Green program specifications results in homes being built to more energy-efficient levels than the 2009 IECC levels. Specifically:

- Certifying at the Silver Performance Level for the ICC 700 standard using either the Prescriptive or Performance Paths will result in a residential building that is more efficient than if the building only complied with the 2009 IECC.
- Certifying at the Silver level under LEED for Homes standard, including mandatory compliance with ENERGY STAR 2006 and earning two additional energy points will result in a residential building that is more efficient than if the building only complied with the 2009 IECC.
- Those features designated as **Mandatory in the IECC** in Table 1 must be complied with to be in compliance with the 2009 IECC.

Contents

Tables

1.0 Introduction

The state of Delaware has launched a residential green program—Delaware Green for Green (G4G)—that provides incentives for buildings certified under one of two third-party verification programs: the National Green Building Standard (ICC 700-2008) or the USGBC LEED for Homes (LEED H). In both cases the homes must be certified at the Silver level (as defined by points earned for criteria met). The ICC 700 Silver Performance Level requires a minimum of 60 points earned by satisfying specific green building criteria delineated under Energy Efficiency (Chapter 7) in addition to complying with other features that can improve the energy efficiency of the house, as set forth under Resource Efficiency (Chapter 6), Water Efficiency (Chapter 8), and Indoor Environmental Quality (Chapter 9). LEED H requires compliance with EPA's Energy Star 2006, and scoring two points under Energy and Atmosphere section.

The provisions of ICC 700-2008 and LEED H were reviewed, and compared to the 2009 IECC to determine whether a residential building meeting the requirements of these programs at the Silver levels as specified by Delaware's G4G program will result in a building that is more energy efficient than a building built only to the 2009 IECC.

The energy-efficiency provisions contained in ICC 700 and LEED H at the specified Silver levels and those in the 2009 IECC were compared side-by-side. The review of ICC 700 focused on Energy Efficiency (Chapter 7), while the review of LEED H focused on the Energy and Atmosphere section, including the mandated ENERGY STAR 2006. Both programs were compared to the similar residential provisions contained in Chapter 4 of the 2009 IECC. The detailed results of the comparison are tabulated in Appendix A of this report.

2.0 Findings

Complying with the Silver Performance Level for ICC 700 using either the Prescriptive or Performance Paths will result in a residential building that is more energy-efficient than if the building only complied with the 2009 IECC.

Complying with Energy Star for 2006, referenced in LEED H, in addition to earning two additional energy points will result in a residential building that is more energy-efficient than if the building only complied with the 2009 IECC.

2.1 ICC-700 Certification. Either the Prescriptive or Performance Path may be used to certify as ICC 700 Silver Performance Level. Both paths require adherence to Mandatory Practices (Section 701.4). Those features designated as Mandatory in the IECC in Table 1 must be complied with to be consistent with the IECC.

Prescriptive Approach:

1. Comply with the Mandatory Practices in Section 701.4.
2. Select 60 points from Green Building Practices options that include, but are not limited to, the following features:
    - Section 703.1.1 (Points for meeting minimum UA threshold for percent above the 2006 IECC)
    - Section 703.2 (Insulation and Air Sealing – no third-party verification performed)
    - Section 704.2 (Lighting and Appliances)
    - Section 704.4.4 (Ductwork in conditioned space), or
    - Section 704.6.2.2 (Test Duct System)
    - Section 703.4 (HVAC Equipment Efficiency)

Performance Approach:

1. Show an energy cost performance level of at least 30% better than a comparable building constructed to the 2006 IECC. (Note that the 2009 IECC is approximately 15% more efficient than the 2006 IECC).
2. Comply with the Mandatory Practices in Section 701.4.

2.2 LEED H Certification. The Performance for Energy Star Homes path is a prerequisite for meeting the Energy and Atmosphere requirements. This prerequisite requires the home to score a HERS (Home Energy Rating System)rating of 85 or less (based on the 2004 IECC) and meet the additional requirements outlined below.

1. The building must score a HERS rating of 85 or less (15% more efficient than the 2004 IRC/2006 IECC). Note that the requirements in the 2004 IRC are identical to those in the 2006 IECC. The 2006 IECC is approximately 15% less efficient than the residential provisions of the 2009 IECC. In addition to achieving the required HERS rating the building envelope must meet maximum air leakage requirements that are more stringent than the 2009 IECC and duct leakage requirements that are as efficient, if not more efficient, than the 2009 IECC.

2. Air sealing and insulation installation must meet the Thermal By-Pass checklist, and ducts must meet a maximum air leakage rate unless the duct systems are located within conditioned space and the building thermal envelope does not exceed 3 ACH 50 air leakage.
3. Two additional Energy and Atmosphere requirements must be met to increase the efficiency of the project and earn the associated two additional points.

Appendix A

Appendix A

The two tables in this section describe the energy-efficiency features that are comparable to the 2009 IECC that are included in ICC 700 (Table 1) and LEED for Homes/ENERGY STAR 2006 (Table 2). Each table lists brief descriptions of the requirement and indicates whether the provision meets the minimum requirement as listed in the 2009 IECC. Use of NA in the tables indicates that there is no comparable provision in the IECC.

Table A-1. ICC 700 Comparison Table

National Green Building Standard Provision	Description	Compliance with the 2009 IECC
CHAPTER 6 – RESOURCE EFFICIENCY		
601.1	Requires that houses over 4,000 ft^2 in conditioned floor area increase the energy-efficiency requirements	Exceeds. No similar requirement in the IECC.
CHAPTER 7 – ENERGY EFFICIENCY		
MANDATORY REQUIREMENTS		
701.4.1.1	Space heating sized in accordance with ACCA Manual J	Compliant. Mandatory in the IECC.
701.4.1.2	Size radiant or hydronic space heating in accordance with ACCA Manual J or approved equivalent	Compliant. Mandatory in the IECC.
701.4.2.1	Ducts sealed with approved sealant devices	Compliant. Mandatory in the IECC.
701.4.2.2	Building cavities not used as supply ducts	Compliant. Mandatory in the IECC.
701.4.3.1	Insulation installed in accordance with manufactures installation instructions or local code; shafts sealed (more of an IRC issue than an IECC issue based on description).	Compliant. Mandatory in the IECC.
701.4.3.2	Floor insulation to maintain permanent contact with subfloor; crawlspace wall insulation installation and continuous vapor retarder overlapped and sealed on floor of crawlspace	Compliant. Mandatory in the IECC.
701.4.3.3	Sealing around windows and doors; band and rim joists insulated and air sealed; bottom plate sealed; skylight shafts and kneewalls insulated in accordance with exterior wall requirements	Compliant. Mandatory in the IECC.

National Green Building Standard Provision	Description	Compliance with the 2009 IECC
701.4.3.4	Attic access door is covered with insulation. Kneewall door is an insulated unit or covered by insulation.	Not compliant with the IECC. Does not specify that attic access must be insulated to the same R-value as the surrounding assemblies. Kneewall doors are required to meet the same R-value as the attic kneewall. **Mandatory in the IECC.**
	Air–tight baffles installed on all eave vents	Exceeds. Not in the IECC
	Can lights are IC rated;	Compliant. **Mandatory in the IECC.**
701.4.4	Maximum vertical fenestration U-factor of U-0.35; maximum skylight and tubular daylighing devices, U-factor of U-0.60; exemption of 15 ft^2 of glazing area	Compliant. Consistent with the prescriptive path in the IECC.
PERFORMANCE PATH		
702	Performance Path	Compliant if improved heating/cooling and water-heating equipment efficiency is not used as a trade-off. If improved equipment efficiency is used to reduce other energy efficiency measures below what the 2009 IECC requires, the building does not comply with the 2009 IECC, although the code official could potentially approve the building via the Section 102.1.1 Above Code Programs option in the IECC.
PRESCRIPTIVE APPROACH		
703.1.1	Building Envelope Prescriptive Path exceeds the 2006 IECC on a UA standpoint by 10% to obtain 14 points.	Compliant. Note that the insulation R-value requirements are identical between the 2006 and 2009 IECC. Fenestration U-factor for the 2009 is equivalent to mandatory window U-factor requirement under ICC 700. UA approach assumes Grade-1

National Green Building Standard Provision	Description	Compliance with the 2009 IECC
		insulation installation. Can only use insulation and fenestration to achieve the 10% UA permitted under Section 102.1.1, Above Code Programs.
703.2	Insulation and air sealing; 15 points with third-party verification.	Exceeds. This is consistent with IECC Table 402.4.2, however the IECC does not require third-party verification.
703.3	Fenestration – 5 to 10 points for improved U-factor	Exceeds prescriptive path. Compliant with UA alternative (Section 703.1.1)
703.4/703.5	HVAC equipment efficiency / DHW efficiency/exhaust fan efficiency; 8–10 points for improved furnace; 2 – 4 points for improved air conditioner.	Exceeds. More efficient than NAECA minimum and would exceed the 2009 IECC if these options are taken.
704.2	Lighting and appliances additional packages; 4 – 8 points.	Compliant if option selected for 50% installed lighting fixtures must be Energy Star to meet high-efficacy lighting requirement. Note that this additional practice must be selected to meet the 2009 IECC. **Mandatory in the IECC.**
704.2.2	Recessed light fixtures that penetrate the thermal envelope are less than 1 per 400 ft^2; 2 points	Exceeds
704.2.3	Occupancy sensors are installed on indoor lights and photocell controls installed on exterior lights; 2 or 4 points	Exceeds. No comparable requirement in the IECC
704.2.4	Tubular daylighting devices or skylights installed in rooms with no windows; 2 points	Exceeds. No comparable requirement in the IECC
704.2.5 / 704.6 / 704.2.7	Energy Star appliances installed; induction cooktop is installed; occupancy sensors on 80% of the hard-wired lighting outlets; 2 – 5 points	Exceeds. No comparable requirement in the IECC
704.3	Renewable energy and solar heating and cooling; 1 – 13 points	Exceeds. No comparable requirement in the IECC. Credit can be taken using a performance-based approach in the IECC.
704.4.1	Duct system sized and designed in accordance with ACCA Manual D; 5	N/A. IRC Chapter 16 references this requirement

National Green Building Standard Provision	Description	Compliance with the 2009 IECC
	points	
704.4.2/704.4.3	Space heating and cooling provided by ductless systems; 15 – 30 points	Exceeds. No comparable requirement in the IECC
704.4.4	Ductwork located in conditioned space; 12 points	Compliant. This option must be selected to be consistent with 2009 IECC unless the system is tested. **Mandatory in the IECC unless testing is conducted.**
704.4.5	Install return ducts or transfer grilles in every room; 5 points	Exceeds. No comparable requirement in the IECC
704.5	HVAC design and installation; 1 to 9 points	Exceeds. No comparable requirement in the IECC
704.6.1	Installation and third-party verification of duct sealing, building envelope air sealing, insulation installation, and installation of doors and windows; 5 points	Compliant. Similar to IECC Section 402.4.2.2 except that sampling is not allowed. **Mandatory in the IECC unless air leakage testing is conducted for the envelope.**
704.6.2	Envelope air leakage testing; 3 – 15 points	Compliant. This option exceeds the option in the IECC for 7 ACH 50. **Mandatory in the IECC unless a visual inspection is conducted.**
704.6.2.2	Test duct system; 5 – 15 points	Compliant. This option must be selected for ducts located in unconditioned space. 4 ACH50 must be selected if system is tested w/o air handler installed. **Mandatory in the IECC unless ducts located in conditioned space.**
704.6.2.3	Balanced HVAC airflows – 8 points	Exceeds. No comparable requirement in the IECC
705.1	Energy consumption control ; 2 – 7 points	Compliant. The IECC requires a programmable thermostat. At a minimum, a programmable communicating thermostat must be installed to meet this requirement if a standard programmable thermostat is not installed. **Mandatory in the IECC.**
705.2	Renewable energy is provided to the building through a renewable energy service plan; 2 – 5 points	Exceeds. No comparable requirement in the IECC

National Green Building Standard Provision	Description	Compliance with the 2009 IECC
CHAPTER 9 INDOOR ENVIRONMENTAL QUALITY		
MANDATORY REQUIREMENTS		
901.3	Wall between the house and garage provides an air barrier and door is weatherstripped and sealed. – 4 to 10 points	Compliant. **Mandatory in the IECC.**

Table A-2. LEED for Homes/Energy Star 2006 Comparison Table

ENERGY STAR MODELING OPTION			
Building Feature	**2009 IECC**	**ENERGY STAR REQUIREMENTS**	**LEVEL OF STRINGENCY VS. 2009 IECC**
	15% more efficient than the 2004 IRC/2006 IECC.	HERS Rating ≤ 85 based on 2004 IRC (155 more efficient than the 2004 IECC)	Same
Envelope Air Leakage	7 ACH 50 or visual inspection option	Thermal By-Pass Checklist	Same
Ductwork	8 cfm/100 ft^2 post construction; 6 cfm/100 ft^2 rough-in, or ducts in conditioned space	6 cfm/100 ft^2, or ducts in conditioned space and envelope ≤ 3 ACH 50	More

Pacific Northwest
NATIONAL LABORATORY

U.S. DEPARTMENT OF
ENERGY

902 Battelle Boulevard
P.O. Box 999
Richland, WA 99352
1-888-375-PNNL (7665)
www.pnl.gov