BUILDING ENERGY CODES PROGRAM

Setting the Standard

U.S. Department of Energy • Office of Energy Efficiency and Renewable Energy

November 2007

Highlights: Energy Codes 2007

Energy Codes 2007 was held in Pittsburgh, Pennsylvania, July 24–27, 2007, at Pittsburgh's only riverfront hotel, the Sheraton Station Square Hotel.

In total, 235 participants represented energy-related organizations from 40 states and territories, including staff from state energy offices, utilities, energy code consultants, energy-efficiency advocacy groups, industry and trade associations, builders, and model code organizations. In addition, 240 individuals attended pre- and post-training.

Energy Codes 2007 provided an opportunity to learn about a wide variety of energy codes- and standards-related topics and to network face-to-face through formal and informal meetings, allowing states and other stakeholders to share challenges and successes. The U.S. Department of Energy (DOE) sponsored the event, and DOE's National Energy Technology Laboratory served as host.

The agenda included training about ANSI/ASHRAE/IESNA[1] 90.1-2004 and Pennsylvania Residential Energy Code Enforcement as well as green building tours featuring the PNC Firstside Center, David L. Lawrence Convention Center, Blackbird Lofts & Artist Studios, Eastside 2 Building B & C, The Robert L. Preger Intelligent Workplace, and Summerset at Frick Park. Two days of sessions included plenary and three technical tracks (residential, commercial, and code adoption and implementation).

See all presentations from Energy Codes 2007, the final agenda, and an attendees list at www.energycodes.gov/news/ecodes2007/index.stm.

[1] The American National Standards Institute/American Society of Heating, Refrigerating and Air-Conditioning Engineers/Illuminating Engineering Society of North America

1. Participants examined under-floor heating and cooling system vents at the Robert L. Preger Intelligent Workplace at Carnegie Mellon University.
2. IBACOS provided tour highlights for the Summerset Land Development located on a former brownfield.
3. Participants viewed the latest technologies at Carnegie Mellon University, including placement techniques for air-quality control such as CO_2 sensors.
4. David L. Lawrence Convention Center, the first LEED-certified (Gold) convention center, highlights included a tour of gray water recycling and exterior lighting techniques.
5. The Pittsburgh skyline was viewed by the Energy Codes 2007 tour participants.
6. The David L. Lawrence Convention Center tour also highlighted energy and environmentally friendly design and construction, including extensive daylighting and controls.

John Hogan Receives Jeffrey A. Johnson Award

John Hogan

John Hogan, of the Seattle Department of Planning and Development, was presented the Jeffrey A. Johnson Award for Excellence in the Advancement of Building Energy Codes and Performance at the U.S. Department of Energy Building Energy Codes Program's (BECPs) annual training event, Energy Codes 2007, held in Pittsburgh, Pennsylvania, July 2007.

This annual Award, instituted in 2006 in memory of Jeffrey A. Johnson, recognizes a leader or team in the United States for sustained service of the highest caliber in the pursuit of energy efficiency goals.

Mr. Hogan is a Senior Code Development Analyst and has been working with the City of Seattle in the energy codes arena for over 25 years. He has been involved with ANSI/ASHRAE/IESNA[2] Standard 90.1 for approximately 15 years and is the former chair of the Envelope Subcommittee of ASHRAE Standing Standards Project Committee 90.1. Mr. Hogan is currently the Chair of ASHRAE Standard Project Committee 189, Design of High-Performance Green Buildings Except Low-Rise Residential Buildings.

Representatives from the U.S. Department of Energy, BECP, the New Buildings Institute, the Northeast Energy Efficiency Partnerships, the California Energy Commission, and the building codes industry participated in establishing the criteria and selecting this year's award recipient. Some comments from these representatives, illustrating Mr. Hogan's achievements follow.

- *John has played a critical role in developing progressive building energy codes in the City of Seattle over the last two decades.*
- *John has done an incredible job working in innumerable forums. He has had a direct, personal, and influential impact on California's building energy efficiency standards.*
- *Recently, John has been very visible in taking us all in the direction of a new generation of energy efficiency standards through his chairmanship of ASHRAE 189.*
- *John is unique – I know no other building official who comes close to having as much expertise and passion as John about energy efficiency codes.*
- *John is particularly strong in the area of impacts (energy savings), as much of his work has had national results.*

[2] The American National Standards Institute/American Society of Heating, Refrigerating and Air-Conditioning Engineers/Illuminating Engineering Society of North America

Raising the Standard of Energy Efficiency

The July 2007 issue of *Setting the Standard* featured the first in what will be a series of articles discussing the U.S. Department of Energy's (DOE) partnership with the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) to increase the efficiency of ANSI/ASHRAE/IESNA[3] Standard 90.1-2010 by 30% relative to Standard 90.1-2004.

In response to ASHRAE's acceptance of DOE's challenge to incorporate greater energy efficiency measures into the Standard, DOE offered to provide technical assistance. DOE and ASHRAE Standing Standards Project Committee (SSPC) 90.1 assessed what they would need to meet the challenge, and identified a number of ways that DOE's BECP could contribute. This article discusses BECP's work with ASHRAE in detail.

Energy Simulations for ASHRAE SSPC 90.1's Mechanical and Envelope Subcommittees

Both the mechanical and envelope subcommittees needed a large number of building energy simulations to assist them in making decisions. The mechanical subcommittee needed to develop a spreadsheet decision-making tool that would allow it to quickly decide which opportunities for energy savings to pursue initially and which to address later. The inspiration for this decision-making tool was the spreadsheet developed by the envelope subcommittee for calculating opaque envelope and fenestration requirements. The tool was based on performance characteristics and estimated first costs of various envelope components. It also contained a series of economic assumptions agreed to by the full committee. The envelope subcommittee needed the regression equations in its existing spreadsheet updated based on new simulations.

To assist both subcommittees' needs, BECP will perform simulations (currently estimated to be in the thousands) using an agreed upon, consistent set of assumptions and DOE's EnergyPlus building energy simulation engine. Taking the approach used in support of the ASHRAE Advanced Energy Design Guides (AEDGs), a small working group with members from both the mechanical and envelope subcommittees was formed to help advise and direct these simulation efforts. Ron Jarnagin, former chair of SSPC 90.1, former chair of ASHRAE AEDG-Small Office committee, and former ASHRAE board member, is leading BECP's simulation efforts. Merle McBride and Richard Liesen of Owens-Corning are working with Ron in this effort.

[3] The American National Standards Institute/ASHRAE/Illuminating Engineering Society of North America

ASHRAE's Standard 90.1-2010 will increase the energy efficiency of commercial buildings by 30% relative to Standard 90.1-2004.

Current Practice for Controls and Equipment Cost Databases for ASHRAE SSPC 90.1's Lighting Subcommittee

The lighting subcommittee has historically explicitly not used economic analysis to generate its lighting power density (LPD) requirements. Though the mechanical and envelope subcommittees grapple with the concern that some requirements could save energy but not necessarily be cost-effective, the lighting subcommittee has always believed that the commonly available energy-efficient lighting technologies used as the basis for LPD requirements are cost-effective in almost all applications.

However, as lighting requirements have become increasingly more stringent in new versions of Standard 90.1, and as more control requirements (using more costly and specialized equipment) are proposed, the lighting subcommittee felt the need to look more closely at the cost-effectiveness of its requirements. This will also have the benefit of keeping them synchronized with the requirements in the mechanical and envelope subcommittees.

The lighting subcommittee is also taking a renewed interest in more advanced lighting control requirements. Though there are already lighting control requirements in Standard 90.1, the subcommittee believes that if additional savings are going to come from the lighting section of the Standard, those savings are more likely to come from additional control requirements rather than from lowered LPD allowances.

Eric Richman, chair of the ASHRAE SSPC 90.1 lighting subcommittee, is leading BECP's efforts in the development of two databases for use by the lighting subcommittee—one for current practice for controls and one for lighting equipment costs.

Learn more about EnergyPlus at www.eere.energy.gov/buildings/energyplus.

Economizer Requirements in IECC 2006 – Code Notes

The 2006 International Energy Conservation Code® (IECC) requires cooling systems in commercial buildings to have economizers, depending on climate zone and cooling system capacity. Economizers save cooling system energy by using outdoor air to cool a building when outdoor conditions are favorable. This is accomplished with sensors and controls that increase the percentage of outside air that is brought inside when the outside air temperature or enthalpy is low enough to help meet the building's cooling load. If the outside air temperature or enthalpy is low enough to meet the entire cooling load, the controls should prevent mechanical cooling operation.

In the 2006 IECC, an integrated air economizer is required for all cooling systems with cooling capacity exceeding 54,000 BTU/h, except in Climate Zones 5A and 6A, where economizers are required only when the cooling capacity exceeds 135,000 BTU/h. Economizers are not required in Climate Zones 1A, 1B, 2A, 3A, 4A, 7 and 8. These climate zones represent extremely hot and humid or cold areas, where the first cost of economizers would not be offset by energy cost savings.

IECC 2006 provides the following exemptions to economizer requirements:

1. Economizers are not required in certain climate zones if the cooling equipment efficiency exceeds minimum requirements as follows: by 10 percent in Zone 2B; by 15 percent in Zone 3B; or by 20 percent in Zone 4B. In these climates and beyond these efficiency thresholds, the increased efficiency of the cooling offsets the potential energy savings of the economizers.
2. Economizers are not required for cooling systems with air or evaporatively cooled condensers and serving spaces with open-case refrigeration. The excess latent load imposed on open-case refrigeration offsets or negates the energy savings from the excess outdoor air.
3. Economizers are not required for cooling systems with air or evaporatively cooled condensers when the outside air pollutants require unusual outside air filtration to meet the minimum outdoor air-ventilation and air-quality requirements of Section 403.3 of the International Mechanical Code.® This recognizes the fact that the added cost of expensive gas-phase filtration systems would reduce the life-cycle cost effectiveness of economizer systems.
4. Economizer requirements do not apply if the cooling system includes a water economizer that provides 100 percent of the expected cooling load at outside air temperatures of 50°F dry bulb/45°F wet bulb and below.

Plan Review

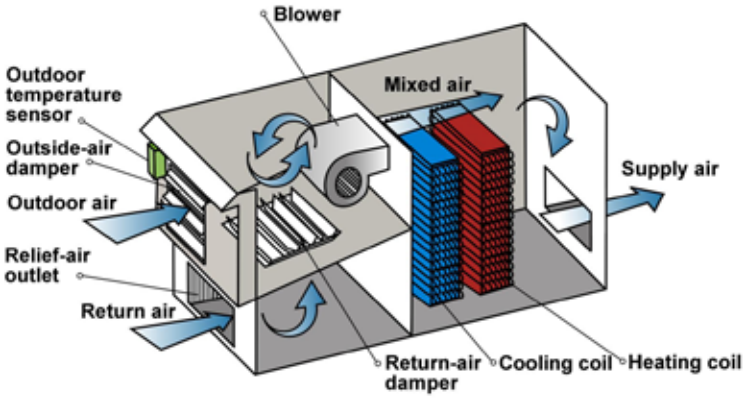
If the building is located in a climate zone requiring economizers and the cooling system capacity is greater than that specified in Table 503.3.1(1), do the following:

1. Verify that the plans require installation of an economizer.
2. If an economizer is not shown in the plans, then verify that the proposed equipment meets the higher efficiency requirement (EER and IPLV as applicable) as per Table 503.3.1(2).
3. If an economizer is not shown in the plans and the equipment efficiency does not meet the high-efficiency requirement mentioned in item 2, then check for the presence of open-case refrigeration or a documented need for an unusual air filtration requirement. This exception is applicable only for systems with air or evaporatively cooled condensors.
4. Verify that the system provides a relief-air outlet to prevent overpressurizing the building and that the relief-air outlet is located to avoid recirculation.

Field Inspection

If an economizer is required and provided, then verify the following items:

1. Economizer controls are installed on each cooling system.
2. The return-air damper, outdoor-air damper and relief-air damper are installed as per the approved plans.



Economizer schematic

Code Citations©

IECC 2006, 503.3.1 Economizers

Supply air economizers shall be provided on each cooling system as shown in Table 503.3.1(1).

IECC 2006, Table 503.3.1(1) Economizer Requirements	
Climate Zones	**Economizer Requirement**
1A, 1B, 2A, 3A, 4A, 7, 8	No requirement
2B, 3B, 3C, 4B, 4C, 5B, 5C, 6B	Economizers on all cooling systems >= 54,000 Btu/h
5A, 6A	Economizers on all cooling systems >= 135,000 Btu/h

Economizers shall be capable of providing 100-percent outdoor air, even if additional mechanical cooling is required to meet the cooling load of the building. Systems shall provide a means to relieve excess outdoor air during economizer operation to prevent overpressurizing the building. The relief air outlet shall be located to avoid recirculation into the building. Where a single room or space is supplied by multiple air systems, the aggregate capacity of those systems shall be used in applying this requirement.

Exceptions

1. Where the cooling equipment is covered by the minimum efficiency requirements of Table 503.2.3(1) or 503.2.3(2) and meets or exceeds the minimum cooling efficiency requirement (EER) by the percentages shown in Table 503.3.1(2).
2. Systems with air or evaporatively cooled condensors and which serve spaces with open case refrigeration or that require filtration equipment in order to meet the minimum ventilation requirements of Chapter 4 of the International Mechanical Code.

IECC 2006, Table 503.3.1(2) Equipment Efficiency Performance Exception For Economizers	
Climate Zones	**Cooling Equipment Performance Improvements (EER or IPLV)**
2B	10% Efficiency Improvement
3B	15% Efficiency Improvement
4B	20% Efficiency Improvement

IECC 2006, 503.4.1 Economizers

Supply air economizers shall be provided on each cooling system as shown in Table 503.3.1(1). Economizers shall be capable of operating at 100-percent outdoor air, even if additional mechanical cooling is required to meet the cooling load of the building.

Exceptions

1. Systems utilizing water economizers that are capable of cooling supply air by direct or indirect evaporation or both and providing 100 percent of the expected system cooling load at outside air temperatures of 50°F (10°C) dry bulb/45°F (7°C) wet bulb and below.
2. Where the cooling equipment is covered by the minimum efficiency requirements of Table 503.2.3(1), 503.2.3(2) or 503.2.3(6) and meets or exceeds the minimum EER by the percentages shown in Table 503.3.1(2).
3. Where the cooling equipment is covered by the minimum efficiency requirements of Table 503.2.3(7) and meets or exceeds the minimum integrated part load value (IPLV) by the percentages shown in Table 503.3.1(2).

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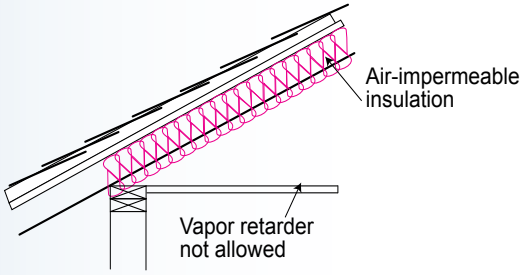
New Residential Code Requirements for Unvented Attic Assemblies

The concept of building attics as conditioned, unvented spaces has grown in acceptance in recent years, and this construction method has been advocated by the U.S. Department of Energy's Building America program. A principal benefit of conditioned attics is that ductwork located in the attic is not exposed to extreme conditions.

With ducts inside the conditioned space, energy loss from leaks and heat conduction from the ducts is much less severe. The 2006 International Energy Conservation Code® specifies a default efficiency of 80% for forced-air systems, if ducts are located in an unconditioned attic. Where the distribution system is run entirely in conditioned space, such as a conditioned attic, the default distribution system efficiency increases to 88%, resulting in energy savings.

A new set of requirements allowing unvented, conditioned attic assemblies is contained in Section R806.4 of the 2006 International Residential Code® (IRC). The 2006 IRC requires that the surface under the roof deck, where moisture would condense, be maintained above 45°F on average during the coldest month. The 2007 Supplement of the IRC simplifies this by specifying the insulation levels that will maintain this temperature.

The IRC requires air-impermeable insulation to prevent moisture reaching the underside of the roof deck in all but climate zones 2B and 3B. If air-permeable insulation is used in the exempt zones, rigid board insulation may be needed above the structural roof sheathing to keep the underside of the roof deck above 45°F for the coldest month.



Roof assembly with air-impermeable insulation

The IRC prohibits the use of a vapor retarder between the conditioned attic and the top-story ceiling of the house so that any moisture that does collect in the attic can escape into the house. A final requirement is that if wood shingles or shakes are used, they must be separated by a ¼-inch air space from the roofing felt over the structural sheathing.

For more information, see the Code Note, Conditioned Attics, at http://resourcecenter.pnl.gov/cocoon/morf/ResourceCenter/article/1520.

For the full requirements of the 2007 Supplement for the IRC, see Section R806.4 of the code at www.iccsafe.org/cs/codes/2007-08cycle/2007Supplement/IRC07S.pdf

Software Updates Released and on the Way

What's New?

RES*check*™ 4.1.2 provides updated weather location references for high-efficiency equipment performance calculations. In addition, the new release includes minor bug fixes for projects that include uninsulated, below-grade walls and crawl walls in the 2006 International Energy Conservation Code® (IECC) and for an inspection checklist item specific to mass wall exterior insulation for Pima County, Arizona, code locations. Also, the New York State code has been updated to the 2007 New York Energy Conservation Construction Code.

RES*check-Web*™ now includes support for the 2006 IECC and provides access for Macintosh® users.

COM*check*™ 3.5.1 offers external lighting compliance features for the IECC 2006 and ANSI/ASHRAE/IESNA[4] Standard 90.1-2004 codes. The new version also includes an update of the New York State code based on IECC 2003.

Coming Soon!

Upcoming software releases include 2006 IECC in COM*check-Web*™.

[4] The American National Standards Institute/American Society of Heating, Refrigerating and Air-Conditioning Engineers/Illuminating Engineering Society of North America

Ask an Expert

Every month, the Building Energy Codes Program's (BECP) Technical Support team responds to over 300 code compliance inquiries from builders, architects, engineers, and code officials around the country. Every issue of *Setting the Standard* offers frequently asked questions from the codes community and answers from BECP's codes experts.

Q: Do RES*check*™ and COM*check*™ support Windows® Vista?

A: Currently, BECP's desktop software tools work correctly only when running in administrative RES*check* and/or COM*check* mode. To properly print and view reports in the Vista Operations System, the workaround that follows is needed.

After following the workaround steps, when the application is started, a dialog box will be displayed stating that the application will run in administrator mode. Click continue, and RES*check* or COM*check* will run normally.

Workaround Steps

1) Right click on the RES*check* shortcut icon to bring up the context menu
2) Select **Properties**
3) Select the **Compatibility** tab
4) In the Privilege Level section at the bottom of the Compatibility display, check the box **"Run this program as an administrator"**
5) Click **Apply**
6) Click **OK**

Q: When using the COM*check* program for the 2003 International Energy Conservation Code® (IECC), we have received this response: *Envelope fails: glazing area of building exceeds 50% of gross area of above-grade walls.* In addition, the envelope compliance index indicates a 12% (white-on-red background), and when the report is printed, the output states: *Envelope TBD: glazing exceeds 50% limit.* **What corrective action, besides modeling the building, can we take to understand that the envelope is really +12% as determined, especially if our glass area exceeds 60%?**

A: The IECC commercial provisions have a mandatory glazing limit not to exceed 50% as noted in Section 802.1. The direct reference for compliance when the glazing is greater than 50% (again, as noted in Section 802.1) is ANSI/ASHRAE/IESNA[5] Standard 90.1. The 2001 version of this standard is the direct reference in the 2003 IECC, as shown in the ASHRAE portion of Chapter 10, Referenced Standards of the IECC. BECP Technical Support suggests switching the code option in COM*check* to ASHRAE Standard 90.1-2001. You must then review your project information for any items that show up in red, and redefine the building type and components that are highlighted in red. The IECC and Standard 90.1 do not have the same definitions for building types and components; therefore, adjustments may be required.

[5] The American National Standards Institute/American Society of Heating, Refrigerating and Air-Conditioning Engineers/Illuminating Engineering Society of North America

Email questions about residential and commercial energy codes to BECP Technical Support at techsupport@becp.pnl.gov, or submit an inquiry at www.energycodes.gov/support/helpdesk.php.

Training Events

New Self-Paced Training Tools Online!

*RES*check *101* and *COM*check *101* for the 2006 International Energy Conservation Code® (IECC) are now available. These tools cover the basics of the 2006 IECC requirements and teach users how to use the software to comply with the code. Sample buildings are included to test trainees' knowledge.

Watch for *RES*check *201* and *COM*check *201* coming soon!

All of BECP's self-paced training tools are accessible at www.energycodes.gov/training/onlinetraining/self-paced.stm.

Webcasts

Over 7,600 people participated in the Building Energy Codes Program's (BECP) webcasts in Fiscal Year 2007, with an average attendance of over 1,200 per event. This includes the nearly 4,500 people who participated in BECP's three-part webcast series about meeting the American Society of Heating, Refrigerating and Air-Conditioning Engineers Standard 90.1-2004 broadcast in spring 2007. New webcasts began this fall, starting with *Exterior Lighting Requirements* and *COM*check™ on November 15.

Watch www.energycodes.gov/events/index.php for upcoming events as they are scheduled.

Access all of BECP's videos, including the Standard 90.1-2004 webcast series, at www.energycodes.gov/training/onlinetraining/videos.stm.

U.S. Department of Energy
Energy Efficiency and Renewable Energy
Bringing you a prosperous future where energy is clean, abundant, reliable, and affordable

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Setting the Standard is published by the Building Energy Codes Program of the U.S. Department of Energy Office of Energy Efficiency and Renewable Energy at the Pacific Northwest National Laboratory. Its purpose is to encourage information exchange among building industry professionals and organizations, state and local code officials, and researchers to facilitate timely development and early adoption of the building energy conservation standards. The Building Energy Codes Program would like to continue sending you information about energy codes and compliance tools, but if you would like your name removed from our contacts list, go to www.energycodes.gov/unsubscribe.stm. Send comments and contributions to Loel Kathmann at Pacific Northwest National Laboratory (techsupport@becp.pnl.gov).
Editor: Loel Kathmann
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September 2007

PNNL-SA-58129