



BUILDING ENERGY CODES PROGRAM

# Setting the Standard

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

March 2008



## Raising the Standard of Energy Efficiency

Lighting is the focus of this contribution to the ongoing *Setting the Standard* article series about 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<sup>1</sup> Standard 90.1-2010 by 30% relative to Standard 90.1-2004. Details follow about the Building Energy Codes Program's (BECP) work with the ASHRAE Standing Standards Project Committee (SSPC) 90.1 Lighting Subcommittee.

DOE is supporting the efforts of the SSPC 90.1 Lighting Subcommittee with three funded tasks aimed at producing new proposals for energy savings and providing better analysis data for proposal development and determination of cost effectiveness: developing daylighting proposals, developing a lighting equipment cost database, and identifying current-lighting controls use.

<sup>1</sup> The American National Standards Institute/ASHRAE/Illuminating Engineering Society of North America

## Developing daylighting proposals

DOE is funding the development of specific daylighting proposals that would require the control of interior lighting when daylight is available. These proposals are being developed under a subcontract with Jon McHugh of the Heschong-Mahone Group, and are an expansion of the work done previously for California's energy efficiency code—Title 24. The subcontract with Jon McHugh includes five tasks in support of potential proposals:

- **Task 1:** Develop requirements for interior-lighting control in appropriate areas of buildings where windows provide sufficient lighting; these requirements would impose automatic interior-lighting shutoff in such areas.
- **Task 2:** Revisit a previous analysis and proposal on interior-lighting controls near skylights; newly developed fuel-cost and escalation-rate data adopted for use by the SSPC 90.1 Lighting Subcommittee are being applied to this analysis to determine the cost effectiveness of additional control requirements.
- **Task 3:** Incorporate requirements specifically for applications where roof monitor and clerestory glazing are part of the building design and provide sufficient daylight.
- **Task 4:** Develop a provision that would require skylights and associated lighting controls be designed into building spaces where it is practical, cost-effective, and provides sufficient daylight capability.
- **Task 5:** Examine the Visual Light Transmittance value of windows to determine an appropriate minimum value for mitigating solar effects while providing reasonable daylighting capability.



Daylighting and lighting in a school facility.



## Developing a lighting-equipment cost database

A lighting-equipment cost database will be used to assess the practicality and cost effectiveness of lighting proposals. Lighting-cost data across the industry are quite variable, depending on the distribution path of the equipment, the data source, and manufacturer-user agreements. The costs developed under this task will yield a consistent, public, and easily referenced source of data that will provide level comparisons of costs for proposal analysis. BECP is obtaining this data and permission to disseminate this data from I.D.E.A., a clearinghouse for electrical-cost data. The data being accessed include standard contractor costs for all available lamps, ballasts, fixtures, and controls associated with commercial-building lighting. The data come from multiple manufacturers of these products, and will be aggregated to averages for each specific product type to represent typical costs across the industry.

## Identifying current lighting-controls use

Identifying the current state-of-the-use lighting controls in new buildings will yield information to help determine the appropriateness of future control-related proposals and help assess the potential for energy savings across the country. Recent research studies, surveys, and market information as well as commercial characteristics data sources, such as NC3, are being used to identify current controls applications. This information will be placed in a database format to allow the SSPC 90.1 Lighting Subcommittee to identify where controls are still not applied.

## New AEDGs Available

The American Society for Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) has completed Advanced Energy Design Guides (AEDG) for Small Office Buildings, Small Retail Buildings, and K-12 School Buildings. These guides, developed in collaboration with partner organizations, including the U.S. Department of Energy, are intended as companion above code documents for ANSI/ASHRAE/IESNA Standard 90.1-1999. They demonstrate how the buildings listed above may be built to be 30% more energy efficient than the Standard. ASHRAE is also working on an additional guide for warehouses.

Download the new AEDGs at <http://www.ashrae.org/freeaedg>.

The screenshot shows the 'Building Energy Codes RESOURCE CENTER' website. At the top, there is a search bar with 'All Media' selected and a 'FOR:' dropdown. Below the search bar are navigation links: 'Home', 'About the Resource Center', 'Ask a Question', 'Advanced Search', and 'Help'. The main content area features a red heading 'It is great to hear from our users!' followed by a paragraph asking for user feedback. Below this is a form with fields for 'First Name', 'Last Name', 'Email Address', and 'Question'. A note states 'Items marked with an asterisk (\*) are required.' The background of the form area shows a close-up of a computer keyboard with keys like 'S', 'U', 'P', 'P', 'O', 'R', 'T' visible.

## Here to Help

The Building Energy Codes Program (BECP) is committed to serving the needs of the energy-codes community. Tell us how we are doing! Your answers to the following questions help us tailor all of our products, including software, training, and communication.

- What energy-codes-related problems or challenges do you encounter on a regular basis?
- What resources do you use to try to solve those challenges?
- What tools or information would you like to have that you do not currently have?
- What energy-code training topics are of interest to you?
- What is the best way for you to receive training?
- What are the most effective sources of new information about building-energy codes for your profession? Do you prefer to read trade publications, receive e-mail, subscribe to newsletters, watch or listen to webcasts or podcasts, or get your information via another source?

Send your feedback to BECP at [feedback@becp.pnl.gov](mailto:feedback@becp.pnl.gov).  
We will use your input to serve you better.

## ICC Code Change Proposals

The U.S. Department of Energy (DOE) developed and submitted 17 code-change proposals for the International Code Council's (ICC) 2007/2008 code-development cycle. The proposals pertain to the International Energy Conservation Code® (IECC) and International Residential Code® (IRC). With one exception, all proposals apply to residential buildings.

Highlights from these proposals follow. View all of DOE's proposals and access complete Public Code Change Proposal Forms for the proposals at [http://www.energycodes.gov/codedevelop/icc\\_0708\\_cycle.stm](http://www.energycodes.gov/codedevelop/icc_0708_cycle.stm).

1. **Require verification of duct sealing by pressurization test.** This would require duct systems that are not fully inside the conditioned space be tested to ensure that air leakage is below a reasonable limit. Although the code already requires that ducts be sealed, its lack of verification requirements results in a continued problem of excessive duct leakage in new residences.
2. **Reduce vertical fenestration U-factor requirements from 0.65 to 0.55 in climate zone 3 and from 0.75 to 0.65 in climate zone 2.** Most windows on the market today that meet the zone 2 and 3 Solar Heat Gain Coefficient (SHGC) requirement of 0.40 will also meet a U-factor requirement of 0.55. These proposed improvements in U-factor will save energy by weeding out inefficient windows and preventing excessive tradeoff credit for other windows.
3. **Permit duct R-value tradeoff in the IECC Section 404 performance path.** This would allow duct-insulation tradeoffs in the performance path, but put a hard limit on duct insulation to a minimum of R-4. Unlike DOE's comparable proposal last cycle, this proposal does not specify a calculation methodology.
4. **Require that mandatory IECC requirements be met even if the above code path in Section 103.1.1 of the IECC is used.**
5. **Reduce maximum allowable SHGC from 0.40 to 0.37 in climate zones 1 and 2 in the IRC.** This would bring the IRC into agreement with IECC, where the 0.37 SHGC requirement was approved last cycle.



View all of DOE's proposals and access complete Public Code Change Proposal Forms for the proposals at [http://www.energycodes.gov/codedevelop/icc\\_0708\\_cycle.stm](http://www.energycodes.gov/codedevelop/icc_0708_cycle.stm).

6. **Clarify that the allowance for ceiling R-value reductions in IECC Sections 402.2.1 and 402.2.2 and IRC N1102.2.1 and N1102.2.2 do not apply to U-factor-based compliance approaches.**
7. **Clarify that heated-slab insulation, when required, must be 2 feet deep in climate zones 1–3.** The IECC and IRC are currently confusing on this subject, as R-5 insulation is required but the required depth appears to be 0 feet.
8. **Clarify that a conditioned crawlspace is not a plenum in Chapter 16 of the IRC.** This change would essentially treat conditioned crawlspaces like conditioned basements, allowing fuel-gas lines and plumbing-waste cleanouts to be located therein. Conditioned crawlspaces are an increasingly popular strategy for bringing ductwork inside the conditioned space.

**Join the discussion!** The Building Energy Codes Program (BCEP) is evaluating DOE proposals as well as those from our stakeholders. We want to know your thoughts and suggestions on all code-change proposals. Submit questions or comments to BCEP Technical Support at [techsupport@becp.pnl.gov](mailto:techsupport@becp.pnl.gov), or submit an inquiry at [www.energycodes.gov/support/helpdesk.php](http://www.energycodes.gov/support/helpdesk.php).



## Ask an Expert

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

**Q: We are designing a project with independent structures that house only electrical equipment. Is there a path to gain exemption from the energy code for cooling these buildings (to cool the electrical equipment) given the reference of ANSI/ASHRAE/IESNA Standard 90.1, Paragraph 2.3(c), which discusses equipment and building systems that support manufacturing processes being exempt? The equipment in these new electrical buildings serves the manufacturing processes; there are no occupants.**

**A: Exemptions under ANSI/ASHRAE/IESNA Standard 90.1, Paragraph 2.3(c) are usually granted at the discretion of your local code official. Generally, Standard 90.1 is intended to regulate energy used to support human occupancy.**

Paragraph 2.3(c) addresses equipment and portions of building systems that use energy to provide for industrial, manufacturing, or commercial processes. It does not exempt the whole building, so each building system must be considered individually. BCEP’s three-point interpretation of your situation follows.

**Human occupancy** – If the cooling in your building is primarily intended to keep the electrical equipment cool, rather than for human occupancy, it would qualify for exemption as equipment to provide for industrial, manufacturing, or commercial processes. These terms are not defined in Standard 90.1, but electrical switchgear, telephone switchgear, computer, and server rooms have all been accorded this status in past cases. If there are no occupants, human comfort is not involved.

**Building systems** – The specific wording of Paragraph 2.3(c) exempts “equipment or portions of building systems that use energy primarily to provide for industrial, manufacturing, or commercial processes.” This includes the electrical, lighting, HVAC, and service-water-heating building systems. In your case, the lighting system is present only for occupants who service the equipment. It is BCEP’s opinion that the human occupancy requirements apply, but would be minimal for the system type and space arrangement your building likely would have. The electric power and HVAC system would probably be exempt. If your building has a service-water-heating system, that system would be for occupants and would be covered by Standard 90.1.

**Envelope** – Because Section 2.3(c) exempts “equipment or portions of buildings systems that use energy,” the building envelope—which is neither a piece of equipment nor an energy-using system—would not be exempt. You would be required to insulate the building per Standard 90.1 and, if there are windows, to use windows that perform in compliance with Standard 90.1. You may be able to justify using the semi-heated requirements in Standard 90.1 if there is no cooling system in the building and a minimal heating system. Otherwise, you would be required to insulate to the nonresidential levels specified in Standard 90.1 for your climate zone.

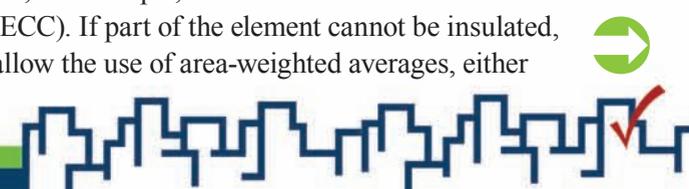
The type of building you describe is not the type of building for which Standard 90.1 requirements were developed. Consider looking beyond the simple prescriptive requirements in Standard 90.1 to the system-performance approaches used in the COMcheck™ or ENVSTD software, or to an Energy Cost Budget (Standard 90.1, Chapter 11) approach. This approach will be more labor intensive for the first building to which you apply the method, but you may find you can reduce the envelope requirements below what is required in the prescriptive requirements and still maintain a comparable level of performance to Standard 90.1 for your building.

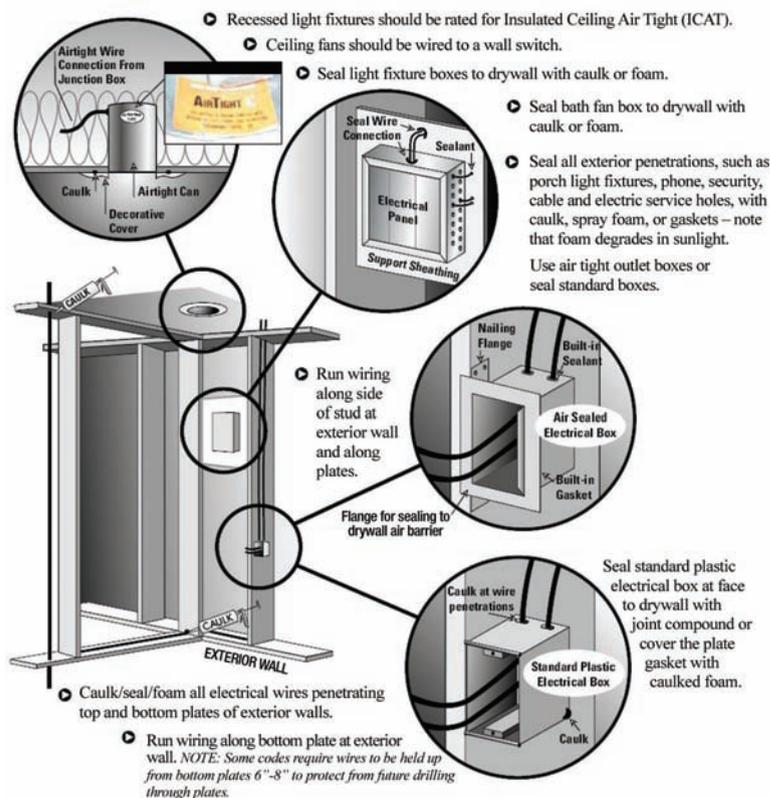


Email questions about residential and commercial energy codes to BCEP Technical Support at [techsupport@becp.pnl.gov](mailto:techsupport@becp.pnl.gov), or submit an inquiry at [www.energycodes.gov/support/helpdesk.php](http://www.energycodes.gov/support/helpdesk.php).

**Q: As a Senior Plans Examiner, I was asked to provide clarification for how to install electrical panels in exterior walls and meet the building envelope requirement. Is an R-19 or R-21 insulation value required behind main electrical panels? Is the main electrical panel to be treated the same as an outlet box in an outside wall? Is it feasible to treat the electrical panel similar to a window opening (i.e., a window requires U-0.35 = 1/R = 2.86 = R-value, so a minimum of R-3 behind the main electrical panel would allow the panel to be treated much like a window)?**

**A: A number of potential answers could be provided to your first question depending on the code being considered and the occupancy of the building.** Codes typically assume that if a building envelope element (such as a wall or roof) is required to be insulated, that that insulation will be applied to the whole element (see, for example, Section 502.2.3 Above-Grade Walls of the 2006 IECC). If part of the element cannot be insulated, all codes allow the use of area-weighted averages, either





### Tips for installing electrical panels.

across the element or across the whole building (see for example, Section 402.1.4 Total UA Alternative in the 2006 IECC). Some codes—most typically ASHRAE Standard 90.1—make explicit assumptions and allowances for various penetrations and recessed equipment, such as electrical panels (see, for example, Section 5.8.1.6 Recessed Equipment of ANSI/ASHRAE/IESNA Standard 90.1-2004).

The general answer is that if you cannot insulate to the full required value behind an electrical panel, and the code you are using does not have explicit allowances for the impact of recessed equipment, you should “make up” for the reduced insulation behind the panel elsewhere in the building in accordance with approved trade-off mechanisms in your jurisdiction. These may include DOE’s COMcheck software. For an electrical box in a wall with little or no insulation, enter a separate wall the area of the electric box in COMcheck and see what needs to be done to bring the building into compliance. Or, do UA tradeoff for the walls or walls and roofs to see what additional action can be taken to bring the building into compliance. You may find that if you have windows that are slightly better than required by code, those windows may be more than enough to compensate for the un-insulated area of an electrical panel. Another suggestion would be to move the electrical panel to an interior wall that is not part of the exterior building envelope.

Moving on to the second question, electrical panels are typically much larger than an outlet box, so addressing the lack of insulation behind the electrical panel is much more important. I do not

know what you are doing with outlet boxes, but insulating them as much as possible (without compressing the insulation) and then using a foam outlet insulator is a good idea.

The third question, on treating an electric panel like a window, is an ingenious, but ultimately bad suggestion. While it is true that windows do typically have an overall R-value something on the order of 2–3 (neglecting air films), that does not mean that you can put R-2 or R-3 behind an electric panel and call it good. Windows provide benefits in terms of solar heat gain (and loss) and visible-light transmittance that is not captured in the U-factor requirements, and electric panels are certainly not windows. Because any insulation behind the electrical panel is good, your proposed solution would help make the building better, but would not necessarily meet the code requirements. If you can put R-3 behind the electrical panel, I would suggest doing so and then using an envelope tradeoff to see what else needs to be done to make up for this.

All *Ask an Expert* answers reflect the *opinions* of BECP staff. BECP **does not provide** formal code interpretations. For formal code interpretations, contact your code official or submit an inquiry to the American Society for Heating, Refrigerating and Air-Conditioning Engineers or to the International Code Council.

## Training Events

### New Webcast Series

In January, the Building Energy Codes Program (BECP) began its three-part webcast series about ANSI/ASHRAE/IESNA Standard 90.1-2007.

These live and recorded webcasts, presented by commercial energy-code experts, and sponsored by the U.S. Department of Energy, are offered at no cost to the building energy-codes community. Each webcast is at least 60 minutes in length, followed by a 30-minute question-and-answer session. Viewers can earn American Institute of Architects (AIA) Continuing Education System (CES) Learning Units (1.5 to 2.0) and International Code Council (ICC) Continuing Education Credits (0.15 to 0.20) toward ICC certification renewal.

**Part 1, Lighting Overview**, was broadcast Thursday, January 10, 2008. Lighting codes expert Eric Richman from Pacific Northwest National Laboratory provided an overview of the lighting requirements of Standard 90.1-2007 for over 2000 participants.

**Part 2, Mechanical Overview**, was broadcast on Thursday, February 28, 2008, from 10:00 AM–12:00 PM Pacific Time. Mark Hydeman of Taylor Engineering, LLC presented an overview of the mechanical requirements of Standard 90.1-2007 for nearly 1200 participants.

**Part 3, Envelope Overview**, will be broadcast Thursday, March 27, 2008, from 10:00 AM–11:30 AM Pacific Time. John Hogan of the City of Seattle, Department of Planning & Development, will provide an overview of the envelope requirements of Standard 90.1-2007.

## New Self-Paced Training Tools

REScheck 201 and COMcheck 201 are now available. These self-paced online training tools cover advanced REScheck™ and COMcheck™ topics, including issues frequently brought to our attention by regular users.

All of BECP's self-paced training tools are accessible at [www.energycodes.gov/training/onlinetraining/self-paced.stm](http://www.energycodes.gov/training/onlinetraining/self-paced.stm).

## Get AIA Credit!

Not only can viewers receive AIA credit for webcasts, but participants can earn AIA CES Learning Units for many of BECP's self-paced training tools. Go online to try a class at your own speed and at a time and place convenient for you. Learn about codes and standards and how they are developed, and learn how to use our free code-compliance software, REScheck and COMcheck.

## New Training Materials

BECP offers Code Notes to clarify code issues. All our Code Notes are found at [www.energycodes.gov/support/code\\_notes.stm](http://www.energycodes.gov/support/code_notes.stm). Recent additions include

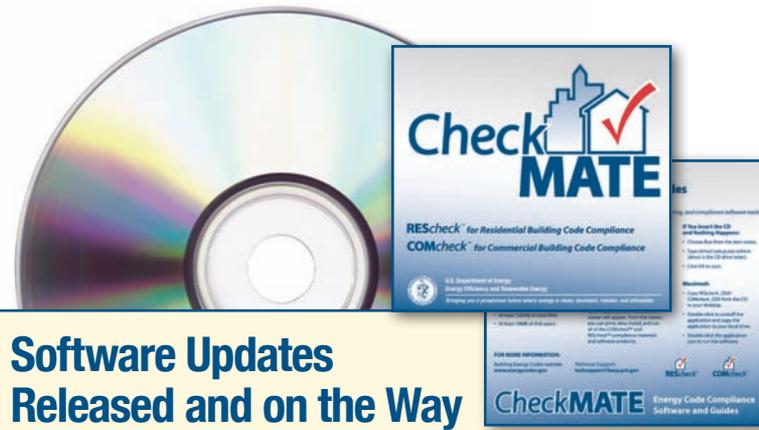
- Conditioned Attics
- Economizer Requirements in IECC 2006.

## Did You Know?

BECP hosts a calendar you can use to promote your events to the energy-codes community or to learn about upcoming events in your area. We invite website visitors to add a training or event on our Calendar of Events—a community source for buildings-related conferences and workshops as well as national and state energy-code training.



Visit [www.energycodes.gov/events/index.php](http://www.energycodes.gov/events/index.php) to view a calendar of upcoming events or to submit an event or training of your own.



## Software Updates Released and on the Way

### What's New?

REScheck™ version 4.1.3 was released in December 2007 and provides the options below.

- REScheck 4.1.3 is Macintosh compatible.
- The New Hampshire state code option is now based on the 2006 International Energy Conservation Code® (IECC).
- The Sustainable Energy Standard code checklist items are revised to be consistent with the 2006 IECC.
- The high-efficiency equipment tradeoff portion of the 2006 IECC is restricted to single-family buildings.

COMcheck™ version 3.5.2 was released in December 2007 and provides the features below.

- COMcheck 3.5.2 is Macintosh compatible.
- The New Hampshire state code option is now based on the 2006 IECC.
- Exterior lighting features are enabled for alterations projects using the ANSI/ASHRAE/IESNA Standard 90.1-2004.
- The New York state code is updated with the 2003 IECC whole building and area category types.

### Coming Soon!

- Additions and alterations in REScheck
- ANSI/ASHRAE/IESNA 90.1-2007 in COMcheck
- Advanced energy code advisor in COMcheck-Web™
- Performance-based compliance with EnergyPlus link in COMcheck-Web
- Support for the 2006 IECC in COMcheck-Web



U.S. Department of Energy

### Energy Efficiency and Renewable Energy

Bringing you a prosperous future where energy is clean, abundant, reliable, and affordable

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](http://www.energycodes.gov/unsubscribe.stm). Send comments and contributions to Loel Kathmann at Pacific Northwest National Laboratory ([techsupport@becp.pnl.gov](mailto:techsupport@becp.pnl.gov)).

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