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The Future of 90.1

By Mick Schwedler, P.E., Member ASHRAE

Some have said that ANSI/ASHRAE/IESNA Standard 90.1, *Energy Standard for Buildings Except Low-Rise Residential Buildings*, describes “the worst building that may be built” from an energy-efficiency standpoint while still complying with energy code requirements. Despite this assessment, Standard 90.1 has been the benchmark for local and national codes because it defines minimum requirements. Here are some examples of how the standard has been implemented.

- The 2006 International Energy Conservation Code® (IECC), developed by the International Code Council (ICC), directly references Standard 90.1 by stating, in Chapter 5:
501.1 Scope. The requirements contained in this chapter are applicable to commercial buildings, or portions of commercial buildings. These commercial buildings shall meet either the requirements of ASHRAE/IESNA Standard 90.1, Energy Standard for Buildings Except for Low-Rise Residential Buildings, or the requirements contained in this chapter.
- Chapter 6 specifically references Standard 90.1-2004.
- The balance of Chapter 5 of the IECC covers envelope, mechanical systems, service water heating, electrical power and lighting, and allows a total building performance path. A number of the requirements in these sections are identical to those in Standard 90.1 and an additional number are similar. Some requirements in Standard 90.1 are not included in the IECC. A practitioner may follow either path and comply with the IECC.
- NFPA 900: Building Energy Code, explicitly cites Standard 90.1 in Chapter 4, *Technical Provision for All Buildings Except Low-Rise Residential Buildings*.
- Within the United States many jurisdictions:

- Reference 90.1 directly; or
- Adopt 90.1 indirectly through the IECC; or
- Adopt 90.1 through NFPA 5000—Building Construction and Safety Code®.

Use by Other Entities

In addition to code adoption, the U.S. Green Building Council’s Leadership in Energy and Environmental Design (LEED®) products reference Standard 90.1. For example:

- LEED for New Construction (NC) Version 2.2 requires compliance with Standard 90.1-2004 as a prerequisite for any level of certification, and requires reducing energy cost by 14% to obtain two “Optimize Energy Efficiency” credits.
- The first public comment version of LEED 2009 included a prerequisite of exceeding the energy efficiency of Standard 90.1-2007 by 10%.

In both documents, “Optimize Energy Efficiency” credits may be earned by exceeding the requirements of the prerequi-

About the Author

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Addendum	Subject	Comments	Estimated Savings (* Denotes According to the Foreword)
A	Cooling Tower Clarification	The standard did not cover closed circuit cooling towers, but this was not obvious to users.	
B	Vivariums	Changes made to address issues of vivaria with respect to fan power requirements.	
C	Vivariums	Additional changes in response to public input.	
G	Metal Buildings	Insulation requirements updates.	
H	VAV Zone Controls	To allow ASHRAE Standards 55, 62.1, and 90.1 to be used in conjunction more easily, this addendum revises the airflow limits for which new energy may be used for reheating or recooling in DDC systems.	*"...about \$0.20/ft ² /yr with a simple pay-back of less than 2 years."
I	Exterior Lighting	Categories for external lighting allowances were expanded and lighting power densities defined.	*Varies by exterior lighting zone and square footage. For a 15,000 ft ² area, savings are from 16% to 50% of exterior lighting power.
J	Mechanical References	References updated.	
K	Furnaces	Clarifies warm air furnace and duct furnace references.	
L	Closed-Circuit Cooling Towers	Efficiency requirements added for closed circuit cooling towers—this was a continuation of Addendum A.	
N	Single-Zone VAV	Establishes requirements for single zone VAV systems and fan modulation on DX units above 110,000 Btu/h on Jan. 1, 2012.	Significant, but not estimated.
P	Lab Exhaust Fans	Added pressure drop allowances for laboratory exhaust fans.	
Q	Vestibules	Added the requirement for vestibules to Climate Zone 4 (near the Mason-Dixon Line).	
Y	Heat Pump Pool Heaters	Establishes ARI 1160 as the test procedure for heat pump pool heaters and requires that the minimum coefficient of performance (COP) of 4 be met at the low outdoor temperature of 50°F (instead of the high outdoor temperature of 80°F currently required).	* "...significantly increase the stringency of Standard 90.1 as heat pump pool heaters will now be required to deliver a COP of 4 at a higher temperature lift."
AC	Lighting Control Incentives	Incentives added.	
AD	Liquid to Liquid Heat Exchangers	Added a new reference for liquid-to-liquid heat exchangers.	

Table 1: Addenda slated for inclusion in the Supplement to 90.1-2007. (See Page 48 for a discussion of the 2007 Supplement.)

site version of Standard 90.1 by specific percentages. The basis of demonstrating this performance is the Performance Rating Method detailed in Appendix G of Standard 90.1.

The Green Buildings Initiative has developed the Green Globes™ building rating system, which requires compliance with—and in some cases, exceeding—the requirements of Standard 90.1.

Membership

The Standard 90.1 committee is a standing standards project committee (SSPC), which means that it is not disbanded once the standard is published.

The committee, comprised of volunteers with assistance from ASHRAE staff, performs the bulk of the work developing and

Addendum	Subject	Comments	Estimated Savings (* Denotes According to the Foreword)
D	Daylighting	In response to research performed by an owner of a significant number of buildings, provides appropriate provisions to better allow daylighting.	
M	Chiller Efficiency and Equation	Adds a Column B to chiller efficiency requirements. Column B increases part load efficiency requirements, but in some cases, decreases full load efficiency requirements. Also applies the use of the adjustment factor for centrifugal chillers selected at nonstandard conditions to more situations.	* "...457.6 GWh of energy per year..."
S	Heat Pump Part Load Change	Updates the COP at 17°F efficiency levels for commercial heat pumps and introduces a new part load energy efficiency descriptor for all commercial unitary products above 65,000 Btu/h of cooling capacity.	
T	PTAC	Clarifies use of "standard" and "non-standard" packaged terminal air conditioners (PTACs).	
U	Centrifugal Cooling Tower Fan Energy Limitation	Requires centrifugal fan units over 1,100 U.S. gpm at the rating conditions to meet the energy efficiency requirements for axial fan units. Exceptions are available.	
W	Appendix G Updates	Clarifications.	

Table 2: Addenda awaiting final approval. (See Page 48 for a discussion of the 2007 Supplement.)

refining proposals, and responding to public review comments and developing consensus. The membership includes individuals and groups representing building owners, builders, code officials, architects, engineers, lighting designers, utilities, industry, as well as the public interest. Members serve on one of five subcommittees that deal with format and compliance, building envelope, mechanical systems, lighting systems, and building simulation. The SSPC meets four times per year, with each meeting lasting three to four days.

Those interested in joining can read about membership expectations of the chair on the 90.1 Web site: <http://sspc901.ashrae.org/membership.html>. There are links for those who wish to be considered for membership.

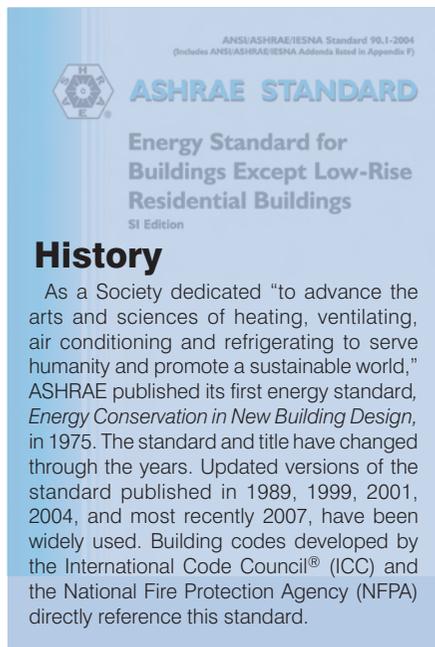
How is Standard 90.1 Updated?

As an ANSI standard, 90.1 follows a rigorous process prior to approval, including one or more public reviews for each change. ASHRAE standards are updated by the cognizant committee through an established process of issuing

addenda for public review, receiving comments, responding to commenters, and reaching consensus. Standard 90.1 is under "continuous maintenance." This means that anyone may submit changes to be considered through the continuous maintenance proposal process (details available at www.ashrae.org/technology/page/812). This allows the committee to continuously—rather than periodically—develop addenda for public review and publication in response to continuous maintenance proposals from the public or from committee members.

Each proposal goes through a public review process, which requires the SSPC formally respond to comments. Often, these comments result in a full second public review of an addendum or an independent substantive change (ISC). In these cases, the changing sections must be sent out for another review.

Following approval by the SSPC, approval by other ASHRAE committees, including the Standards Committee and Board of Directors, is mandatory prior to



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Addendum	Subject	Comments	Estimated Savings (* Denotes According to the Foreword)
E	Energy Recovery	Expands the requirement for outdoor air energy recovery.	
F	Ballasted, Vented, And "Cool" Roofs	In response to continuous maintenance proposals, adds a number of roof types available to be used.	
O	Transformers	Adds federal requirements for transformers.	* "...4.74 quads of primary energy over 28 years (2007 to 2035). In terms of cumulative electric site energy savings, that is roughly equivalent to 596 billion kWh over 28 years, or 21.3 billion kWh per year."
R	Make Appendix G A Normative Reference	Appendix G defines modeling requirements for buildings "intended for use in rating the energy efficiency of the building designs that exceed the requirements of this standard." Appendix G is used by USGBC for LEED energy cost savings estimates.	
AB	Expansion Of Addendum D	Daylighting requirements.	Preliminary estimates of the effect of Addendum D and AB are an 8.8% reduction of lighting energy across all building types.
AF	Pipe Sizing	Defines minimum pipe sizes by flow rate.	Significant
AK	Hydronic Variable Flow Systems	Reduces threshold for efficient part load pumping to pumps exceeding 5 hp. Established requirement for "critical valve reset" for DDC systems.	Significant
AL	Skylights	Requirements in large enclosed spaces.	If Title, Purpose, and Scope recommendations are accepted and the standard is applied to lighting in unheated warehouses, it is estimated that for each year of construction, 160 GWh will be saved.

Table 3: Selected proposed addenda presently in the public review process.

publication. Because IESNA is a cosponsor of 90.1, approval by its Board of Directors is also required.

Work Plan Goals

In the Work Plan adopted unanimously by the SSPC in June 2007, the goal is: "A 2010 standard that results in 30% total energy-cost savings improvement compared to 90.1-2004."

The overall goal is national average based on aggregate construction and climate-weighted energy cost savings and may not be achieved for every building type in every climate. Energy cost is the agreed upon normalized metric, and is used as a surrogate for environmental emissions.

Immediate Plans for the Standard

Supplement to 90.1-2007

Since the publication of 90.1-2007, SSPC 90.1 and all levels of ASHRAE have approved a number of addenda. Every 18 months, ASHRAE collects those addenda that have been approved and issues a supplement to the standard. A list of those addenda already approved is provided in Table 1. Note that there is no "official" subject for these items; the subjects in the table are general titles used here to organize the addenda. Also included for some addenda are estimated savings according to the foreword of the addendum.

The addenda that are likely to help save significant energy cost include:

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- VAV zone controls;
- Boiler efficiency;
- Single-zone VAV;
- Vestibules; and
- Heat pump pool heaters.

Possible Addenda to Supplement to 90.1-2007

As this article is being written, in addition to the addenda already discussed, there are six more items that may be included in the supplement. Inclusion of these addenda is dependent on final approval and the publication date of the supplement.

Proposed Addenda in Public Review Process

Because the standard is under continuous maintenance, as of July 2008, a significant number (19) of additional proposed addenda are in one of the public review stages. Seven of these proposed addenda are summarized in *Table 3*. Recall these are proposed addenda subject to ASHRAE and ANSI processes.

Possible Future Changes

SSPC 90.1 also has recommended a change to expand the title, purpose, and scope (TPS) of the standard to include industrial, commercial, and manufacturing processes. Even if the TPS recommendation is approved, most industrial, commercial, and manufacturing processes will not be covered unless an additional addendum is approved. For example, the standard contains no efficiency requirements for refrigerated cases. To add such a requirement, the TPS must first be changed via the addendum process, then a separate addendum adding a table for refrigerated case efficiency requirements would need to be approved. The SSPC is working closely with cognizant ASHRAE technical committees, process and building owners, and the building community to ensure such changes would be made *where appropriate*.

In addition to this possible modification, Standard 90.1 subcommittees are considering possible changes as addenda in daylighting, mechanical system efficiency, envelope criteria, and more cost-effective lighting technology.

Each addendum is subject to the same rigorous public review process.

Summary

Due to the work of volunteer members of SSPC 90.1 and other ASHRAE and IESNA committees, and the rigorous continuous maintenance process, Standard 90.1 is changing to reflect society's increased interest in energy and energy cost savings. As the standard changes, building owners and operators will reap the benefits of higher efficiency as engineers, designers, code officials, manufacturers, and others comply with—and exceed the requirements of—the standard that defines the minimum efficiency for most commercial buildings.●