Bringing It Together – Building Envelope:

ANSI/ASHRAE/IESNA Std 90.1 - Looking Towards 2010

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Outline

- Overall goal for ANSI/ASHRAE/IESNA 90.1-2010
- Outline of ANSI/ASHRAE/IESNA 90.1-2007
- Addenda to 90.1-2007 that have already been approved and will be in 90.1-2010 (~16)
- Proposed addenda to 90.1-2007 that have already had initial public review (~20)
- Proposed addenda to 90.1-2007 and concepts that are being considered

Overall Goal for Standard 90.1-2010

- Work Plan for SSPC 90.1:
  "that Standard 90.1-2010 is developed with the goal of achieving a 30% energy savings improvement compared to Standard 90.1-2004"

- Official DOE assessment has not yet been published, but Standard 90.1-2007 is expected to show some energy savings compared to Standard 90.1-2004, but may be limited

- Consequently, 90.1-2010 could contain significant steps in energy efficiency

ASHRAE Standard 90.1-2007
Organization

- Chapters 1, 2, 3: Purpose, Scope, Definitions
- Chapter 4: Administration and Enforcement
- Chapter 5: Building Envelope
- Chapter 6: Heating, Ventilating, & Air Conditioning
- Chapter 7: Service Water Heating
- Chapter 8: Power
- Chapter 9: Lighting
- Chapter 10: Other Equipment
- Chapter 11: Energy Cost Budget

ASHRAE Standard 90.1-2007
Organization

- Chapter 12: Normative References
- Appendix A: Rated R-value of Insulation and Assembly U-factor, C-factor, and F-factor Determinations
- Appendix B: Building Envelope Climate Criteria
- Appendix C: Methodology for Building Envelope Trade-off Option in Subsection 5.6
- Appendix D: Climatic Data
- Appendix E: Informative References
- Appendix F: Addenda Description Information
- Appendix G: Performance Rating Method

Addenda to 90.1-2007, already approved

- **Addendum aw (from 90.1-2004) (Chapter 9, Lighting):**
  In Section 9.4.1.4, allows 5 W of continuous night lighting in bathroom to be exempt from a master control switch in hotel/motel guest rooms.
  (adds an exception, reduction in stringency)
- **Addendum a, (Chapter 6, Mechanical):**
  For Table 6.8.1G, adds footnote d stating that the cooling tower requirements in the Standard apply to open circuit cooling towers only, until such time that separate requirements for closed circuit cooling towers are established in the Standard.
  (adds an exception, reduction in stringency)

Addenda to 90.1-2007, already approved

- **Addendum b, (Chapter 6, Mechanical):**
  In Section 6.5.2.3, exception (a), eliminates the specific section and now denotes only ASHRAE Standard 62.1 in general and allows for another, higher outdoor ventilation rate to be set by the regulating body for these specific applications.
  (adds to exception, reduction in stringency)
- **Addendum c, (Chapter 6, Mechanical):**
  In Section 6.5.2.3, adds vivariums to the list of spaces in exception that require specific humidity levels to satisfy process needs.
  (adds to exception, reduction in stringency)

Addenda to 90.1-2007, already approved

- **Addendum g, (Chapter 5, Building Envelope):**
  In Table 5.5, revision to the insulation criteria for metal buildings, expansion of default U-factors for metal buildings in Tables A2.3 and A3.2.
  (increase in stringency)
- **Addendum h, (Chapter 6, Mechanical):**
  For Section 6.5.2.1, new exception (b) largely addresses the apparent conflict between Standards 55, 62.1 and 90.1 and also takes advantage of the energy savings potential of DDC controls.
  (possible increase in stringency)

Addenda to 90.1-2007, already approved

- **<u>Addendum i, (Chapter 9, Lighting):</u>**
  In Section 9.4.5, establishes a 4-zone lighting power density approach to exterior lighting. *(increase in stringency)*
- **<u>Addendum j, (Chapter 12, Norm. References):</u>**
  Updates the mechanical test procedures and references in ASHRAE/IESNA Standard 90.1-2007, modifies a reference in Table 6.8.1E, the normative references in Chapter 12 and informative references in Informative Appendix E. *(housekeeping, no change in stringency)*

Addenda to 90.1-2007, already approved

- **Addendum k, (Chap. 6, Mech.; Chap 7, Water Heating):** In Tables 6.8.1E and Table 7.8, identifies the specific sections of the referenced standards; Table 7.8 is also updated to reflect the current Federal efficiency levels for residential water heaters, and a requirement for Electric Table Top Water Heaters has been added. *(increase in stringency)*
- **Addendum l, (Chapter 6, Mechanical):** In Table 6.8.1G, adds minimum efficiency and certification requirements for both axial and centrifugal fan closed circuit cooling towers (also known as fluid coolers); adds reference to ATC-105S, the Cooling Technology Institute (CTI) test standard for closed circuit cooling towers, has been added to Section 12, Normative References. *(increase in stringency)*

Addenda to 90.1-2007, already approved

- **Addendum n, (Chapter 6, Mechanical):**
  Adds new Section 6.4.3.10, extending variable air volume fan requirements to large single zone units.
  (increase in stringency)
- **Addendum p, (Chapter 6, Mechanical):**
  In Table 6.5.3.1B, provides larger pressure credits for laboratory exhaust systems that allow prescriptive compliance of systems serving fume hoods.
  (adds to exception, reduction in stringency)

Addenda to 90.1-2007, already approved

- **<u>Addendum q, (Chapter 5, Building Envelope):</u>**
  In Section 5.4.3.4, reduces exceptions for the vestibule requirements for Climate Zone 4.
  (increase in stringency)
- **<u>Addendum y, (Chapter 7, Water Heating):</u>**
  In Table 7.8, adds rating conditions for heat pump pool heaters.
  (housekeeping)

Addenda to 90.1-2007, already approved

- **<u>Addendum ac, (Chapter 9, Lighting):</u>**
  Add new Table 9.6.2, add lighting control credits for automatic controls to allow increases in installed lighting wattage.
  (adds to exception, reduction in stringency)
- **<u>Addendum ad, (Chapter 6, Mechanical):</u>**
  Add new Table 6.8.1K, add requirements for certification (but not minimum efficiency) of liquid to liquid heat exchangers.
  (housekeeping)

These 16 addenda will be included in the 2008 supplement to 90.1 to be published this fall.

Addenda to 90.1-2007, had public review

- **Addendum z, (from 90.1-2004) (Chapter 5, Building Envelope):**
  In Section 5.4.3.1, would provide requirements for a continuous air barrier.
  (increase in stringency)
- **Addendum d, (Ch. 5, Envel.; Ch. 9, Lighting):**
  In new Sections 9.4.1.3 and 9.4.1.3 (with companion changes in Chapter 5), would require the use of photocontrols combined with skylighting to reduce the electricity used for lighting.
  (increase in stringency)

Addenda to 90.1-2007, had public review

- **Addendum e, (Chapter 6, Mechanical):**
  In Section 6.5.6.1, would modify the requirements for energy recovery by expanding them to cover outside air percentages greater than 30%.
  (increase in stringency)
- **Addendum f, (Chapter 5, Envelope):**
  In Section 5.5.3.1, would revise to require “cool roofs” in Climate Zones 1-3.
  (increase in stringency)

Addenda to 90.1-2007, had public review

- **<u>Addendum m, (Chapter 6, Mechanical):</u>**
  In Section 6.4.1.2, would add an additional path for compliance for water-cooled chillers in new Table 6.8.1C.
  (increase options, reduction in stringency)
- **<u>Addendum o, (Chapter 8, Power):</u>**
  In new Section 8.4.2, would add requirements for low-voltage dry-type transformers.
  (increase in stringency)

Addenda to 90.1-2007, had public review

- **<u>Addendum r, (Appendix G, Rating Method):</u>**
  For Appendix G, would change from an Informative Appendix into a Normative Appendix. *(does not change minimum requirements)*
- **<u>Addendum s, (Chapter 6, Mechanical):</u>**
  In Tables 6.8.1A and 6.8.1B, would update 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. *(increase in stringency)*

Addenda to 90.1-2007, had public review

- **Addendum t, (Chapter 6, Mechanical):**
  In Table 6.8.1D, would revise the nomenclature for the “replacement” and “new construction” product classes.
  (no changes in stringency)
- **Addendum u, (Chapter 6, Mechanical):**
  In new Section 6.5.5.3, would modify the requirements for axial fan open circuit cooling towers.
  (increase in stringency)

Addenda to 90.1-2007, had public review

- **<u>Addendum v, (Chapter 6, Mechanical):</u>**
  In new Section 6.4.2.2, would establish requirements for pump sizing.
  (no changes in stringency)
- **<u>Addendum w, (Appendix G, Rating Method):</u>**
  In Table G3.1.1A, would apply exception (a) to Section G3.1.1 here, would exempt multifamily buildings from the exhaust air energy recovery requirement.
  (does not change minimum requirements; for rating method, exception reduces stringency)

Addenda to 90.1-2007, had public review

- **<u>Addendum x, (Chapter 9, Lighting):</u>**
  In Section 9.4.1.2, would now also require automatic lighting shutoff for small buildings, would require occupancy sensors for more uses.
  (increase in stringency)
- **<u>Addendum aa, (Chapter 9, Lighting):</u>**
  In Section 9.4.1, would prohibit “automatic-on” for lighting in most spaces.
  (increase in stringency)

Addenda to 90.1-2007, had public review

- **Addendum ab, (Chapter 9, Lighting):**
  In Section 9.4.1.3, would add new requirements for automatic controls for lighting in daylighting areas under skylights.
  (increase in stringency)
- **Addendum ae, (Chapter 6, Mechanical):**
  In new Sections 6.4.4.1.4 and 6.4.4.1.5, would require insulating the surfaces of radiant panels that do not face conditioned spaces.
  (increase in stringency)

Addenda to 90.1-2007, had public review

- **Addendum af, (Chapter 6, Mechanical):**
  In Section 6.5.4.5, would set a minimum efficiency requirement for hydronic systems to parallel the minimum fan system efficiency.
  (increase in stringency)
- **Addendum ag, (Chapter 5, Building Envelope):**
  In new Section 5.8.1.10, would require staggering of edge joints for rigid insulation.
  (no change in stringency, but expected improvement in field performance)

Addenda to 90.1-2007, had public review

- **<u>Addendum ak, (Chapter 6, Mechanical):</u>**
  In Section 6.5.4.1 and new Section 6.5.4.4.2, would require variable flow for hydronic systems > 10 hp, and for individual chilled water pumps, heat pumps, and unitary air conditioners > 5 hp. *(increase in stringency)*
- **<u>Addendum al, (Chapter 5, Building Envelope):</u>**
  In new Section 5.5.4.2.3, would require a minimum skylight area in spaces > 10,000 ft^2 directly under a roof and ceiling height > 15 feet. *(increase in stringency)*

ASHRAE Standard 90.1-2007
Building Envelope Chapter & Appendices

- Chapter 5: Building Envelope
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ASHRAE Standard 90.1-2007
Building Envelope Chapter & Appendices

- Chapter 5: Building Envelope, Tables 5.5-1 to 8
- Addenda as & at to 90.1-2004 were significant steps forward for the building envelope
- As a result, the building envelope requirements in Standard 90.1-2007 are more stringent overall than the envelope requirements in 2006 IECC:
  - residential buildings over 3 stories: most cases,
  - nonresidential spaces, opaque components: for many cases,
  - nonresidential spaces, fenestration: similar in general, more stringent in colder climates (climate 7 – north half of Minnesota, climate 8)

ASHRAE Standard 90.1-2010

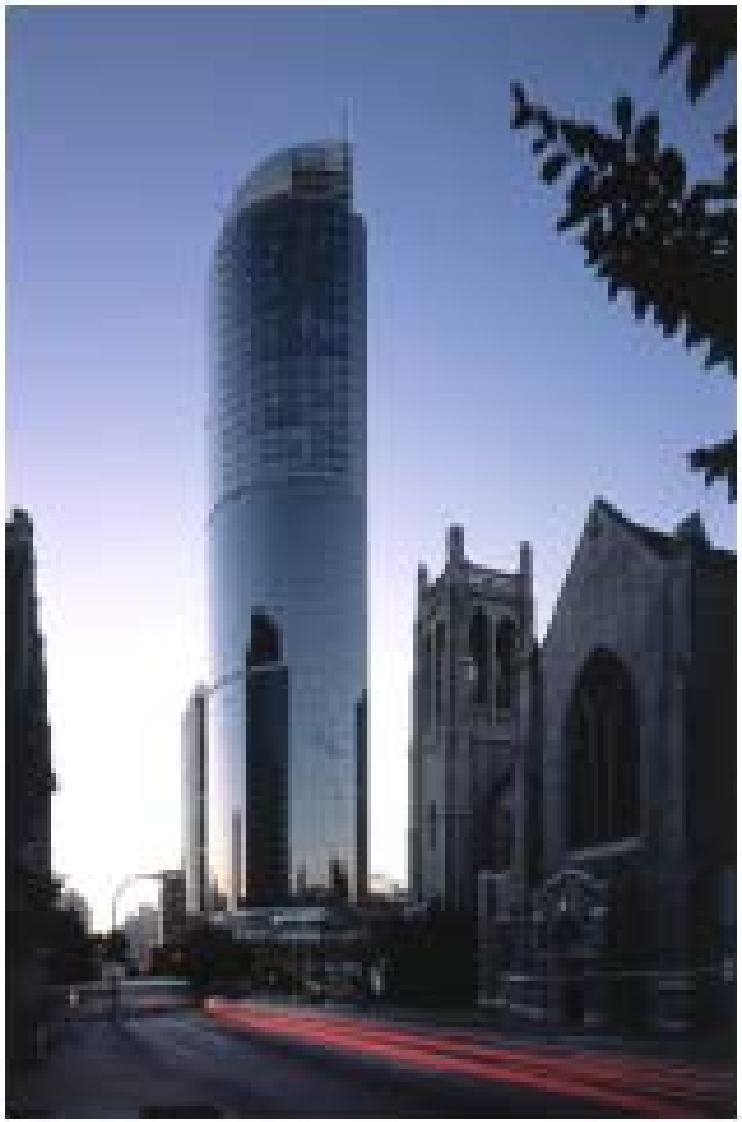
- **Overall Approach**
- Goal is 30% of total building energy savings for Standard 90.1-2010 compared to 90.1-2004
- SSPC 90.1 has recommended broadening the scope of Standard 90.1 to eliminate the exception for process energy use:
  - so expect energy savings in more categories
- SSPC 90.1 is using estimates of higher energy costs and longer planning horizons in developing revisions to criteria:
  - so expect energy efficiency levels to increase

Building Envelope Concepts

- **Tables 5.5-1 to 8, Prescriptive Tables**
- Primary focus for energy savings in the building envelope
- PNNL providing analytical support
- For opaque components:
  - expect an increase in min. insulation R-values
- For fenestration:
  - expect a lowering of max. U-factors and SHGC (now seeing some double-glazed curtainwalls with NFRC Label Certificates with U < 0.35)

More Building Envelope Energy Efficiency

48-story hotel/condo, U-0.21 (3-layer)



More Building Envelope Energy Efficiency

19-story office, U-0.14 (4-layer)

Building Envelope Concepts

- **Building Orientation, Prescriptive**
- **Issue:**
  how to address buildings with worse-than-average siting and fenestration orientation
- **Concept:**
  solar gain from east-facing and west-facing fenestration to be less than solar gain from north-facing and south-facing (comply by adjusting area or tuning of SHGC by orientation)
- **Challenges:**
  buildings with long axis facing east or west

Building Envelope Concepts

- **Window Overhangs, Prescriptive**
- **Issue:**
  how to reduce solar gain further when fenestration SHGC values are already low
- **Concept:**
  add requirements for overhangs, or require a minimum percentage shading that would vary by orientation
- **Challenges:**
  developing a methodology that is not overly complex to administer

Building Envelope Concepts

- **Daylighting by Sidelighting, Prescriptive**
- **Issue:**
  how to require daylighting through windows
- **Concepts:**
  minimum visible transmittance (VT), or
  minimum ratio of VT/SHGC, or
  minimum effective aperture (VT x window %)
- **Challenges:**
  high VT can restrict use of triple/quad.-glazing
  minimum effective aperture could result in
  increase in window area & higher energy use

Building Envelope Concepts

- **Daylighting by Toplighting, Prescriptive**
- **Issue:**
  how to require daylighting from skylights in unconditioned spaces (e.g. warehouses) to save lighting energy, not heating/cooling
- **Concepts:**
  require minimum skylight area
- **Challenges:**
  establishing a “building envelope” requirement for a space that is not covered now within Chapter 5 and does not need to be insulated

Building Envelope Concepts

- **Thermal Bridging, Prescriptive**
- **Issue:**
  how to reduce unaccounted-for thermal bridging
- **Concepts:**
  all continuous elements (e.g. z-furring) to be analyzed, or
  all structural elements (e.g. tops of parapet walls) to be fully insulated or to have 3/8-inch thick low-conductance thermal break and fasteners to be stainless steel
- **Challenges:**
  practicality of implementation on a general basis

Building Envelope Concepts

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- **Issue:**
  how to reduce unaccounted-for thermal bridging
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  all structural elements (e.g. tops of parapet walls) to be fully insulated or to have 3/8-inch thick low-conductance thermal break and fasteners to be stainless steel
- **Challenges:**
  practicality of implementation on a general basis

Building Envelope Concepts

- **Other Building Envelope Issues to Address**
- **Expansion of the default tables for single-rafter roofs (Table A2.4):**
  - expand to include continuous insulation
- **Convert VLT to VT, add definition:**
  - revise terminology for consistency with NFRC rating and labeling system

Energy Code Adoption Options

- **If existing Energy Code is Standard 90.1:**
  - update to Standard 90.1-2007, and
  - considering incorporating addenda from 2008 Supplement to Standard 90.1

- **If existing Energy Code is IECC:**
  - update to 2006 IECC, and
  - modify Chapter 6 to reference 90.1-2007, and
  - adopt building envelope criteria for your climate from Tables 5.5-1 to 8
  - considering incorporating addenda from 2008 Supplement to Standard 90.1

More Information?

- Proposed addenda to Standard 90.1-2007 are available during the review process.
- The 2008 Supplement expected to be available this fall.
- The Standard 90.1-2007 Users Manual is expected to be available this fall.
- For more information, contact:

www.ashrae.org