ANSI/ASHRAE/IESNA Standard 90.1-2004

Presented by

Larry Spielvogel, PE

Consulting Engineer

spielvogel@comcast.net

Why is Standard 90.1-2004 Important?

- It replaces ANSI/ASHRAE/IESNA Standard 90.1-2001
- It is one option for compliance with the 2006 ICC IECC
- It is the commercial building energy reference in NFPA 5000, NFPA's family of building codes
- It is the professional "standard of care" set by ASHRAE consensus
- Federal Government buildings are required to do 30% better than the minimum requirements of 90.1

2

This Is A Consensus Standard!

- The 2004 version of Standard 90 has been more than a decade in the making
- A full and open process
- A broad, balanced committee (60 members)
- 3 Public reviews and dozens of addenda
- Over 79,000 public comments
- Overwhelming consensus vote to publish

3

Relation To IECC

- "Where one or more of these sections [of IECC] is not satisfied, compliance for that section(s) shall be demonstrated in accordance with the applicable provisions of ASHRAE/IESNA 90.1." (IECC 501.2)

4

Organization of Standard 90.1-2004

1 Purpose
2 Scope
3 Definitions, Abbreviations, and Acronyms
4 Administration and Enforcement
5 Building Envelope
6 Heating, Ventilating, and Air-Conditioning (HVAC)
7 Service Water Heating
8 Power
9 Lighting
10 Other Equipment
11 Energy Cost Budget (ECB) Method
12 Normative References

5

Appendices – Standard 90.1-2004

NORMATIVE (part of standard)

A Assembly U-, C-, and F-Factor Determination

B Building Envelope Climate Criteria

C Envelope Trade-Off Methodology

D Climate Data

- *In 1999 & 2001 envelope criteria in 26 tables in Appendix B*
- *In 2004 only 8 tables, now included in text of Envelope section.*
- *Appendix B now contains only **climate** criteria.*

INFORMATIVE (not part of standard)

E Informative References

F Addenda Description Information *(2004/2001)*

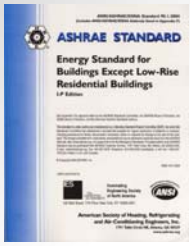
G Performance Rating Method *(2004)*

Items in red apply only to Standard 90.1-2004 / 2001

6

Section 1 - Purpose

The purpose of this standard is to provide minimum requirements for the energy-efficient design of buildings except low-rise residential buildings



7

Section 2 - Scope

- New buildings and their systems
- New *portions* of buildings and their systems (additions)
- New systems and equipment in *existing* buildings (alterations)

8

Section 2 – Scope *(continued)*

- Envelope
  - if heated by a heating system with an output capacity $\geq$ 3.4 btu/h-ft^2 or
  - if cooled by a cooling system with a sensible output $\geq$ 5 btu/h-ft^2
- Virtually all mechanical and lighting systems are covered

9

Scope Exceptions

- Too little heating or cooling
- Single-family, multifamily of three stories or less, manufactured or modular homes
- Buildings that don't use electricity or fossil fuel
- Equipment and portions of building systems that use energy primarily for industrial, manufacturing, or commercial purposes

Section 3 - Definitions

- Definitions – *in italics*
- Abbreviations
- Acronyms

Standard (excerpt)

5.3.1.2 Above-Grade Wall Insulation. All *above-grade walls*, including *mass walls*, *metal building walls*, *steel framed walls*, and *wood framed and other walls* shall have a *rated R-value of insulation* not less than that specified in Tables 5-1 through 5-26. Mass wall heat capacity shall be determined from Table A-6 or A-7, as appropriate.

Definitions

wall: that portion of the building envelope, including opaque area and fenestration, that is vertical or tilted at an angle of 60° from horizontal or greater. This includes above- and below-grade walls, between floor spandrels, peripheral edges of floors, and foundation walls. For the purposes of determining building envelope requirements, the classifications are defined as follows:

(a) ***above-grade wall:*** a wall that is not a below-grade wall.
(b) ***below-grade wall:*** that portion of a wall in the building envelope that is entirely below the finish grade and in contact with the ground.
(c) ***mass wall:*** a wall with a heat capacity exceeding (1) 7 Btu/ft^2·°F (143 kJ/m^2·K) or (2) 5 Btu/ft^2·°F (102 J/m^2·K) provided that the wall has a material unit weight not greater than 120 lbs/ft^3 (1920 kg/m^3).
(d) ***metal building wall:*** a wall whose structure consists of metal spanning members supported by steel structural members (i.e., does not include spandrel glass or metal panels in curtain wall systems).
(e) ***steel framed wall:*** a wall with a cavity (insulated or otherwise) whose exterior surfaces are separated by steel framing members (i.e., typical steel stud walls and curtain wall systems).
(f) ***wood framed and other walls:*** all other wall types, including wood stud walls.

Section 4 – Administration and Enforcement

- Addresses new buildings, additions to existing buildings, and alterations to existing buildings
- Addresses replacement of portions of existing buildings
- Discusses changes in space conditioning

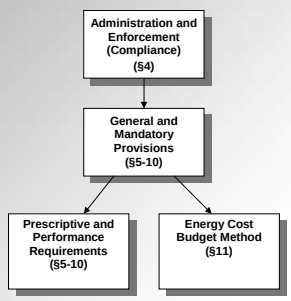
Section 4 – Administration and Enforcement

- Addresses compliance documentation
- Addresses labeling of materials and equipment
  - Fenestration, doors, insulation, mechanical equipment, and packaged terminal air conditioners
- Addresses alternative materials and methods of construction
- Addresses inspections

Section 4 – Administration and Enforcement

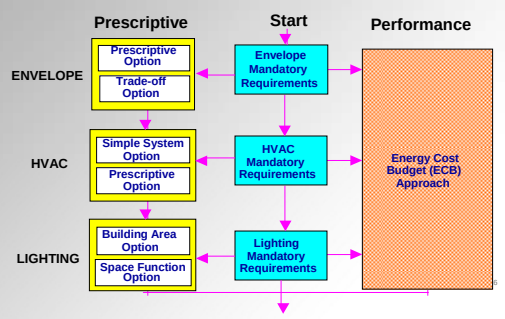
- Section 4 merely provides the overall statement that new buildings, additions, alterations, replacements, and changes in space conditioning fall under the requirements of the Standard
- Details of which requirements the building must actually meet in various situations are discussed in the technical sections 5, 6, 7, 8, 9,10, and 11 in the X.1 section named "General"

General Compliance Paths



15

Alternate Compliance Paths



Form Of Requirements

X.2 All yyy must zzz.

X.3 Yyy shall comply with zzz.

- Exception(s)
- May be up to 15 exceptions (Section 9.3.1) based on climate, building type, application, special needs, etc.
- Enforceable requirements with very specific exceptions and exemptions

17

Form Of Requirements

- Text
- Tables
  - Lots of tables
- No graphs
  - No interpretation, interpolation, extrapolation
- No figures
  - only 4 figures in entire standard

18

Prescriptive Options: Overview

- Prescriptive is most simple option to use
  - but least flexible
- 90.1-2004 version provides a 'true' prescriptive path

19

Performance Options: Overview

- More flexible, but more complex
- Description:
  - May establish a target based on the form and orientation of the proposed design.
  - May specify a target in energy consumption per square foot of floor area.
  - May limit tradeoffs to the building envelope.
  - May allow tradeoffs with other systems in the building.

20

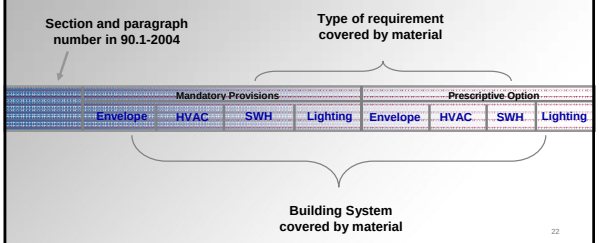
Technical Sections Of 90.1-2004 Are Reorganized

90.1-1999/2001	**90.1-2004**
X.1 General	X.1 General
	X.2 Compliance Paths
	X.3 Simple Buildings or Systems
X.2 Mandatory Provisions	X.4 Mandatory Requirements
X.3 Prescriptive Requirements	X.5 Prescriptive Requirements
X.4 Trade-Offs	X.6 Alternate Compliance Path
	X.7 Submittals
	X.8 Products

Items in red are new in Standard 90.1-2004

21

Presentation Reference

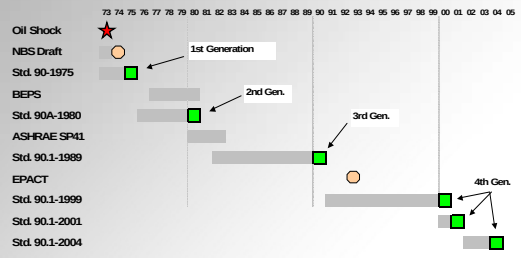


22

Development and Use of Standard 90

23

30 Years Of Standard 90



24

Standard 90 Development

- Core Team – Standard 90 developed jointly by:
  - American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) and
  - Illuminating Engineering Society of North America (IESNA)
- Developed under American National Standards Institute (ANSI) consensus guidelines

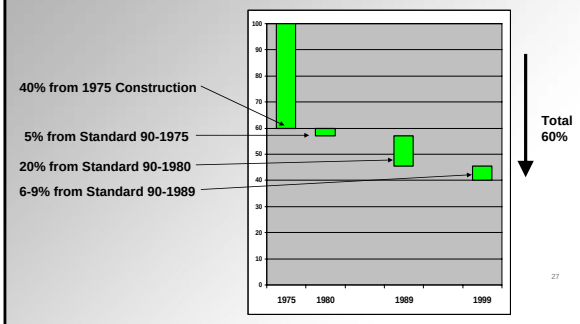
25

Other Development Participants

- Developed with participation from many building and construction organizations including:
  - American Institute of Architects (AIA)
  - Building Owners and Managers Association (BOMA)
  - North American Insulation Manufacturer's Association (NAIMA)
  - Air-Conditioning and Refrigeration Institute (ARI)
  - Gas Appliance Manufacturers Association (GAMA)
  - National Apartment Association (NAA)

26

Standard 90 Energy Savings



27

Compare Changes In Scope

	1975	1980	1989	1999 - 2004
Minimum Energy Requirements	Yes	Yes	Yes	Yes
Guidance (Beyond Minimums)	Yes	Yes	Yes	No
Separate Guidelines	No	No	No	Yes *
Additions & Alterations	No	No	No	Yes
Code Language	No	No	No **	Yes
Alternate Compliance Methods	Yes	Yes	More	More

28

*** Code Language for 1989 version produced 4 years later in 1993*

Uses Of Standard 90.1

- Used in Model Codes (e.g. IECC 2006).
- Referenced directly by state energy codes.
- World wide - a major source for energy codes.
- Used as baseline for advanced efficiency programs:
  - Some US utilities
    - Equipment incentive programs
    - Design Assistance Programs
  - Environmental rating systems (LEED®)
  - Advanced Energy Guidelines – AIA/ASHRAE/IES/ Small Office Design Guide to use 30% less energy than 90.1-1999

29

What's new in 90.1-2004/2001/1999? (Part 1)

- Implementation considered
  - Reorganized for ease of use
  - Written in code language
- Overall simplicity addressed
  - Simplified paths for compliance
  - Requirements move from simple to complex
- Both IP and SI versions available
- User's Manual available

30

What's new in 90.1-2004/2001/1999? (Part 2)

- Extended scope and coverage
  - alternations and additions
  - Explicit treatment of minimally conditioned spaces
- Requirements use clearer, enforceable language
- Expanded climates
  - Only prescriptive requirements that vary with climate are those for building envelope
  - In 1999 and 2001, just 2 variables used to identify climate variation – HDD65 and CDD55
  - In 2004, more complex climate analysis used, with more variables,
    as part of the process of reducing the number of climate zones.

31

What's new in 90.1-2004/2001/1999? (Part 3)

- Climate Zones
- Climate Parameters used by 90.1-2004
  - For envelope requirements only 2 parameters used – HDD65 and CDD50
  - For mechanical system requirements, 4 additional parameters
- All these climate parameters are listed for numerous locations in Appendix D.

32

Use Of Code Language

- Standards language (permissive, non-enforceable): *"Designers <u>should consider</u> the use of renewable energy."*
- Code language (mandatory, enforceable): "*Designs <u>shall incorporate</u> the use of renewable energy sources."*

33

Key Sections Simpler

- Envelope:
  - One envelope table for a location contains all prescriptive requirements
- Lighting:
  - One page of lighting prescriptive requirements
- HVAC:
  - Simplified Approach Option for HVAC requirements for smaller commercial buildings

34

Summary Of Changes 1999-2004

Informative Appendix F contains a listing of changes by addenda from previous versions:

Addendum Type	**90.1-2004** (from 2001)	**90.1-2001** (from 1999)
Administrative	4	2
Envelope	1	9
Mechanical	17	13
Lighting/Power	7	8
ECB	3	2
Total Addenda	32	34

35

One Basic Premise of Energy Laws, Codes, and Standards

- **To provide and require a variety of means to enable efficient building operation**
- **Especially controls and limits**

36

One Consequence of Energy Laws, Codes, and Standards

- They provide and require a variety of means to waste energy efficiently
- This is why so many green and LEED® buildings have high energy use

37

Be Aware of Process Syndrome

38

Be Aware of Consensus By Attrition

39

THANK YOU!

ANY QUESTIONS?

40