ASHRAE Standard 90.1-2013 and 10 CFR 433
Regulations, Requirements, and Tips

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Legislative Mandate

• Congress directed DOE to develop Federal building energy efficiency requirements for commercial and low-rise multi-family residential buildings that require those buildings to:
  ◪ Meet the ASHRAE Standard 90.1
  ◪ If life-cycle cost-effective, achieve 30% savings beyond ASHRAE Standard 90.1

Implementation of Legislative Mandate

• These requirements are implemented in 10 CFR 433 Energy Efficiency Standards For The Design And Construction Of New Federal Commercial And Multi-Family High-Rise Residential Buildings

• The current version of Standard 90.1 required is **Standard 90.1-2013**

https://www.ecfr.gov/cgi-bin/text-idx?tpl=/ecfrbrowse/Title10/10cfr433_main_02.tpl
10 CFR 433 – Past and Present

2006 – Interim Final Rule based on Standard 90.1-2004

2007 – Final Rule based on Standard 90.1-2004


2013 – Final Rule based on Standard 90.1-2010

2015 – Final Rule based on Standard 90.1-2013

2019 Planned – Final Rule based on Standard 90.1-2016
History of Standard 90.1 since 90.1-2004

• Bigger!
• Better!
• Lots of Changes!
Page Count for Versions of Standard 90.1

Page Count

2004: 179
2007: 183
2010: 221
2013: 270
2016: 380

BIGGER!
Standard 90.1 Efficiency Over Time

10 CFR 433 Baselines
Std 90.1-2004 - Original
Std 90.1-2007 - 4.5% lower
Std 90.1-2010 - 18.5% lower
Std 90.1-2013 - 7.5% lower
Std 90.1-2016 - 6.8% lower
Std 90.1-2019 - TBD
New Addenda (Changes) in Versions of Standard 90.1

Lots of Changes!

<table>
<thead>
<tr>
<th>Year</th>
<th>Count of Addenda</th>
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<tbody>
<tr>
<td>2007</td>
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<tr>
<td>2010</td>
<td>109</td>
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<td>2013</td>
<td>110</td>
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<tr>
<td>2016</td>
<td>121</td>
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Significant Changes in Standard 90.1-2013 (Increased Stringency)

• **Envelope** – Walls, roofs, fenestration, orientation, toplighting

• **HVAC, SWH, and Other** – Equipment efficiency for many types of equipment, high capacity water heating systems, motors

• **Power** – Transformers, voltage drop, electrical metering

• **Lighting** – Reduced lighting power allowances for interior and exterior, interior and exterior controls

Significant Changes in Standard 90.1-2016 (Increased Stringency)

- **Envelope** – Fenestration, metal building walls, doors, air barrier design
- **HVAC** – Equipment efficiency for many types of equipment, chilled water plant metering, economizer fault detection and diagnostics
- **Lighting** – Reduced lighting power allowances for interior and exterior, exterior and parking garage controls, parking area controls

Future of Standard 90.1 and 10 CFR 433

• Bigger!
• Better!
• Even More Changes!

Standard 90.1 will likely continue to improve under ASHRAE’s development.

DOE will continue updating 10 CFR 433 until Congress tells DOE otherwise, or until DOE finds that the new version of Standard 90.1 is not cost-effective.
Visions of the Future for Standard 90.1

Standard 90.1 will continue to improve. We just don’t know how quickly and how much it can improve.
Complying with Standard 90.1

✓ Mandatory Requirements
✓ Choosing a Compliance Path for Meeting Standard 90.1
✓ Using the Performance Rating Method for Demonstrating “at least 30% better if life-cycle cost-effective”
Mandatory Requirements in Standard 90.1

• These requirements MUST be met for all new Federal commercial and high-rise multi-family residential buildings

• There are LOTS of mandatory requirements

• All subsections of Standard 90.1-2013 that are numbered as “X.4,” “X.7,” “X.8,” and “X.9” are mandatory
Mandatory Requirements Count

- **2004**: 57 mandatory requirements
- **2007**: 58 mandatory requirements
- **2010**: 67 mandatory requirements
- **2013**: 72 mandatory requirements
- **2016**: 75 mandatory requirements

**Legend:**
- **Mandatory Technical Requirements**
- **Mandatory Documentation Requirements**
Mandatory Requirement Exceptions

• Some requirements have exceptions that are useful to Federal buildings
  ▪ Example – Standard 90.1-2013 has mandatory requirements for interior and exterior lighting controls, but many requirements have exceptions for security reasons

• Other requirements do not have useful exceptions
  ▪ Standard 90.1-2013 has mandatory requirements for building energy metering and building energy sub-metering that may exceed legislatively-mandated Federal metering requirements
  ▪ Standard 90.1-2013 has a lot of documentation requirements that are required in the private sector, but that may or may not be needed in the Federal sector.
    ✓ Example – in the absence of an “authority having jurisdiction”, who is the recipient of “compliance documentation”?
Choosing a Compliance Path for Standard 90.1-2013

- Standard 90.1-2013 offers a number of different compliance paths. Users can choose any compliance path listed in Section 4.2.1.1 of ASHRAE Standard 90.1-2013.
  - Users can also choose to use DOE’s COMcheck software to show compliance with Standard 90.1-2013 (see www.energycodes.gov/comcheck for free download).
- But users **MUST** use the Performance Rating Method in Standard 90.1-2013 and the whole building energy simulation for the “at least 30% better if life-cycle cost-effective” portion of 10 CFR 433.
Using the Performance Rating Method (PRM)

• The PRM is a whole building design tool. Start out with a whole building design team.

• If your team does not include experienced building modelers, consider hiring or contracting with an experienced modeler or modeling team. The PRM is complex and it is highly unlikely that you (or anyone else) can learn the PRM from scratch.

• Remember that modeling can be done at all phases of the design process, not just at the end. Make sure your budget allows for enough modeling to optimize your building design.
Useful Links - PRM

• Standard 90.1-2013
  ▪ See https://ashrae.iwrapper.com/ViewOnline/Standard_90.1-2013_I-P. The PRM is in Appendix G.

• Acceptable energy simulation programs  Whole building simulation tool recommendations are available at:
  ▪ Tools that meet the ASHRAE Standard 140 requirement in the PRM are available at https://www.energy.gov/eere/buildings/qualified-software-calculating-commercial-building-tax-deductions
  ▪ DOE’s complete list of software tools at https://www.buildingenergysoftwaretools.com/ or https://www.energy.gov/eere/buildings/building-energy-modeling
Run As Many Simulations as You Can?

- Running a lot of simulations and managing a lot of simulation output is a lot of work. Help **MAY** be on the way.

- In ASHRAE Standard 90.1-2016, the PRM has been revamped to provide a common baseline that will not change in future versions. The baseline is approximately that of Standard 90.1-2004.

- The **HOPE** is that a fixed baseline will attract private sector software developers to provide new tools to automate the PRM method.
1. Federal agencies are already required to use EnergyStar or FEMP-designated equipment under 10 CFR 436. This “counts” as part of the percent better than Standard 90.1. See https://www.energy.gov/eere/femp/search-energy-efficient-products

2. Selection of mechanical system types is not regulated in the PRM, although baseline system types are specified. If you choose a more efficient system than the baseline, that “counts” as part of the percent better than Standard 90.1. You can also get credit for “rightsizing” of HVAC equipment. See https://aceee.org/files/proceedings/2016/data/papers/5_190.pdf for an example of the impact system selection can have
3. The PRM baseline is neutral on building and window orientation. You can get credit for optimal window orientation.

4. The PRM has a set of baseline WWR assumptions. Use fewer or smaller windows than the baseline and you get credit (usually).

5. The PRM has a set of baseline envelope assumptions that include use of lightweight steel framed construction. Use wood framed construction or insulated metal panels and you can get credit.

6. The PRM is based on energy cost. While fuel costs are required to be the same between the baseline and proposed designs, you can get take advantage of fuel shifting (sometimes) for both HVAC and SWH.
7. You can get credit for onsite renewable energy and site-recovered energy, which is considered to have a “$0” cost in the PRM.

8. DOE has modified the percentage calculation in Standard 90.1-2013 to exclude process loads. You still need to model process loads but you can exclude them in the calculation of the percent better. (Buildings with significant process loads need to model those loads so that the building energy simulations properly capture the building performance.)
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