



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
- Section 109 of the Energy Policy Act of 2005, 42 USC 6834, <https://www.law.cornell.edu/uscode/text/42/6834>

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

2011 – Final Rule based on Standard 90.1-2007

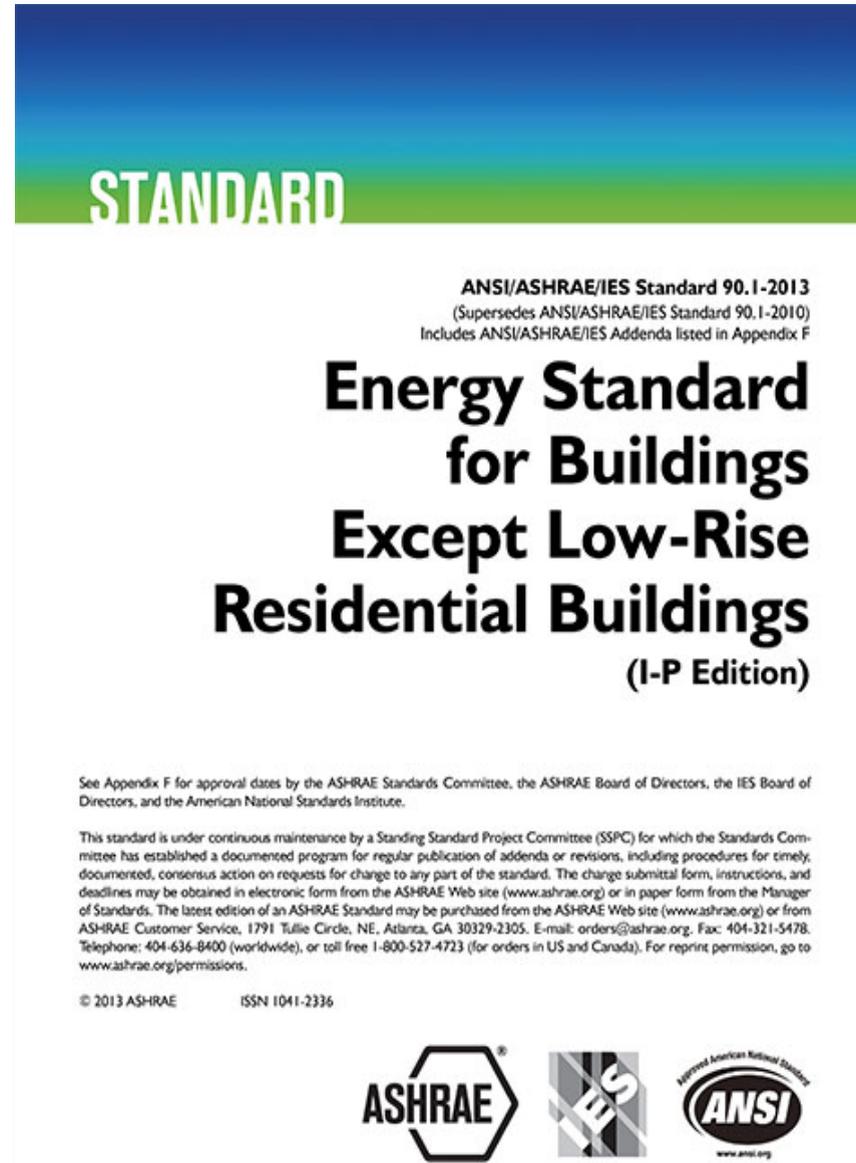
2013 – Final Rule based on Standard 90.1-2010

2015 – Final Rule based on Standard 90.1-2013

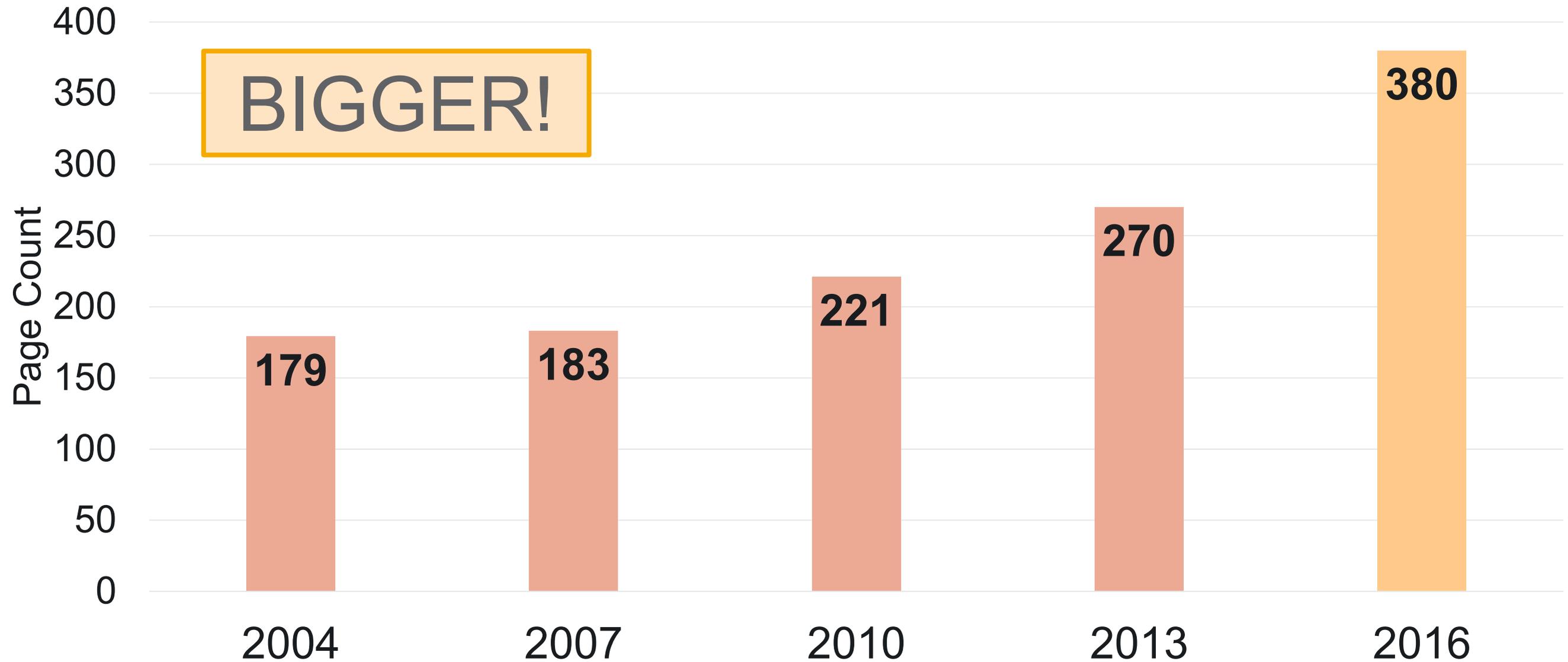
2019 Planned – Final Rule based on Standard 90.1-2016

History of Standard 90.1 since 90.1-2004

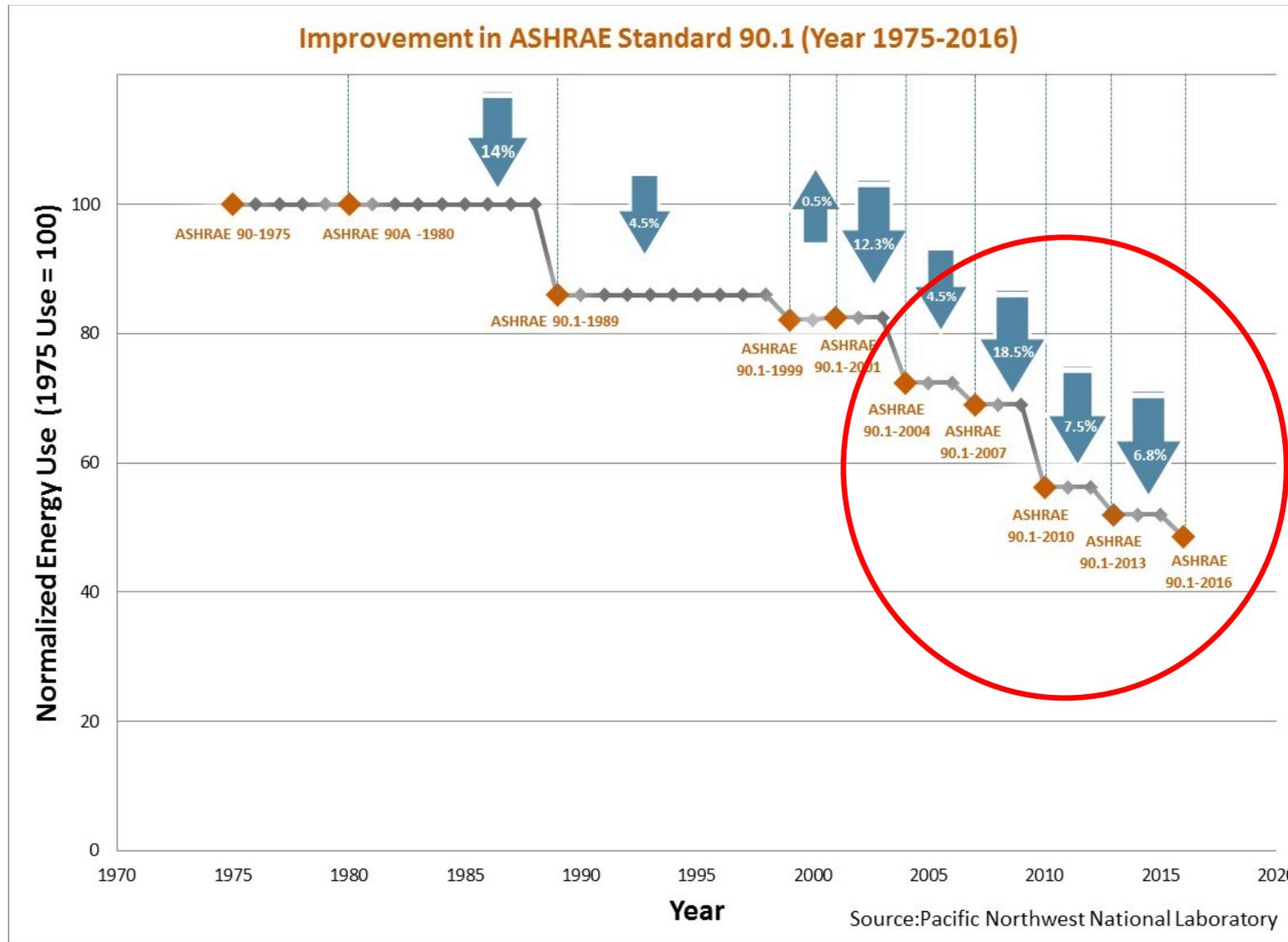
- Bigger!
- Better!
- Lots of Changes!



Page Count for Versions of Standard 90.1



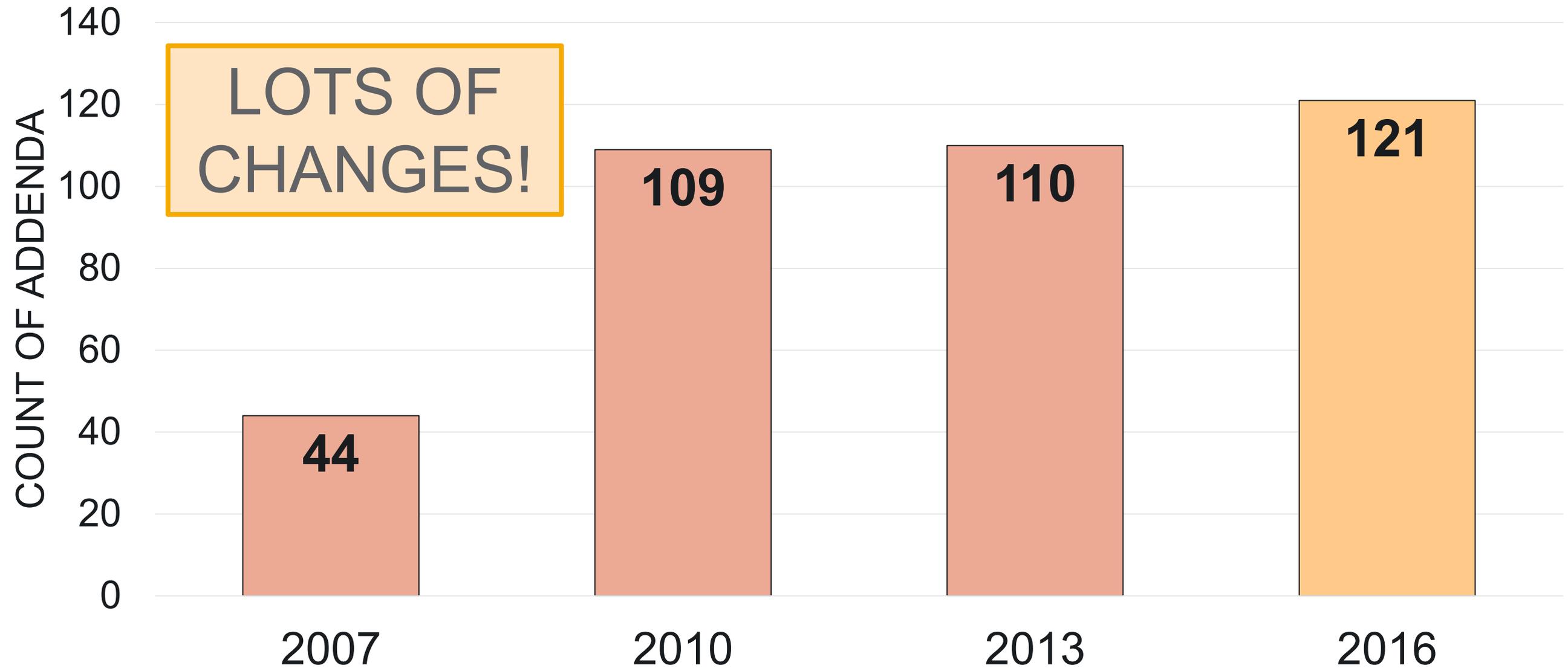
Standard 90.1 Efficiency Over Time



BETTER!

- 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



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

See much more detail at:

www.energycodes.gov/sites/default/files/documents/901-2013_finalCommercialDeterminationQualitativeAnalysis_TSD.pdf and
www.energycodes.gov/sites/default/files/documents/901-2013_finalCommercialDeterminationQuantitativeAnalysis_TSD.pdf.

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

See much more detail at:

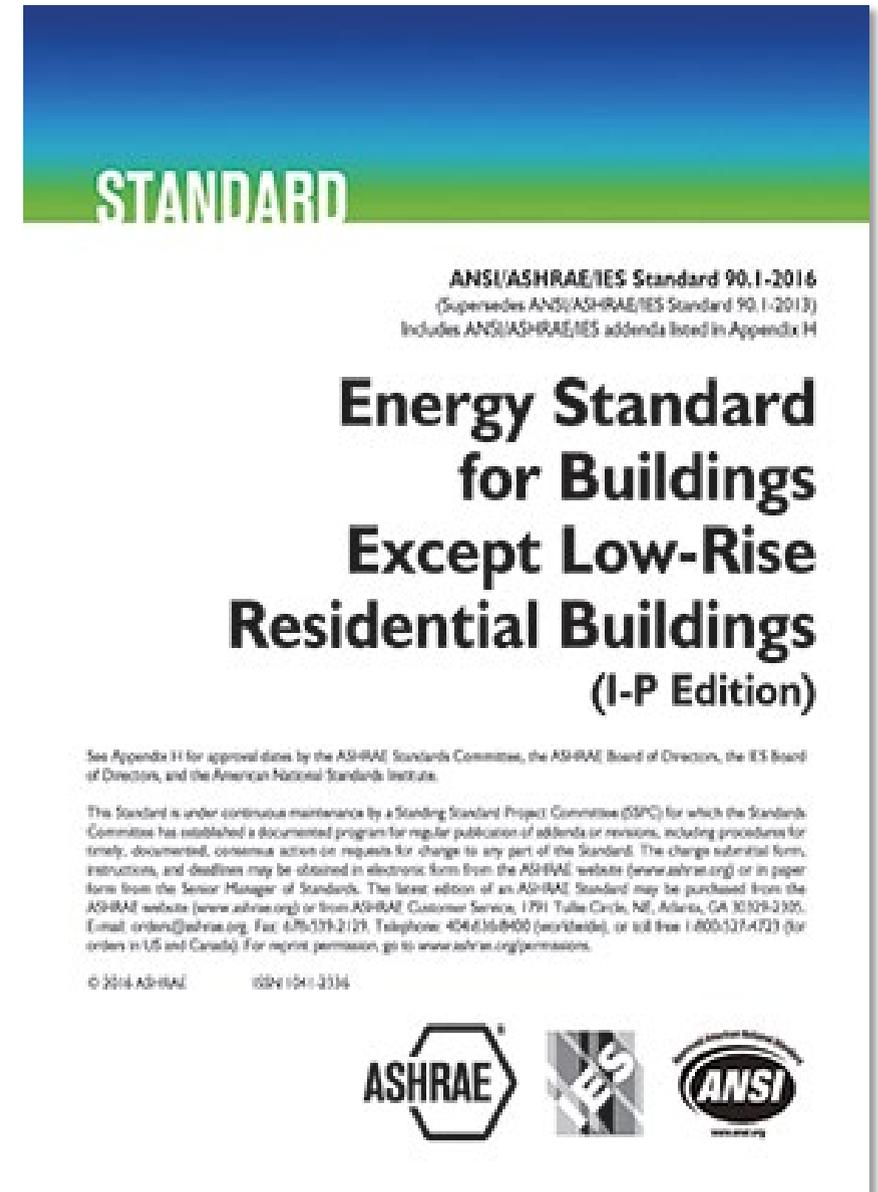
www.energycodes.gov/sites/default/files/documents/02202018_Standard_90.1-2016_Determination_TSD.pdf

Future of Standard 90.1 and 10 CFR 433

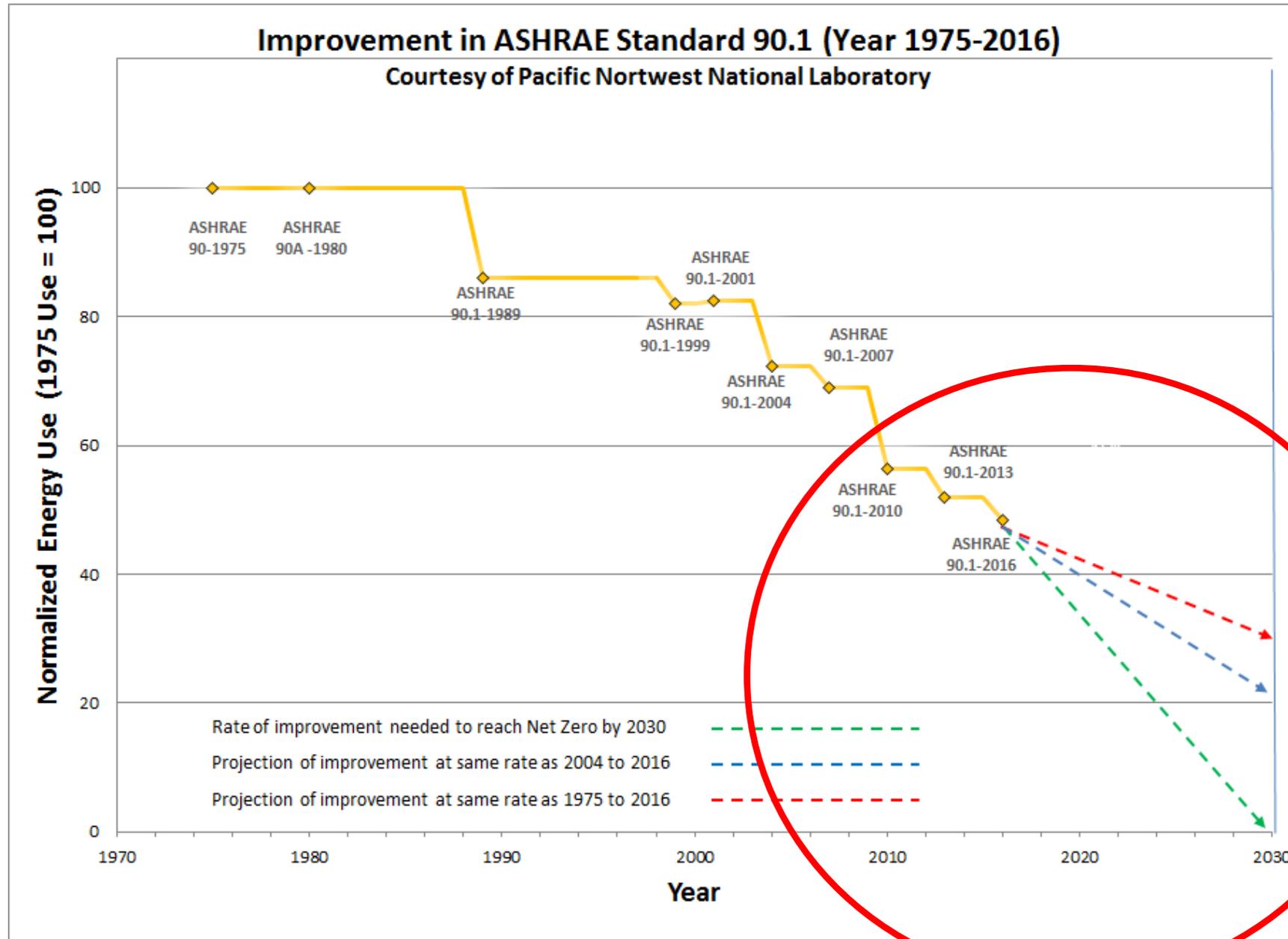
- Bigger!
- Better!
- Even More Changes!

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.

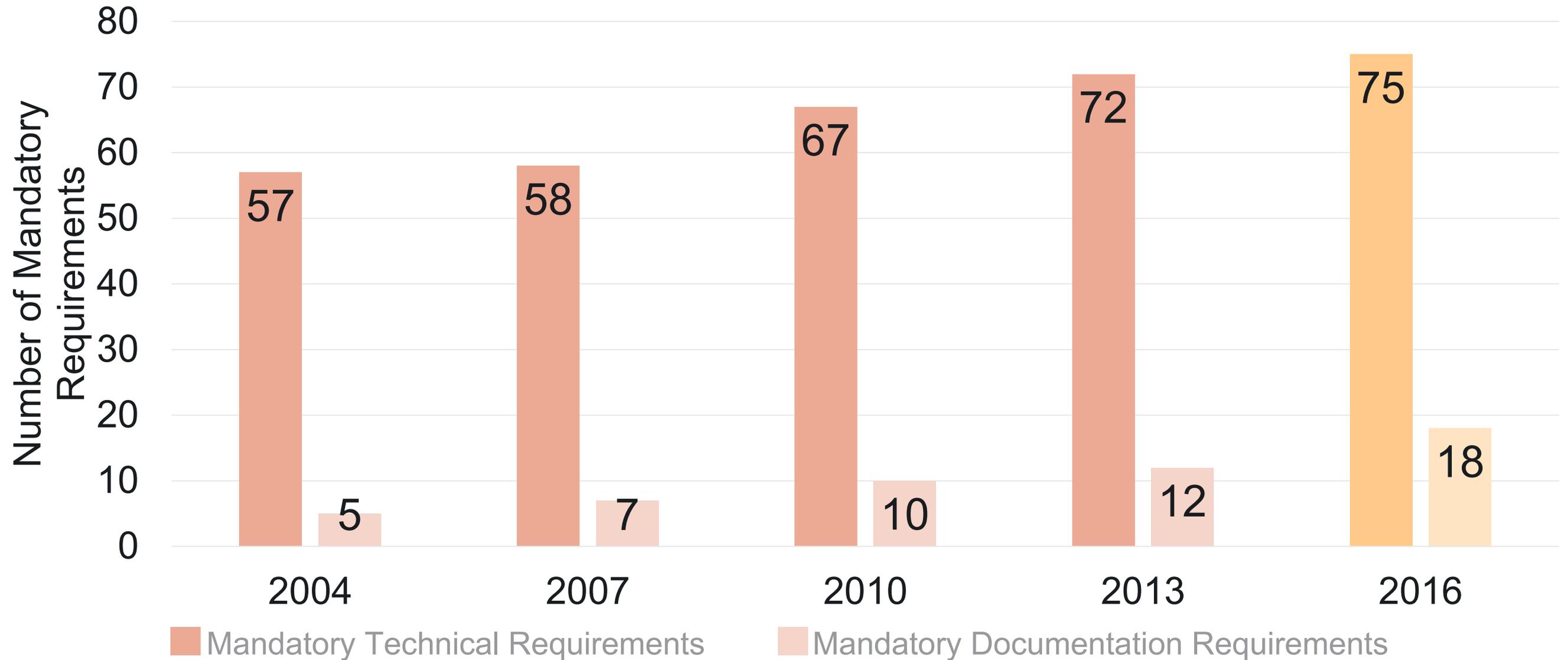
Complying with Standard 90.1

- ✓ 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



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.

Tips for Increasing the Percentage I

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

Tips for Increasing the Percentage II

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 light-weight 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.

Tips for Increasing the Percentage III

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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