ADDENDA

ANSI/ASHRAE/IES Addendum c to
ANSI/ASHRAE/IES Standard 90.2-2018

High-Performance Energy Design of Residential Buildings

Approved by the ASHRAE Standards Committee on February 4, 2023; by the ASHRAE Board of Directors on February 8, 2023; by the Illuminating Engineering Society on February 15, 2023; and by the American National Standards Institute on March 8, 2023.

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FOREWORD

The following is an explanation of why the changes in title, purpose, and scope (TPS) are necessary and how they will help integrate ASHRAE Standard 90.2 with other ASHRAE standards.

This revision is intended to achieve the goal of developing a globally appropriate, up-to-date leadership standard that will appeal to jurisdictions, energy efficiency program administrators, and organizations that want to encourage exemplary levels of energy performance in residential buildings.

The majority of changes fit into four general categories: leadership standard, high-rise residential, retrofit, and climate.

Leadership Standard

The 2018 edition of Standard 90.2 began with an ASHRAE Standards Advisory Panel (SAP) that developed a set of recommendations to create a new Standard 90.2 that was fundamentally different in intent than the previous version. The goal was a standard that "advances energy efficiency ahead of industry benchmarks such as the (International Energy Conservation Code) IECC." The new Standard 90.2 was intended not to compete with the IECC in providing a standard suitable as a minimum code in all jurisdictions, as required in the U.S. Energy Policy Act of 1992, and as ASHRAE Standard 90.1 is for commercial and high-rise buildings. Instead, it was intended as a leadership standard for jurisdictions that wanted to do more, for a specification for voluntary or incentivized programs, for foreign jurisdictions, or for organizations that want to implement ambitious climate goals for their operations. Several votes of the SSPC ratified this goal, and the published standard in 2018 achieves it by requiring more than 50% additional savings as compared to the 2006 IECC, and by focusing on whole-building performance to allow greater flexibility to users.

The success of Standard 90.2 as a leadership standard is reflected by the fact that the Consortium for Energy Efficiency, a North American organization of utilities and other energy efficiency program administrators, has already referenced its requirements in their specification for new housing efficiency programs, and its recommendations appear in an appendix of the IECC.

Now the market is beginning to look seriously at energy and greenhouse gas emissions performance. The need to retrofit buildings, at least in developed countries such as the United States, is increasingly recognized as even more important to achieving climate goals than the need to minimize annual emissions from new construction.

As a result, the SSPC voted unanimously to continue Standard 90.2's efforts to be a leadership standard and then voted unanimously on a definition of leadership that requires this change in TPS in order to meet it.

This change responds to the technical aspects of the need for leadership, building on recent efforts by government agencies, businesses, and the nonprofit sector. It also allows SSPC 90.2 to act in accordance with the goals set forth in the ASHRAE Position Document on Climate Change.

This standard is intended to be complementary to other efforts to promote energy efficiency, not only within ASHRAE but among other code and standard-writing organizations. As a leadership standard, it will almost of necessity have some overlap with the scope of other standards: If it didn't, SSPC 90.2 would be charged with writing both the minimum standard and the leadership standard. But overlap does not imply conflict or duplication: SSPC intends to work collaboratively and to be careful to avoid conflicts with other standards.

For example, SSPC 62.2 sets minimum requirements for indoor air quality, but some jurisdictions, especially those subject to a high level of wildfire smoke, may want higher levels of protection. SSPC 90.2 has formed a joint working group with SSPC 62.2 to develop such standards.

*Note that the scope has been revised to cover requirements for high levels of energy performance **of** residential buildings rather than **in** residential buildings, because the former can include outdoor energy use associated with the building (particularly for lighting), some of which is already regulated in Standard 90.2-2018*

Note also that using the ISO definition for "energy performance," greenhouse gas emissions can be an energy performance indicator.

High-Rise Residential

Since energy efficiency codes were first developed, they've placed high-rise (and mixed use) residential buildings in a different category than low-rise residential buildings, and ASHRAE and others developed a

different structure for energy codes based on this distinction. But the distinction now creates confusion and, from a technical point of view, should not be continued. Fundamentally, the building science is indifferent to the distinction between high-rise and low-rise residential, which is historically linked to fire-ladder reach. Low-rise buildings may include thousand-unit, three-story buildings with common central HVAC, while high-rise residential includes, as an extreme but real case, a more than 30-story single-family home. And if dwelling units are sealed against air leakage from one unit to another then stack effect is minimized.

In today's real estate markets in North America, an increasing fraction of new construction is multi-family buildings of three, four, or five stories, often with ground-floor retail. It creates confusion among builders to have separate and incompatible standards for a four-story building as compared to a three-story building constructed next door on the same schedule, or for a three-story building, which may or may not have a retail space on the ground floor. While Standard 90.1 will continue to provide the code-minimum level requirements for residential buildings of four or more stories, it makes sense for a leadership standard, such as Standard 90.2, to cover all residential units regardless of the building type.

Other reasons for this change include the following:

- *Standard 90.2-2018 sets its main requirements based on the test standard ANSI/RESNET/ICC Standard 301-2014, and the scope of the 2019 version of this test standard has been expanded to cover all residential dwelling units. It makes sense for Standard 90.2 to harmonize with RESNET 301-2019.*
- *Increasingly, local jurisdictions are looking at energy efficiency stretch codes, and ASHRAE lacks any leadership standards for residential buildings' energy and emissions performance.*
- *Utilities may be interested in a leadership standard for this market, as there is no other specification at the moment besides Energy Star, which is not as ambitious (for low-rise residential) as Standard 90.2-2018.*
- *The market need for advanced energy performance standards is not limited to the United States. High-rise residential is an often overlooked or under-resourced area for energy performance standards, especially considering that high rise is a larger portion of the market in most countries other than the U.S.*

Standard 90.1 is used as the basis for energy codes in many other countries. SSPC 90.2's new efforts will look more carefully at the needs of other interested countries from the beginning of the development of the expanded standard.

Retrofit

As energy analysts begin to look at what it would take for the U.S. and other developed countries to meet the goals of the Paris agreement, the consistent result (see the IPCC report of November 2018 and IEA's 2021 Milestones on the path to Net Zero by 2050 as examples) is that deep retrofits will be required of almost all buildings worldwide within the next dozen years or so.

But there is no substantive standard—that is, a standard that is based on specifiable actions that the building owner can take, such as adding insulation or sealing air leaks or upgrading the HVAC system—that is in enough of a leadership mode to assure a city or other jurisdiction that adoption will result in meeting climate needs. This expansion of scope allows ASHRAE to fill this need, and in doing so to advance ASHRAE's mission.

Retrofit standards at a leadership level are not easy to write, and SSPC 90.2 may not have the ability to meet the need in a comprehensive and timely way. We project that a retrofit standard might specify a level of ERI, or a set of prescriptive requirements, that all buildings would have to meet. It might have exceptions that reduce the requirements in cases where existing conditions make the typical retrofit action infeasible.

An adopting jurisdiction would decide whether the retrofits must be completed by a certain date, at point of sale or lease, or by other triggering events; or a set of requirements that a building would be required to make conditionally upon something else; or whether compliance offers benefits in terms of taxes or other permits. These issues are not within ASHRAE's expertise and will not be within the proposed scope.

What is within the scope are the technical standards for energy performance of the retrofitted structures. The key point is that the issue is complicated and likely to require a lot of work. But without the change in scope, the SSPC lacks the framework to begin making these revisions. If the SSPC can successfully generate new energy-efficient requirements for retrofits, ASHRAE will have responded to a serious customer need; if not, the standard will continue to offer guidance for remodels and additions per the current scope but will fail to meet the societal need.

Retrofit standards have been used successfully in California to address seismic safety, and they are broadly used in Europe. Climate change poses the likelihood of serious degradations of health and safety conditions and warrants similarly strong policy responses. ASHRAE can help jurisdictions meet these challenges in a technically sound manner.

Climate

The need to address greenhouse gas emissions has become more salient both domestically in the U.S. and globally since the publication of Standard 90.2 in November 2018. This change is evident in state and local actions on clean energy—both efficiency and renewable energy—in the federal government's prompt action to restore American participation in the Paris Agreement, in IPCC and IEA publications, and in official guidance from the International Organization for Standardization to its standards-writing committees to address climate change in all of their standards. (See ISO Guide 84:2020; ASHRAE is connected with ISO through ANSI's status as a member.)

The current purpose of Standard 90.2 is high energy performance. Energy performance is usually parallel to improved performance using climate metrics; thus the 2018 version of Standard 90.2 saves about 50% of energy and emissions compared to its baseline of 2006 code. But this is not always the case: sometimes an explicit focus on emissions reduction can yield even greater savings that are disproportionate to energy savings. Therefore Sections 1 and 2 expand the scope to further consider greenhouse gas emissions performance in addition to energy performance. This change is reflective of two main public purposes that an energy standard can serve: reducing costs and reducing climate emissions.

This change allows consideration in the standard of how building energy performance improvements can work by changing the time of energy consumption in order to allow more renewable energy (both on-site and on the grid) to be usefully deployed. Changing time of use can reduce both greenhouse gas emissions and cost. RESNET is currently developing standards for crediting methods that alter the time of energy consumption to reduce greenhouse gas emissions.

Other Issues

Other changes in Title, Purpose, and Scope:

- *The change in Title is limited to eliminating the restriction to low-rise residential buildings. This limitation was adopted by the SSPC, after considerable discussion, to emphasize that the new Standard 90.2 with broader scope is an outgrowth of the existing standard, and not a new standard. It is consistent with the SSPC's goal of focusing revisions on Addenda through the continuous maintenance process, which we have already done twice, rather than attempting a complete rewrite of the standard. The only negative vote on the TPS last summer expressed concerns about whether the SSPC could do everything proposed in the expanded scope, and the continuous maintenance process allows us to keep the work load manageable while proceeding down the most ambitious path we can succeed at. Minimizing the changes in the Title is also self-consistent with the content of Standard 90.2-2018, whose title is "Energy Efficient Design…" even though the scope includes consideration of renewable energy generated on site.*
- *The words "energy efficient" are retained even though the meaning is broader than ASHRAE has used in the past. Energy efficiency usually means the achievement of comparable energy services for lower energy consumption, but here the word also means the following:*
  - *1) the achievement of higher levels of energy service; and*
  - *2) the consideration of energy performance of the entire energy system, including the grid impacts. Thus, a building might become more efficient by changing the time at which energy is consumed without necessarily reducing annual site energy consumption.*
- *The words "high levels of energy and greenhouse gas performance" mean an increase in performance with reference to the levels embodied in codes, such as Standard 90.1 or the IECC, which specify "minimum" levels of energy efficiency. Standard 90.2-2018 illustrates these goals by requiring an ERI typically 20-25% lower than that required in the 2018 IECC.*

  The words are intended to convey the meaning that this is a leadership standard. Thus the intention is not to overlap or duplicate with other ASHRAE standards (or other standards) covering the same activities (retrofit, new construction, renovations, etc.) or covering energy at a more basic level of minimum legal requirements.

  In a fundamental way, the word "high" will be defined by the SSPC 90.2 work products. For the near term, the term will challenge the SSPC to develop text that carries out the meaning. It will provide a consensus forum for deciding in technical detail what highly efficient means.
- *Renewable energy: The Scope does not limit the applicability of the standard to residential buildings that consume fuels delivered to the site; it includes buildings that are off-grid and powered only by on-site renewable energy, as well as those buildings that do not require mechanical conditioning due to their efficient design. It is a strange anomaly of most codes that they only apply if heating or cooling capacity is over a threshold, while staying within the threshold now often denotes a very efficient space and not an unconditioned space. (This is not true of Standard 90.2-2018, however.) Renewable energy generated on*

site is considered within the ambit of energy efficiency and energy/greenhouse gas emissions performance, as it was in the 2018 publication, and as it is in the energy codes of California and Texas and other jurisdictions.

- *Controls and Internet connectivity for HVAC renewable energy systems (elimination of the words "design, construction, and verification" in Section 2, new systems explicitly covered in Section 2.2 items i and j): California's new energy code provides credits for energy storage in conjunction with renewable energy systems on-site, and this type of requirement is almost certain to be expanded to consider thermal storage as well as electrical storage. RESNET has decided, at the Board level, to develop time-of-use factors for computing energy ratings, including possibly ERI, and to develop algorithms to credit the use of various control schemes on HVAC and other equipment, and is proceeding with this standards development. To harmonize with such expected changes in the reference standard, SSPC 90.2 may consider operation as well as design, construction, and verification, so these aspects should not be out of scope. However, the main concept in Exemption 2.3.a is retained, as the new version will not require* specific procedures *for operation and maintenance.*

We are likely to want to do this work in any event, given the lack of guidance anywhere on how to model control algorithms that affect time of energy use. For example, if a water heater has the option of turning off at certain hours, corresponding either to a time of use utility tariff or an Internet signal, and of heating the water hotter than the thermostat setting when renewable energy is plentiful, how should these two options be modeled? Should limits on assumed thermostat settings be required? Do we provide credit by assuming that a capability (the time clock or the Internet connection) being there, or do we condition it on a probability of use at different possible settings?

Direct control by utilities increases the effectiveness of storage. The algorithms should reflect this finding. The Consortium for Energy Efficiency's specification on Internet connectivity, developed in partnership with AHRI, has detailed requirements for communication systems that the SSPC may want to use as a basis of requirements in Standard 90.2. These standards and specifications refer to operational characteristics as well as design and construction. Thus the Scope has been modified to cover connected controls in general, regardless of the media used to create connectivity.

Note: In this addendum, changes to the current standard are indicated in the text by underlining (for additions) and ~~strikethrough~~ (for deletions) unless the instructions specifically mention some other means of indicating the changes.

Addendum c to Standard 90.2-2018

Revise Section Title as shown.

High-Performance Energy ~~Efficient~~ Design of ~~Low-Rise~~ Residential Buildings

Revise Section 1 as shown.

1. PURPOSE

The purpose of this standard is to establish ~~the minimum~~ whole-building design ~~energy performance~~ requirements that enable high levels of *energy performance* and *greenhouse gas emission performance* for ~~energy efficient~~ *residential buildings*.

Revise Section 2 as shown.

2. SCOPE

This standard provides ~~the minimum design, construction and verification~~ requirements for achieving high levels of *energy performance* and *greenhouse gas emission performance* of ~~new~~ *residential buildings* and their systems ~~and new portions of existing *residential buildings* and their systems that use renewable and non-renewable forms of energy~~.

2.1 Building and portions of buildings covered:

a. ~~One- and two-family *d*~~*D*welling *units* in which the occupants are nontransient
b. ~~*Multi-family structures* of three stories or fewer above grade~~*Common areas* associated with residential occupancies
c. *Outbuildings* associated with residential occupancies

2.2 Systems Covered

a. Building envelope
b. HVAC and mechanical systems
c. Service hot-water systems
d. Major appliances
e. Interior and exterior ~~l~~lighting systems
f. Snow and ice melt systems
g. *Pools* and spas
h. *Renewable energy* systems
i. Energy storage systems
j. Connected controls

2.3 Exemptions. This standard does not apply to ~~the following:~~ transient housing, such as hotels, motels, nursing homes, jails, dormitories, and barracks.

~~a. Specific procedures for the operation, maintenance, and use of *residential buildings*.~~
~~b. Transient housing, such as hotels, motels, nursing homes, jails, dormitories, and barracks.~~

2.4 Health, Safety and Welfare. This standard shall not be used to abridge any safety, health, or environmental requirements.

Revise Section 3 as shown.

3.1 Definitions

energy performance: measurable result(s) related to energy efficiency, energy use, and/or energy consumption, evaluated against organizational goals and other performance factors such as the indoor environment. (***Informative Note:*** Adapted from ISO Standard 50001:2018)

greenhouse gas emission performance: measurable result(s) of greenhouse gas emissions associated with a building, including but not limited to Scope 2 and 3 emissions from the energy supply system serving the building, evaluated against organizational goals and other performance factors such as the indoor environment. (***Informative Note:*** Adapted from ISO Standard 50001:2018)

greenhouse gas (GHG)*:** gaseous constituent of the atmosphere, both natural and anthropogenic, that absorbs and emits radiation at specific wavelengths within the spectrum of infrared radiation emitted by the Earth's surface, the atmosphere, and clouds. (Informative Note:*** Adapted from ISO 14064-1:2018)

3.2 Abbreviations and Acronyms

GHG	greenhouse gas

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ASHRAE is concerned with the impact of its members' activities on both the indoor and outdoor environment. ASHRAE's members will strive to minimize any possible deleterious effect on the indoor and outdoor environment of the systems and components in their responsibility while maximizing the beneficial effects these systems provide, consistent with accepted Standards and the practical state of the art.

ASHRAE's short-range goal is to ensure that the systems and components within its scope do not impact the indoor and outdoor environment to a greater extent than specified by the Standards and Guidelines as established by itself and other responsible bodies.

As an ongoing goal, ASHRAE will, through its Standards Committee and extensive Technical Committee structure, continue to generate up-to-date Standards and Guidelines where appropriate and adopt, recommend, and promote those new and revised Standards developed by other responsible organizations.

Through its *Handbook*, appropriate chapters will contain up-to-date Standards and design considerations as the material is systematically revised.

ASHRAE will take the lead with respect to dissemination of environmental information of its primary interest and will seek out and disseminate information from other responsible organizations that is pertinent, as guides to updating Standards and Guidelines.

The effects of the design and selection of equipment and systems will be considered within the scope of the system's intended use and expected misuse. The disposal of hazardous materials, if any, will also be considered.

ASHRAE's primary concern for environmental impact will be at the site where equipment within ASHRAE's scope operates. However, energy source selection and the possible environmental impact due to the energy source and energy transportation will be considered where possible. Recommendations concerning energy source selection should be made by its members.

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