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

**Public Review Draft**

# Proposed Addendum c to Standard 90.2-2018, Energy Efficient Design of Low-Rise Residential Buildings

**Second Public Review (June 2022)**
**(Draft Shows Proposed Independent Substantive Changes to Previous Public Review Draft)**

This draft has been recommended for public review by the responsible project committee. To submit a comment on this proposed standard, go to the ASHRAE website at www.ashrae.org/standards-research--technology/public-review-drafts and access the online comment database. The draft is subject to modification until it is approved for publication by the Board of Directors and ANSI. Until this time, the current edition of the standard (as modified by any published addenda on the ASHRAE website) remains in effect. The current edition of any standard may be purchased from the ASHRAE Online Store at www.ashrae.org/bookstore or by calling 404-636-8400 or 1-800-727-4723 (for orders in the U.S. or Canada).

This standard is under continuous maintenance. To propose a change to the current standard, use the change submittal form available on the ASHRAE website, www.ashrae.org.

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**(This foreword is not part of this standard. It is merely informative and does not contain requirements necessary for conformance to the standard. It has not been processed according to the ANSI requirements for a standard and may contain material that has not been subject to public review or a consensus process. Unresolved objectors on informative material are not offered the right to appeal at ASHRAE or ANSI.)**

# FOREWORD

*The following is an explanation of why the changes in Title, Purpose, and Scope are necessary and how they will help integrate ASHRAE 90.2 with other ASHRAE standards.*

*This June 2022 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 and greenhouse gas emission performance in residential buildings.*

*This second public review draft is largely identical in terms of technical content to the first draft, with the exception of the removal of the previous Section 2.3.1 in response to a comment. However, the wording has changed--to increase clarity and reduce the potential for misunderstanding--in response to comments.*

*The majority of changes compared to the published 90.2-9018 fit into four general categories: leadership standard, high-rise residential, retrofit, and climate. The main changes in language since the first review draft reflect an attempt to triangulate between the recommendations of the diverse set of comments we received, but do not fundamentally change what is within the new scope and what is outside it. Rather, they mostly respond to suggestions that clarify the intent. The only change with technical content, in practice, is the deletion of Section 2.3.1.*

***Leadership Standard:***

*The 2018 revision of 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 ASHRAE 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 90.1 is for commercial and high-rise buildings. Instead it was intended as a leadership standard for jurisdictions that wanted to do more, or for a specification for voluntary or incentivized programs, or 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 compared to the 2006 IECC, and by focusing on whole-building performance to allow greater flexibility to users.*

*The success of 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 emission performance. This revised version explicitly calls out these terms to make it clear that we expect to create requirements around them.*

*Also, 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 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 (although we no longer use this expression to avoid confusion), 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 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 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 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 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 3, 4, or 5-stories, often with ground floor retail. It creates confusion among builders to have separate and incompatible standards for a 4-story building compared to a 3-story building constructed next door on the same schedule, or for a 3-story building which may or may not have a retail space on the ground floor, and some commenters pointed this out in suggesting that we implement the proposed change. While ASHRAE 90.1 will continue to provide the legally required (in the U.S.) code-minimum level requirements for residential buildings of 4 stories and more, it makes sense for a leadership standard, such as 90.2, to cover all residential units regardless of the building type.*

*Other reasons for this change are the following:*

1) *ASHRAE 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 ASHRAE 90.2 to harmonize with RESNET 301-2019, especially since no one has identified any problems resulting from the change.*

2) *Increasingly, local jurisdictions are looking at energy efficiency stretch codes, and ASHRAE lacks any leadership standards for residential buildings' energy and emissions performance.*
3) *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 90.2-2018.*
4) *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 other countries than in the U.S.*

*Many commenters supported this change, and many opposed it. However, the commenters in opposition did not offer any building science-based reasons for their opposition. It seemed to the SSPC that if there were reasons to create a separation between 3 story and 4 story residences, it would relate to differences in the technical content—what the standard requires—and not to the inability to create a leadership standard for high rise and mixed-use residential buildings, especially since the standard does not have a prescriptive path and instead is based on tradeoffs in meeting a defined performance level. Perhaps that level of performance should be different based on building height, but we saw no evidence for the need for such a differentiation, nor did we see evidence to suggest whether the existing benchmarks needed to be adjusted upward as opposed to downward. In any event, that issue relates not to the scope but to the technical content of the standard, which is yet to be developed.*

*ASHRAE 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, or 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 ASHRAE 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 90.2 is high energy performance. Energy performance is usually parallel to improved performance using climate metrics; thus the 2018 version of 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 emission 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 clarifies that the new Standard may include consideration 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 has developed standards for crediting methods that alter the time of energy consumption to reduce greenhouse gas emissions.*

*The word "clarifies" is used above rather than "enables" because climate pollution considerations are already implicitly within the scope of 90.2. ASHRAE 90.1 has used energy costs as the metric for energy consumption since 1989, but cost is not within its TPS. Rather, the ASHRAE world has assumed that an energy-derived metric is a constructive way of measuring energy for compliance purposes. Thus 90.2 could use emissions-weighted energy as its performance metric just as 90.1 uses cost-weighted energy.*

***Other Issues:***

*Other changes in Title, Purpose, and Scope:*

- ***The change in Title was limited in the first public review draft to eliminating the restriction to low-rise residential buildings. It was revised in this second public review draft to clarify that 90.2 will require high levels of performance, and that it is not a widely-scoped green building standard but is instead focused on energy. These revisions respond to comments by selecting a middle path that attempts to respond both to comments supporting more assertive language in leadership or to expand the scope further to include green buildings with those that preferred to keep the title as proposed in the first review draft.***

***This limitation was adopted by the SSPC, after considerable discussion, to emphasize that the new 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 more self-consistent with the content of 90.2-2018, whose title is "Energy Efficient Design…" even though the scope includes consideration of renewable energy generated on site.***

- ***"energy efficient":*** *The words "energy efficient" are removed from this draft because come commenters felt they were ambiguous or confusing, and the terms energy performance and greenhouse gas emission performance seemed to help reduce or eliminate the confusion.*
- *The words "high levels of ~~energy~~ performance ~~*energy performance* and *greenhouse gas emission performance"* mean an increase in performance with reference to the levels embodied in codes, such as ASHRAE 90.1 or the IECC, which specify "minimum" levels of energy efficiency. 90.2-2018 illustrates these goals byrequiring an ERI typically 20-25% lower than that required in the 2018 IECC. Both energy and GHG emission performance are defined in this proposal, in a way that does not commit 90.2 to any particular expansion of scope but permits expansion into areas such as indoor environmental quality, which is necessary because such considerations are already present in the normative requirements and thus should be acknowledged in the TPS.*

*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 90.2-2018, however.) Renewable energy generated on site is considered within the ambit of energy/greenhouse gas emission 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. The wording of section j is revised in response to a comment that the deleted word was confusing.*
*We are likely to want to do work on controls and O&M 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 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.*

*This also allows us to explore possible synergies with ASHRAE Standard 100.*

*Notes:*

1) *These changes are to enable normative text that the SSPC may add either on its own initiative or in response to public comment. It does not commit the SSPC to utilizing this additional scope.*
2) *Some definitions will have to change to accommodate this expansion of scope. For just one example, note that the new scope uses the term multi-family structures. This term is currently defined in 90.2 to limit the standard to buildings of three stories and fewer. This will need to change. Similarly, the SSPC will have to consider defining common areas. Such changes are not part of this public review: they are part of the normative text that will be offered for public review when the technical parts of the standard are ready.*
3) ***The changes being introduced in this second public review draft are the result of commenter feedback, discussion, and attempts at compromising between a diverse set of viewpoints.***

***[Note to Reviewers: This public review draft makes proposed independent substantive changes to the previous public review draft. These changes are indicated in the text by underlining (for additions) and strikethrough (for deletions) except where the reviewer instructions specifically describe some other means of showing the changes. Only these changes to the previous draft are open for review and comment at this time. Additional material is provided for context only and is not open for comment except as it relates to the proposed substantive changes.]***

## Addendum c to 90.2-2021

*Revise Section Title as follows:*

~~Energy Efficient~~ High Performance Energy Design of Residential Buildings

*Revise Section 1 as follows:*

## 1. PURPOSE

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

*Revise Section 2 as follows:*

## 2. SCOPE

This standard provides requirements for achieving high levels of ~~energy performance~~ *energy performance* and *greenhouse gas emission performance* of *residential buildings* and their systems.

### 2.1. Building and portions of buildings covered:

a. *Dwelling units* in which the occupants are non-transient
b. *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 lighting systems
f. Snow and ice melt systems
g. *Pools* and spas
h. *Renewable energy* systems
i. Energy storage systems
j. Connected ~~or algorithmic~~ controls

**2.3. Exemptions.** This standard does not apply to the following:

~~a. Specific procedures for the operation, maintenance, and use of *residential buildings,* other than for controls connected to building components and systems listed in Section 2.2.~~
~~b.~~ a. 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 follows:*

### 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.

[Source: adapted from ISO Standard 50001:2018]

*[Note to reviewers: Energy performance currently is measured by the ERI defined according to our ruleset, which addresses indoor air quality by not crediting leakage reductions beyond a threshold. This definition allows us if the 62.2/90.2 working group so suggests to require balanced ventilation at rate potentially higher than the 62.2 minimum, and to set requirements for retrofits that are constrained by cost considerations, and to consider comfort improvements that increase energy consumption. Thus it is not a measure of efficiency in the usual sense, because it does not count all energy uses equally. And also because it counts on-site renewable generation.]*

***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.

[Source: adapted from ISO Standard 50001:2018]

*[Notes to reviewers: This definition is designed to be parallel to the energy performance definition, allowing consideration of aspects of demand flexibility and solar that affect the $CO_2e$ Rating Index. While I believe that we already have the flexibility to use the $CO_2e$ Rating Index under our current scope—after all the current scope read strictly does not allow 90.1 or 189.1 to regulate energy COST—it is better to be transparent about new GHG standards. Transparency also makes it clear that considering non-$CO_2$ GHGs that are emitted upstream of the house is clearly part of GHG performance but arguable for energy performance.]*

***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.

[SOURCE: ISO 14064-1:2018]

## 3.2. Abbreviations and Acronyms

*GHG greenhouse gas*