BSR/ASHRAE/IES Addendum j
to ANSI/ASHRAE/IES Standard 90.2-2018

Public Review Draft

Proposed Addendum j to
Standard 90.2-2018, High-Performance
Energy Design of Residential Buildings

Third Public Review (February 2024)
(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).

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FOREWORD

This proposal includes three modifications to the current Standard. First, it allows for the use of offsite power, owned by the building owner, to be counted toward the ERI score. Second, it includes requirements for energy storage when on-site or off-site power are being used to meet the ERI score. Third, it lowers the ERI and CRI requirements when using on-site or off-site power while establishing an efficiency backstop. This new language expands access to renewable power systems when on-site power is not possible. It also ensures that the building incorporating the renewable power is best able to capture the benefits from it.

ERI scores were based on an analysis conducted by PNNL where 4 kW of solar PV were installed on reference housing in each climate zone. CRI scores were lowered by 10 points where renewable power systems are utilized based on the additional carbon free energy and the required energy storage provisions. Both ERI and CRI were separately validated for accuracy and determined to be achievable in each climate zone. Energy storage factors were taken from a 2021 analysis by the U.S. Energy Information Administration (EIA) that found that utility-scale batteries and pumped storage generally return about 80% of the electricity they store. A distance loss factor of 0.0008 was taken from a 2015 Oak Ridge National Laboratory study (ORNL/TM-2015/5) which found that a 345 kV utility line loses 160 MW per 100 miles for 2000 MW transmitted.

This proposal is motivated by the desire of both ASHRAE as an institution and SSPC 90.2, as well as numerous other stakeholders, to approach net zero energy and carbon within the 5 year publication schedule for ASHRAE 90.2. An approach to net zero clearly depends on incorporating more renewable energy into the requirements, and this goal may not be practical with on-site generation alone in many cases. Two examples are where the site is constrained by offsite shading or is small in comparison to the floor area of the building, such as for a 40-story condominium building in a large downtown.

The provisions in this Addendum are needed to support a move to encourage renewables more strongly in the Standard. The 2018 version assumed some modest amount of renewable energy in developing the ERI requirements, but the targets are feasible to achieve with efficiency alone, and are required to do so in this Addendum. But the lower ERI and CRI requirements all but require some renewables, and evidently the net zero goals cannot be met by efficiency alone.

We noted in developing this Addendum that the goal of an adoptable net zero standard requires these considerations. On the other hand, we observe, and seek comment on the observation, that a net zero Appendix can be extremely simple when the rules in this Addendum are added to the normative portion of the standard: the net zero requirements are simply to meet the rest of the standard and achieve ERI or CRI ratings of Zero.
Modify the standard as follows

**off-site power production**: energy that is legally bound to a dwelling unit owner that is generated by one of the following entities:
- Community Renewable Energy Facility,
- a Renewable Energy Investment Fund, or
- an off-site renewable energy system owned by the dwelling unit owner.
- Financial renewable power purchase agreement
- Physical renewable power purchase agreement
- Utility green power purchase program

**renewable energy power purchase agreement (PPA), financial**: a financial arrangement between a renewable electricity generator and a purchaser wherein the purchaser pays or guarantees a price to the generator for the project’s renewable generation. Also known as a “financial power purchase agreement” and “virtual power purchase agreement.”

**renewable energy power purchase agreement (PPA), physical**: a contract for the purchase of renewable electricity from a specific renewable electricity generator to a purchaser of renewable electricity.

### 6. PERFORMANCE REQUIREMENTS

#### 6.3 Off-Site Power Utilization

When **off-site power production** is used, ERI shall be calculated in accordance with BSR/RESNET/ICC 301 with the OPP in Equation 4.1.2 of BSR/RESNET/ICC 301 replaced with OPP_{Adj} as calculated in accordance with Equation 6-1. Off-site power production shall meet the requirements of Section 6.3.4 8.7. RECs generated in conjunction with off-site power shall be retired on behalf of the dwelling unit owner.

\[
OPP_{adj} = OPP + \sum_i^n RE_i \cdot PF_i
\]  
(6-1)

**OPP_{Adj}**: On-Site and Off-site power
**OPP**: Electric power produced on the site of a Rated Home as defined in RESNET/ICC 301
**RE_i**: Annual energy procured with the i-th procurement method

\[
PF_i = \eta_{stor} \cdot \eta_{trans} \cdot (1 - (d_{dist} \cdot d_{loss}))
\]  
(6-2)

Where:
- \(\eta_{stor}\): Round trip efficiency of off-site energy storage.
- \(\eta_{trans}\): Efficiency of all transformers between where the electricity is produced and site being evaluated
- \(d_{dist}\): distance between where the electricity is produced and site being evaluated. Measured in the most direct way possible (miles)
- \(d_{loss}\): Energy lost per distance (kW/mile)
### Table 6-2 Procurement Factor Coefficients

<table>
<thead>
<tr>
<th>term</th>
<th>Value</th>
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<tbody>
<tr>
<td>$\eta_{stor}$</td>
<td>0.80</td>
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<tr>
<td>$\eta_{trans}$</td>
<td>0.95</td>
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<tr>
<td>$d_{loss}$</td>
<td>0.0008 kW/mile</td>
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</tbody>
</table>

#### 8.7 Renewable Energy Systems and Energy Storage Verification

When on-site power production, off-site power production or energy storage is used for compliance, the following shall be verified:

a. All minimum requirements of Section 6.3.

b. The on-site power production system and/or energy storage system is installed in accordance with the configuration and performance characteristics modeled in the proposed design.

c. A report is available for the off-site power production system and energy storage system demonstrating that it is operational, has the stated capacity installed, and has the stated energy storage system capacity installed (if applicable).

d. Documentation that shall demonstrate that not less than 15 years of annual renewable energy production capacity and energy storage capacity used to comply with this standard is legally bound to the dwelling unit owner and is structured to survive a full or partial transfer of ownership of the dwelling unit.

e. Documentation that shall demonstrate that not less than 15 years of annual renewable energy production capacity and energy storage capacity used to comply with this standard is legally bound to the dwelling unit.