

GEW23-14

602.1, 602.1.1, 602.1.2, 602.1.2.1, Table 602.1.2.1, 602.1.2.2, Table 602.1.2.2, 602.1.2.3

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Revise as follows:

602.1 Performance-based compliance. Compliance for buildings and their sites to be designed on a performance basis shall be determined by predictive modeling. Predictive modeling shall use ~~source site~~ energy kBtu/sf-y unit measure based on compliance with Section 602.1.1 and CO₂e emissions in Section 602.3. Where a building has mixed uses, all uses shall be included in the performance-based compliance.

602.1.1 zEPI. Performance-based designs shall demonstrate a zEPI of not more than 51 as determined in accordance with Equation 6-1 for energy use reduction and shall demonstrate a CO₂e emissions reduction in accordance with Section 602.2 and Equation 6-2 for CO₂e.

$$zEPI = 57 \times (EUI_p/EUI) \tag{Equation 6-1}$$

where:

EUI_p = the proposed energy use index in ~~source site~~ kBtu/sf-y for the proposed design of the building and its site calculated in accordance with Section 602.1.2.

EUI = the base annual energy use index in ~~source site~~ kBtu/sf-y for a baseline building and its site calculated in accordance with Section 602.1.2.

602.1.2 Base annual energy use index. The proposed energy use index (EUI_p) of the building and building site shall be calculated in accordance with Equation 6-1 ~~and Appendix G to ASHRAE 90.1, as modified by Sections 602.1.2.1 through 602.1.2.3.~~ The annual energy use shall include all energy used for building functions and its anticipated occupancy.

602.1.2.1 Modifications to Appendix G of ASHRAE 90.1. The performance rating in Section G1.2 of ASHRAE 90.1 shall be based on energy use converted to consistent units in accordance with Sections 602.1.2.2 and 602.1.2.3, instead of energy cost.

**TABLE 602.1.2.1
ELECTRICITY GENERATION ENERGY CONVERSION FACTORS BY EPA eGRID SUB-REGION***

| eGRID 2007 SUB-REGION ACRONYM | eGRID 2007 SUB-REGION NAME | ENERGY CONVERSION FACTOR |
|-------------------------------|----------------------------|--------------------------|
| AKGD | ASCC Alaska Grid | 2.97 |
| AKMS | ASCC Miscellaneous | 4.76 |
| ERCT | ERCOT All | 2.93 |
| FRCC | FRCC All | 2.97 |
| HIMS | HICC Miscellaneous | 3.82 |
| HIOA | HICC Oahu | 3.14 |
| MORE | MRO East | 3.40 |
| MROW | MRO West | 3.41 |

| eGRID-2007-SUB-REGION-ACRONYM | eGRID-2007-SUB-REGION-NAME | ENERGY CONVERSION FACTOR |
|-------------------------------|----------------------------|--------------------------|
| NYLI | NPCC-Long-Island | 3.20 |
| NEWE | NPCC-New-England | 3.01 |
| NYCW | NPCC-NY/Westchester | 3.32 |
| NYUP | NPCC-Upstate-NY | 2.51 |
| RFCE | RFCEast | 3.15 |
| RFCM | RFCEast-Michigan | 3.05 |
| RFCW | RFCEast-West | 3.14 |
| SRMW | SERC-Midwest | 3.24 |
| SRMV | SERC-Mississippi-Valley | 3.00 |
| SRSO | SERC-South | 3.08 |
| SRTV | SERC-Tennessee-Valley | 3.11 |
| SRVC | SERC-Virginia/Carolina | 3.13 |
| SPNO | SPP-North | 3.53 |
| SPSO | SPP-South | 3.05 |
| CAMX | WECC-California | 2.61 |
| NWPP | WECC-Northwest | 2.26 |
| RMPA | WECC-Rockies | 3.18 |
| AZNM | WECC-Southwest | 2.95 |

a. Sources: EPA eGrid2007 version 1.1, 2005 data; EPA eGrid regional gross-grid loss factors; EIA Table 8.4a (Sum tables 8.4b and 8.4c) and Table 8.2c (Breakout of Table 8.2b), 2005 data.

602.1.2.2 Electric power. In calculating the annual energy use index, electric energy used shall be consistent units by converting the electric power use at the utility meter or measured point of delivery to Btus and multiplying by the conversion factor in Table 602.1.2.1 based on the geographical location of the building.

**TABLE 602.1.2.2
U.S. AVERAGE BUILDING FUELS ENERGY CONVERSION FACTORS BY FUEL TYPE^a**

| FUEL TYPE | ENERGY CONVERSION FACTOR |
|-------------|--------------------------|
| Natural Gas | 1.09 |
| Fuel Oil | 1.13 |
| LPG | 1.12 |

a. Source: Gas Technology Institute Source Energy and Emissions Analysis Tool.

602.1.2.3 Nonrenewable energy. In calculating the annual energy use index for fuel other than electrical power, energy use shall be converted to consistent units by multiplying the nonrenewable energy fossil fuel use at the utility meter or measured point of delivery to Btu's and multiplying by the conversion factor in Table 602.1.2.2. The conversion factor for energy sources not included in Table 602.1.2.2 shall be 1.1. Conversion factors for purchased district heating shall be 1.35 for hot water and 1.45 for steam. The

conversion factor for district cooling shall be 0.33 times the value in Table 602.1.2.1 based on the EPA eGRID Sub-region in which the building is located.

Reason: These suggested edits would help to streamline the IgCC and improve the accounting of energy usage in Chapter 6.

They would also make the IgCC easier to understand, easier to enforce, easier to measure, easier to verify performance, and make the code consistent with ASHRAE Standard 189.1, which uses site energy metrics.

In addition, this proposal would bring that will be in line with the agreement between ASHRAE, USGBC, AIA, and IESNA.

Although zEPI is a relatively new concept and has not been used in any other enforceable building code, it offers promise so far as tracking the energy efficiency performance of buildings towards a goal of "net zero." In the first publication of the IgCC, the code used a version of ZEPI that required users to convert calculated annual site energy consumption into "source energy" units. However, ZEPI works with any consistent energy unit input, whether it be site or source energy units.

This proposal would eliminate the extra steps involved in converting site to source energy and would make the process more consistent with ICC affiliates that have consciously chosen to use site energy metrics.

For example, the conclusion by a panel of experts that published the ASHRAE *Report of the Technology Council Ad Hoc Committee on Energy Targets* (June 2010) concluded:

"The Vision 2020 Ad Hoc also realized that in order to make such a vision a reality, they would need to define a single meaning for net-zero energy building. The conclusion they reached is supported by this Energy Targets Ad Hoc. Quoting from the Vision 2020 report:

'Ultimately, the only way to measure if a building is a NZEB is to look at the energy crossing the boundary. Other definitions, including source, emissions, and cost, are based on this measured information and include weighting factors and algorithms to get to the metric of interest. Because of the complications involved in making these computations, **site energy measurements** have been chosen through an agreement of understanding between ASHRAE, the American Institute of Architects (AIA), the U.S. Green Building Council (USGBC), and the Illuminating Engineering Society of North America (IESNA).'

In addition, in a report entitled *DOE Commercial Building Energy Asset Rating Program Focus Groups with Primary Stakeholders in Seattle*, in a series of focus groups convened by the U.S. Department of Energy, a primary conclusion was that users of building performance data preferred site energy to source energy. One of the key findings of the Report was:

"Including site versus source energy use was confusing or did not provide value. Site information was preferred by most stakeholders.

In another part of the report it stated:

"Comparing site energy use versus source energy use is confusing or does not provide value. Page 1 of the asset rating report compared site energy use and source energy use. Several building stakeholders did not find the source energy use information helpful because they are more concerned with site energy. For example, one participant commented *"When I first looked at this in trying to figure out what it all meant, I ended up just focusing on the "site energy use," I mean, thinking that the "source energy use" really wasn't going to be on anyone's high priority list of evaluations when they're looking at buying a building.*" And another participant has this to say about source information: *"As a building owner...do I really care about source energy use? ...I'm just more focused on what's it costing me."* In addition, a few building stakeholders were confused by source energy and did not understand the purpose of presenting the information."

Furthermore, there have been significant changes in energy production since 2005 (more renewable electricity production, more hydraulic fracturing of shale gas, more deepwater drilling and oil sands production of fuel oil) which is not captured in any of the current Chapter 6 table estimates. In addition, no projected estimates are shown for the years 2015 and beyond. These values are not static, and to knowing use significantly incorrect as well as static estimates will create situations that contradict the purpose of this code (e.g., building designers selecting energy types such as fuel oil with a lower source estimate than electricity will lead to many non-green buildings that will increase the amount of oil imports).

Bibliography:

1. DOE CBAR Asset Rating Program focus groups:

http://apps1.eere.energy.gov/buildings/publications/pdfs/commercial_initiative/asset_rating_s_eattle_focus_groups.pdf

2. ASHRAE Tech Council June 2010 report:

http://www.tc76.org/docs/Energy_Targets_Report_2010-06-22.pdf

3. Fossil fuel upstream source energy estimates and emissions information:

<http://www.netl.doe.gov/energy-analyses/pubs/NG-GHG-LCI.pdf>

<http://www.pnas.org/content/early/2011/10/13/1107409108.full.pdf>

http://www.ipcc-nggip.iges.or.jp/public/gp/bgp/2_6_Fugitive_Emissions_from_Oil_and_Natural_Gas.pdf

https://circabc.europa.eu/d/d/workspace/SpacesStore/db806977-6418-44db-a-64-20267139b34d/Brandt_Oil_Sands_GHG_Final.pdf

<http://www.nytimes.com/2011/09/27/business/energy-environment/in-north-dakota-wasted-natural-gas-flickers-against-the-sky.html?pagewanted=all>

<http://www.investmentu.com/2011/September/natural-gas-flaring.html>

Cost Impact: Will not increase the cost of construction.

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