GEW24-14

602, 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, 602.1.3, 602.2, 602.2.1, 602.2.2, Table 602.2.2, 602.2.3

Proponent: Maureen Guttman, Building Codes Assistance Project, representing Building Codes Assistance Project (mguttman@ase.org)

Revise as follows:

602 ~~MODELED PERFORMANCE PATHWAY~~ ~~REQUIREMENTS~~ PERFORMANCE-BASED COMPLIANCE

602.1 Performance-based compliance. Compliance for buildings and their sites to be designed on a performance basis shall be determined by predictive modeling of both energy performance and CO_2e emissions. Predictive energy modeling shall use source energy kBtu~~/sf-y~~ unit measure based on compliance with ~~Section 602.1.1 and CO_2e emissions in Section 602.3. Where a building has mixed uses, all uses shall be included in the performance-based compliance~~ Section 602.2. Predictive CO_2e emissions modeling shall be in accordance with Section 602.3.

~~602.1.1 zEPI~~ 602.2 Energy performance modeling. Performance-based designs shall demonstrate a zEPI of not more than ~~51~~ 50 as determined in accordance with Equation 6-1 ~~for energy use reduction and shall demonstrate a CO_2e emissions reduction in accordance with Section 602.2 and Equation 6-2 for CO_2e~~.

zEPI = 57 x (Proposed building performance/Baseline building performance) ~~(EUIp/EUI)~~

(Equation 6-1)

where:

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

Proposed Building Performance = The proposed building performance in source kBtu for the proposed design of the building and its site calculated in accordance with Section 602.2.1.

Baseline Building Performance = The baseline building performance in source kBtu for a baseline building and its site calculated in accordance with Section 602.2.1.

57 = A fixed value representing the performance of a baseline building designed to comply with the 2012 *International Energy Conservation Code*.

~~602.1.2 Base annual energy use index.~~ 602.2.1 Modeling methodology. The proposed ~~energy use index (EUIp)~~ building performance and the baseline building performance 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~~ Section 602.2.1.1 and Section 602.2.1.2. The ~~annual~~ energy use modeling shall include all energy used for building and site functions and ~~its~~ anticipated occupancy.

~~602.1.2.1~~.602.2.1.1 ~~Modifications to Appendix G of ASHRAE 90.1~~ Energy units. The ~~performance rating~~ building performance calculations in Section ~~G1.2~~ G3 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. 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 Btus and multiplying by the conversion factor in Table 602.1.2.2 based on the geographical location of the building.

TABLE ~~602.1.2.1~~ 602.2.1.1
ELECTRICITY GENERATION ENERGY CONVERSION FACTORS BY EPA

(portions of table not shown remain unchanged)

~~602.1.2.2 Electric power~~ 602.2.1.2 Site to source electric power conversion. In calculating the ~~annual energy use index~~ the proposed building performance and the baseline building performance, electric energy used shall be calculated in source energy ~~consistent units~~ by ~~converting~~ multiplying the electric power use at the utility meter or measured point of delivery ~~to~~ in Btus ~~and multiplying~~ by the conversion factor in Table 602.1.2.1 based on the geographical location of the building.

~~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.~~

TABLE ~~602.1.2.2~~ 602.2.1.2
U.S. AVERAGE BUILDING FUELS ENERGY CONVERSION FACTORS BY FUEL TYPE[a]

FUEL TYPE	ENERGY CONVERSION FACTOR
Natural Gas[a]	1.09
Fuel Oil[a]	1.13
LPG[a]	1.12
Purchased District Heating - Hot Water	1.35
Purchased District Heating - Steam	1.45
District Cooling	0.33 x value in Table 602.1.2.1
Other	1.1

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

~~602.1.3 Registered design professional in responsible charge of building energy simulation.~~ ~~For purposes of this section, and where it is required that documents be prepared by a *registered design professional*, the *code official* is authorized to require the owner to engage and designate on the building permit application a *registered design professional* who shall act as the registered design professional in responsible charge of building energy simulation. Modelers engaged by the registered design professional in responsible charge of building energy simulation shall be certified by an *approved* accrediting entity. Where the circumstances require, the owner shall designate a substitute registered design professional in responsible charge of building energy simulation who shall perform the duties required of the original registered design professional in responsible charge of building energy simulation. The *code official* shall be notified in writing by the owner whenever the registered design professional in responsible charge of building energy simulation is changed or is unable to continue to perform the duties.~~

~~602.2 Annual direct and indirect CO_2e emissions~~ 602.3 CO_2e emissions modeling. The CO_2e emissions ~~calculations~~ for the proposed and baseline building and building site shall be ~~determined~~ based on the proposed and baseline building performance calculated in accordance with Sections 602.2.1 and ~~602.2.2~~ as modified by Sections 602.3.1 and 602.3.2. The emissions associated with the proposed

design shall be less than ~~or equal to~~ the CO_2e emissions associated with the standard reference design in accordance with Equation 6-2.

CO_2e pdp ≥ (zEPI x CO_2e ~~srbd~~bbp)/57 **(Equation 6-2)**

where:

zEPI = the minimum score in accordance with Section ~~602.1.1~~ 602.2.

CO_2e pdp = emissions associated with the proposed ~~design~~ building performance.

CO_2e ~~srbd~~ bbp=emissions associated with the ~~standard reference budget design~~ baseline building performance in accordance with Section 602.1.2.

57 = A fixed value representing CO_2e emissions of a baseline building designed to comply with the 2012 *International Energy Conservation Code*.

~~602.2.1~~ 602.3.1 ~~Onsite~~ CO_2e emissions from electricity. Emissions associated with use of electric power shall be ~~based on electric power excluding any renewable or recovered waste energy covered under Section 602.2.1. Emissions shall be~~ calculated by converting the electric power used by the building at the electric utility meter or measured point of delivery, to MWHs, and multiplying by the CO_2e conversion factor in Table 602.2.1 based on the EPA eGRID Sub-region in which the building is located.

~~602.2.2~~ 602.3.2 Onsite nonrenewable energy. Emissions associated with the use of nonrenewable energy sources other than electrical power ~~such as natural gas, fuel oil, and propane~~ shall be calculated by multiplying the fossil fuel energy used by the building and its site at the utility meter by the national emission factors in Table 602.2.2 ~~and the conversions required by this section. Emissions associated with fossil fuels not specified in Table 602.2.2 shall be calculated by multiplying the fossil fuel used by the building at the utility meter by 250~~. Emissions associated with purchased ~~district energy shall be calculated by multiplying the energy used by the building at the utility meter by 150 for hot water and steam, and for~~ district cooling shall be calculated by multiplying by the factors from Table ~~602.2.2~~ 602.2.1 based on the EPA eGRID Sub-region in which the building is located.

~~**TABLE 602.2.2 602.3.2**~~
~~**FOSSIL FUEL EMISSION FACTORS**~~

~~EMISSION RATE (lb/MMbtu HHV)~~	~~NATURAL GAS AS STATIONARY FUEL~~	~~FUEL OIL AS STATIONARY FUEL~~	~~PROPANE AS STATIONARY FUEL~~
~~CO_2e~~	~~137.35~~	~~200.63~~	~~162.85~~

~~For SI: MMBtu = 1,000,000 Btu = 10 terms: HHV = High-heating value.~~

TABLE 602.3.2
FOSSIL FUEL EMISSION FACTORS

STATIONARY FUEL TYPE	EMISSION FACTOR
Natural Gas	13.7.35
Fuel Oil	200.63
Propane	162.85
Other Fossil Fuels	250.00
Purchased District Energy – Hot water and steam	150.00

For SI: MMBtu – 1,000,000 Btu = 10 terms; HHV = High-heating value.

~~602.2.3 Annual direct and indirect CO_2e emissions associated with onsite use of fossil fuels and purchased district energy.~~ ~~Emissions associated with the use of natural gas, fuel oil and, propane shall be calculated by multiplying the natural gas, fuel oil, and propane delivered to the building at the utility meter by the corresponding emission factors in Table 602.2.2. Emissions associated with fossil fuels not listed shall be calculated by multiplying the fossil fuel delivered to the building at the utility meter by 250.~~

~~Emissions associated with purchased district heating shall be calculated by multiplying the heating energy delivered to the building at the utility meter by 150 for hot water and steam, and for district cooling, the factors from Table 602.2.1 based on the EPA eGRID Sub-region in which the building is located.~~

Reason: This proposal clarifies and simplifies Section 602 of the IgCC by cleaning up language, reorganizing the sections, and reducing the zEPI calculation to the basic required units.

602.1 This Section clearly states that modeling shall produce information on both energy performance and CO2e emissions, and changes the energy units from kBtu/sf-y to kBtu.

602.1.1 (new 602.2) This proposal is a modification on that submitted by the American Institute of Architects. Instead of using EUI and EUIp, this proposal uses the units and language that are found in ASHRAE Appendix G for clarity and consistency. The EUI concept is not forsaken, but the need to divide the energy use by building area is an unnecessary complication, since the baseline building and proposed building will be exactly the same. Furthermore, it is unnecessary to specify that the energy use is "annual", since whatever measure of time is used must be consistent for both the baseline and proposed calculations.

We agree with AIA that zEPI is a critical piece of the goals included in the IgCC that focuses the energy perfomance of buildings and sites on achieving a zero net energy design for buildings. zEPI points to a unit on a scale that goes from a theoretical 100 to zero where 100 equal actual performance for existing buildings as identified in the 2003 CBECS database and 57 equals the performance level associated with the 2012 IECC.

The 57 on that scale is a fixed number which was assumed as part of the 2012 IgCC to equate to the performance of the 2012 IECC energy performance. The 50 represents a 10% reduction from what the IECC would allow. To truly get to a zero energy performance goal will require adjusting zEPI each code cycle. This change indicates that zEPI should be adjusted to 50, which would lead to steps as follows:

2015 - zEPI = 50
2018 - zEPI = 40
2021 -zEPI = 30
2024 - zEPI = 20
2027 - zEPI = 10
2030 - zEPI = 0

We believe that communities which wish to achieve zero energy design buildings are looking to this code for that approach to clearly be outlined and included in the code.

602.1.2 (new 602.2.1) This Section is renumbered to be a direct subsection of 602.2, in that it builds on the zEPI requirement with further information on how the building performance modeling shall be done. The language is cleaned up to make it clear that the modeling shall be done in accordance with ASHRAE Appendix G as modified.

602.1.2.1 (new 602.2.1.1) The title of this Section did not make sense, as required modifications were identified in multiple Sections. The change to Section G3 of ASHRAE
90.1 refers directly to the modeling methodology, whereas the previously referenced Section G1.2 addressed Performance Rating. This Section also incorporates a provision formerly in Section 602.1.2.3, as it is related to the calculation of energy units.

602.1.2.2 (new 602.2.1.2) The title of this Section is changed to clarify the actual purpose of the Section, which constitutes the second required modification to Appendix G. The language is amended for clarity.

602.1.2.3 is deleted in its entirety. The first sentence of the Section is moved up to Section 602.1.2.1 (new 602.2.1.1), and the other sentences are deleted in favor of providing the information in Table 602.1.2.2 with the other fuel conversion factors.

Table 602.1.2.2 is expanded to include the fuel conversion factors formerly in 602.1.2.3, and the footnote marking is clarified to be applicable only to NG, Fuel Oil, and LPG.

602.1.3 is deleted in its entirety. The requirement for a registered design professional in responsible charge is a defined term and is recognized in practice. Adding to the term a qualifier for energy modeling adds a level of complexity that isn't recognized in any form by a sanctioning body and adds confusion to the professions.

602.2 (new 602.3) is amended to more closely parallel the language in 602.1.1 and 602.1.2 (new 602.2).

The abbreviations used in the calculation are changed to correlate with the definitions provided.

602.2.1 (new 602.3.1) and 602.2.2 (new 602.3.2) The titles are changed for clarity.

Table 602.2.2 (new Table 602.3.2) is replaced to include the emission conversion factors formerly in 602.2.2.

Cost Impact: Will not increase the cost of construction

GEW24-14: 602-GUTTMAN939