RESNET/ICC 301-2022 Addendum B-2022, CO2e Index

Revise table note x. for Table 4.2.2(1) Specifications for the Energy Rating Reference and Rated Homes as follows:

x. Any untested forced air distribution system is permitted to be modeled with a DSE of 0.70. When both of the following conditions are met and documented, duct leakage testing is also not required.

1. At a pre-drywall stage of construction, 100 percent of the ductwork and airhandler shall be visible and visually verified to be contained inside the Conditioned Space Volume.
2. At a final stage of construction, ductwork that is visible and the air handler shall be verified again to be contained in the Conditioned Space Volume.

To calculate the energy impacts on the Rated Home, a DSE of 0.80, shall be applied to both the heating and cooling system efficiencies.

If at the pre-drywall stage of construction, the ductwork is visually verified to be 100 percent fully ducted with no building cavities used as supply or return ducts, a DSE of 0.88 shall be applied to both the heating and cooling system efficiencies. As an alternative to the DSE = 0.88, a value of 4 cfm per 100 square feet of Conditioned Floor Area may be modeled for duct leakage to outside if the above conditions are met and no ductwork is contained within envelope assemblies adjacent to the exterior or Unconditioned Space Volumes. ~~If at a pre-drywall stage of construction, the ductwork is visually verified to be 100 percent fully ducted with no building cavities used as supply or return ducts, a DSE of 0.88 shall be applied to both the heating and cooling system efficiencies.~~

Revise table note (a) for Table 4.3.1(1), Configuration of Index Adjustment Design, as follows:

Table 4.3.1(1) Configuration of Index Adjustment Design

Table 4.3.1(1) Notes:

(a) The procedure for determining the combined air exchange rate resulting from infiltration combined with Dwelling Unit Mechanical Ventilation Systems ~~is~~shall be consistent with that shown in Table 4.2.2(1) table notes (g) and (h).

Revise section 7.1.2.2. as follows:

7.1.2.2. Emission. The emissions for the Rated Home shall be calculated in accordance with Sections 7.1.2.2.1 and 7.1.2.2.2.

7.1.2.2.1. Emissions. Emissions for all homes shall be calculated in accordance with Sections 7.1.2.2.1.1. and 7.1.2.2.1.2.

7.1.2.2.1.1. For electricity use, data for the sub-region annual total output emission rates published by Environmental Protection Agency's ~~2019 eGrid~~2020 eGRID database[1] for electricity generation shall be used to calculate emissions.[2] except ~~CO_2~~CO_2e emissions, which shall be calculated using the ~~Cambium database[3,4] for the most recent year's Mid-case, average hourly CO_2 generation rate (*co2_rate_avg_load_enduse*: kgCO_2 per MWh_{enduse}) for the local ZIP Code~~ provisions of Section ~~6.~~28.2 to calculate the annual hourly CO_2e emissions for the Rated Home.

7.1.2.2.1.2. For fossil fuel use, emissions shall be calculated using the emission factors given in Table 7.1.2(1).

Table ~~5~~7.1.2(1) Emission Factors for Household Combustion Fuels[5]

Fuel Type	Units	MBtu per Unit	~~CO_2~~CO_2e lb/MBtu	NOx lb/MBtu	SO_2 lb/MBtu
Natural Gas	Therm	0.1000	~~117.6~~147.3	0.0922	0.0006
Fuel Oil #2	Gallon	0.1385	~~161.0~~195.9	0.1300	0.0015
Liquid Petroleum Gas (LPG)	Gallon	0.0915	~~136.46~~177.8	0.1421	0.0002

7.1.2.2.2. Emission Savings. Estimated emission savings for the Rated Home shall be calculated in accordance with Sections 7.1.2.2.2.1. through 7.1.2.2.2.3.

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[1] (Informative Reference) http://www.epa.gov/cleanenergy/energy-resources/egrid/index.html

[2] (Informative Note) RESNET will compile and publish annual total output emission rate data for NOx, SO₂ and ~~CO_2~~CO_2e in accordance with the provisions of this section that can be used by Approved Software Rating Tools for the calculation of emissions.

[3] https://cambium.nrel.gov/

[4] Gagnon, Pieter, Will Frazier, Elaine Hale, and Wesley Cole, 2020. "Cambium Documentation: Version 2020." Golden, CO: National Renewable Energy Laboratory. NREL/TP-6A20-78239. https://www.nrel.gov/docs/fy21osti/78239.pdf

[5] (Informative Note) Developed from the U.S. EPA AP 42, Fifth Edition Compilation of Air Pollutant Emissions Factors, Volume 1, Chapter 1: External Combustion Sources. https://www.epa.gov/air-emissions-factors-and-quantification/ap-42-fifth-edition-volume-i-chapter-1-external-0

7.1.2.2.2.1. The CO_2e Index Reference Home shall be identical to the Energy Rating Reference Home except that it shall use electricity for all energy end uses. The ~~Energy Rating Reference Home~~ emissions for the CO_2e Index Reference Home shall be determined ~~by fuel type~~ by applying the emission factors ~~emissions~~ determined in accordance with Section 7.1.2.2.1 to ~~the~~ its Purchased Energy ~~individual fuel types of the Energy Rating Reference Home~~.

7.1.2.2.2.2. The Rated Home emissions shall be determined by fuel type by applying the ~~same~~ emission factors determined in accordance with ~~data used for the Energy Rating Reference Home in~~ Section ~~0~~7.1.2.2.1 ~~above~~.

7.1.2.2.2.3. For Confirmed, Sampled and Projected Ratings, estimated emission savings shall be calculated in accordance with Sections 7.1.2.2.2.3.1. and 7.1.2.2.2.3.2.

7.1.2.2.2.3.1. Estimated emission savings with respect to the ~~Energy Rating Reference Home~~ CO_2e Index Reference Home shall be the difference between the emissions of the ~~Energy Rating Reference~~ CO_2e Index Reference Home and the emissions of the Rated Home.

7.1.2.2.2.3.2. Estimated emission savings with respect to the Typical Existing Home shall be determined in accordance with Sections 7.1.2.2.2.3.2.1. and 7.1.2.2.2.3.2.2.

7.1.2.2.2.3.2.1. ~~For each fuel type, m~~Multiply the ~~Energy Rating Reference Home~~ CO_2e Index Reference Home emissions by 1.3 to determine the Typical Existing Home emissions by fuel type.

7.1.2.2.2.3.2.2. Estimated emission savings with respect to the Typical Existing Home shall be the difference between the emissions of the Typical Existing Home and the emissions of the Rated Home.

Revise section 7.3. as follows:

7.3. Labeling. Energy Rating labels shall, at a minimum, contain the information specified by Sections 7.3.1 through 7.3.8.

7.3.1. Real property physical address of the home, including city and state or territory.

7.3.2. Energy Rating Index of the home.

7.3.3 ~~CO₂~~CO_2e Index for the home, calculated in accordance with Section 6.

7.3.4 Projected ~~CO₂~~CO_2e emissions for the home, calculated in accordance with Sections ~~5~~7.1.2.2.1.1 and ~~5~~7.1.2.2.1.~~1~~2.

7.3.5. Projected annual site energy use of the home by fuel type.

7.3.6. Projected annual energy cost of the home,[6] calculated in accordance with energy price rate provisions of Section 7.1.2.1.1.

7.3.7. Name and address of the Approved Rating Provider.

7.3.8. Date of the Energy Rating.

Revise section 8. as follows:

8. ~~CO₂~~ CO_2e **Rating Index.** The ~~CO₂~~ CO_2e Index shall be calculated for the Rated Home in accordance with equation ~~6-1~~8.1 using the provisions of Sections ~~6~~8.1 through ~~6.5~~8.4

$$CO_2e \text{ Index} = ACO2 / (ARCO2 * IAF_{RH}) * 100 \qquad \text{(Equation } \mathbf{68\text{-}1)}$$

where:

ACO2 = Annual hourly ~~CO₂~~ CO_2e emissions from the Rated Home

ARCO2 = Annual hourly ~~CO₂~~ CO_2e emissions from the ~~CO₂~~ CO_2e Index Reference Home

IAF_{RH} = Index Adjustment Factor in accordance with Equation 4.3-2

8.1 The ~~CO₂~~ CO_2e emission factors for household combustion fuel use shall be those given in Table ~~5.1.2(1)~~7.1.2(1).

8.2 The ~~CO₂~~ CO_2e emission factors for electricity use shall be the levelized ~~CO₂~~ CO_2e combined combustion and pre-combustion, end-use emission rates having 100-year IPCC 6th Assessment Report Global Warming Potential as calculated using the 2021 Cambium database[7,8] for the Low Renewable Energy Cost Scenario for the Long-Run Marginal month-hour CO_2e emission rates (lrmer_co2e) for the applicable Cambium Grid and Emission Assessment (GEA) region in accordance with the local ZIP Code using equation 8-2 with a starting year of 2025.[9,10,11] ~~emission factors calculated using the~~

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[6] (Informative Note) The projected energy cost shown on the label might not reflect the projected energy costs to be paid by the occupant as metering configurations can result in certain energy costs and end-uses being paid by the building owner.

[7] (Normative Note) https://cambium.nrel.gov/

[8] (Normative Note) Gagnon, Pieter; Frazier, Will; Hale, Elaine, Cole, Wesley (2022): Long-run Marginal Emission Rates for Electricity - Workbooks for 2021 Cambium Data. National Renewable Energy Laboratory, Golden, CO. https://data.nrel.gov/submissions/183

[9] (Informative note) National Renewable Energy Laboratory (NREL) provides a spreadsheet tool for the calculation of levelized CO_2e emission rates that can be accessed at https://data.nrel.gov/submissions/183.

[10] (Informative Note) RESNET provides a spreadsheet of the hourly emission factors and ZIP code mappings that meet these criteria that can be accessed at https://www.resnet.us/wp-content/uploads/RESNET_2021_CO2e_GEAdata.xlsx.

[11] (Informative Note) These Cambium CO_2e emission data are provided in units of kg/MWh.

~~Cambium database[12],[13] for the Low Renewable Energy Cost Scenario for the Long-Run Marginal enduse CO_2 generation rate (*co2_lmer_enduse*: $kgCO_2$ per MWh_{enduse}) for the local ZIP Code using equation 6-2 with a starting year of 2025.[14]~~

$$LRMER_{levelized} = \frac{\sum_{t=0}^{n-1} \frac{LRMER_t}{(1+d)^t}}{\sum_{t=0}^{n-1} \frac{1}{(1+d)^t}}$$ **(Equation ~~6~~8-2)**

where:

$LRMER_t$ = long-run marginal emission rate for year t

d = real social discount rate = 0.03

n = evaluation period in years = 25

8.3   The ~~CO_2~~ CO_2e emission factors shall be applied to the hourly Purchased Energy by fuel type for both the Rated Home and the ~~CO_2~~ CO_2e Index Reference Home.

8.4   The ~~CO_2~~ CO_2e Index Reference Home shall be identical to the Energy Rating Reference Home except that it shall use electricity for all energy end uses.

8.5   ~~Where reported, the CO_2 savings for the Rated Home shall be the CO_2 emissions for the CO_2 Index Reference Home minus the CO_2 emissions for the Rated Home.~~

9.   Normative References.

ANSI/RESNET/ICC ~~380-2019~~380-2022, "Standard for Testing Airtightness of Building, Dwelling Unit, and Sleeping Unit Enclosures; Airtightness of Heating and Cooling Air Distribution Systems; and Airflow of Mechanical Ventilation Systems" and ANSI Approved Addenda. Residential Energy Services Network, Oceanside, CA.

~~[12] https://cambium.nrel.gov/~~
~~[13] Gagnon, Pieter, Will Frazier, Elaine Hale, and Wesley Cole, 2020. "Cambium Documentation: Version 2020." Golden, CO: National Renewable Energy Laboratory. NREL/TP-6A20-78239. https://www.nrel.gov/docs/fy21osti/78239.pdf~~
~~[14] (Informative note) National Renewable Energy Laboratory (NREL) provides a spreadsheet tool for the calculation of levelized CO_2 emission rates. The NREL spreadsheet tool uses the input parameters specified by this section as inputs to the spreadsheet tool.~~