MINHERS Addendum 66f

CO$_2$e Rating Index

Date Approved:	September 21, 2022
Voluntary Compliance Date:	October 21, 2022
Mandatory Compliance Date:	October 21, 2022
Transition Period:	(Replaces Interim Addendum 66i on the MCD)
Proponent:	RESNET
Organization:	RESNET

Purpose: Addendum 66f amends the MINHERS Chapter 3 to add criteria to ANSI/RESNET/ICC 301-2019 for the calculation and labeling of a CO$_2$ Index. The addendum establishes criteria and identifies data for the calculation of the CO$_2$ Index necessary for software providers to revise energy rating software to produce the new CO$_2$ rating and to print it on the rating label. Development of the CO$_2$ Index rating utilizes current Minimum Rated Features and does not require additional data to be collected by raters.

An interim version of Addendum 66, (66i), was adopted by RESNET to allow software providers to begin the revision of their software. The Mandatory Compliance Date for producing reports with the CO$_2$ Index rating is the Mandatory Compliance Date (MCD) indicated above.

Amendment:

Modify Section 1 as follows:

1. Scope. This standard is applicable to Dwelling Units and Sleeping Units in Residential or Commercial Buildings, except hotels and motels.[1] Energy Ratings determined in accordance with this Standard are for individual Dwelling Units or Sleeping Units only. This Standard does not

provide procedures for determining Energy Ratings for whole buildings containing more than one unit.

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[1] (Normative Note) The terms "Dwelling Unit" and "Sleeping Unit" are interchangeable with the term "home" throughout this Standard, except where specifically noted.

This standard identifies the metrics, tolerances, procedures, calculations and the required documentation to: (1) calculate the standard energy use of Dwelling Units and Sleeping Units, (2) determine the Energy Rating Index of Dwelling Units and Sleeping Units, (3) determine the CO_2e Index of Dwelling Units and Sleeping Units, (4) define the minimum rated features of Dwelling Units and Sleeping Units, (5) calculate the retrofit savings for existing Dwelling Units and Sleeping Units, (6) calculate the cost effectiveness of energy saving improvements to Dwelling Units and Sleeping Units and (7) label the certified energy and CO_2e performance of Dwelling Units and Sleeping Units.

Modify Section 5 as follows:

5.1.2.2. ~~**Pollution**~~ **Emissions** ~~**Savings.**~~ ~~Where determined, t~~The ~~pollution~~ emissions ~~savings~~ for the Rated Home shall be calculated in accordance with Sections 5.1.2.2.2.1 and 5.1.2.2.2.2.

5.1.2.2.1. ~~**Pollution**~~ **Emissions**. ~~Pollution e~~Emissions for all homes shall be calculated in accordance with Sections 5.1.2.2.1.1 and 5.1.2.2.1.2.

5.1.2.2.1.1. For electricity use, data for the sub-region annual total output emission rates published by Environmental Protection Agency's ~~2012~~ 2020 eGRID database[1] for electricity generation shall be used to calculate emissions~~.~~[2] except CO_2e emissions, which shall be calculated using the provisions of Section 6.2 to calculate the annual hourly CO_2e emissions for the Rated Home.

5.1.2.2.1.2. For fossil fuel use, ~~pollution~~ emissions shall be calculated using the emission factors given in Table 5.1.2(1).

Table 5.1.2(1) ~~**National Average**~~ **Emission Factors for Household** **Combustion** **Fuels[3]**

Fuel Type	Units	MBtu per Unit	~~CO₂~~CO₂e lb/MBtu	NOx lb/MBtu	SO₂ lb/MBtu
Natural Gas	Therm	0.1000	~~117.6~~147.3	~~93.0~~0.0922	0.0006~~0~~
Fuel Oil #2	Gallon	0.1385	~~159.4~~195.9	~~127.8~~0.1300	~~0.5066~~0.0015

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

[2] (Informative Note) RESNET will compile and publish annual total output ~~pollution~~ emission rate data for NOx~~,~~ and SO₂ ~~and CO₂~~ in accordance with the provisions of this section that can be used by Approved Software Rating Tools for the calculation of emissions.

[3] (Informative Note) ~~Developed from the U.S. DOE National Impact Analysis AHAM2 report (appendix 15A)~~ EPA, AP 42, Fifth Edition, Volume I, Chapter 1: External Combustion Sources https://www.epa.gov/air-emissionsfactors-and-quantification/ap-42-fifth-edition-volume-i-chapter-1-external-0

Liquid Petroleum Gas (LPG)	Gallon	0.0915	~~136.46~~177.8	~~153.40~~.1421	~~0.0163~~0.0002

5.1.2.2.2. ~~Pollution~~ Emission Savings. Estimated ~~pollution~~ emission savings for the Rated Home shall be calculated in accordance with Sections 5.1.2.2.2.1 through 5.1.2.2.2.3.

5.1.2.2.2.1. The CO2e 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 pollution~~ emissions for the CO2e Index Reference Home shall be determined ~~by fuel type~~ by applying the emission factors ~~pollution emissions~~ determined in accordance with Section 5.1.2.2.1 to ~~the~~ its Purchased Energy ~~individual fuel types of the Energy Rating Reference Home~~.

5.1.2.2.2.2. The Rated Home ~~pollution~~ emissions shall be determined by fuel type by applying the ~~same pollution~~ emission factors determined in accordance with ~~data used for the Energy Rating Reference Home in~~ Section 5.1.2.2.1~~5.1.2.2.2.1 above~~.

5.1.2.2.2.3. For Confirmed, Sampled and Projected Ratings, estimated ~~pollution~~ emission savings shall be calculated in accordance with Sections 5.1.2.2.2.3.1 and 5.1.2.2.2.3.2.

5.1.2.2.2.3.1. Estimated ~~pollution~~ emission savings with respect to the ~~Energy Rating Reference Home~~ CO2e Index Reference Home shall be the difference between the ~~pollution~~ emissions of the ~~Energy Rating Reference~~ CO2e Index Reference Home and the ~~pollution~~ emissions of the Rated Home.

5.1.2.2.2.3.2. Estimated ~~pollution~~ emission savings with respect to the Typical Existing Home shall be determined in accordance with Sections 5.1.2.2.2.3.2.1 and 5.1.2.2.2.3.2.2.

5.1.2.2.2.3.2.1. ~~For each fuel type, m~~Multiply the ~~Energy Rating Reference Home pollution~~ CO2e Index Reference Home emissions by 1.3 to determine the Typical Existing Home ~~pollution~~ emissions by fuel type.

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

5.3. Labeling. Energy Rating labels shall, at a minimum, contain the information specified by Sections 5.3.1 through 0.78.

> **5.3.1.** Real property physical address of the home, including city and state or territory.
>
> **5.3.2.** Energy Rating Index of the home.
>
> **5.3.3.** CO_2e Index for the home, calculated in accordance with Section 6.[4]

> **5.3.4.** Projected CO_2e emissions for the home, calculated in accordance with Sections 5.1.2.2.1.1 and 5.1.2.2.1.2.
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> ~~5.3.3.~~~~5.3.4.~~**5.3.5.** Projected annual site energy use of the home by fuel type.
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> ~~5.3.4.~~~~5.3.5.~~**5.3.6.** Projected annual energy cost of the home,[5] calculated in accordance with energy price rate provisions of Section 5.1.2.1.1.
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> ~~5.3.5.~~~~5.3.6.~~**5.3.7.** Name and address of the Approved Rating Provider.
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> ~~5.3.6.~~~~5.3.7.~~**5.3.8.** Date of the Energy Rating.

Add the following new section and renumber following sections accordingly:

6. **CO_2 Rating Index.** The CO_2e Index shall be calculated for the Rated Home in accordance with equation 6-1 using the provisions of Sections 6.1 through 6.4

> **CO_2e Index = ACO2 / (ARCO2 * IAF_{RH}) * 100   (Equation 6-1)** where:
>
> ACO2 = Annual hourly CO_2e emissions from the Rated Home
> ARCO2 = Annual hourly CO_2e emissions from the CO_2e Index Reference Home
> IAF_{RH} = Index Adjustment Factor in accordance with Equation 4.3-2

> 6.1. The CO_2e emission factors for household combustion fuel use shall be those given in Table 5.1.2(1).
>
> 6.2. The CO_2e emission factors for electricity use shall be the levelized CO_2e combined combustion and pre-combustion, end-use emission rates having IPCC 6th Assessment Report 100-year time horizon Global Warming Potential (GWP) as calculated using the

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[4] (Normative note) Where Cambium data are not available for the Rated Home location, the CO_2 Index and projected CO_2e emissions shall not be required.

[5] (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.

2021 Cambium database[6,7] for the Low Renewable Energy Cost Scenario for the LongRun 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 6-2 with a starting year of 2025.[8,9,10]

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

where:

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

d = real social discount rate = 0.03

n = evaluation period in years = 25

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

6.4. 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.

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[6] (Informative note) https://cambium.nrel.gov/

[7] (Informative 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

[8] (Informative note) National Renewable Energy Laboratory (NREL) provides a spreadsheet tool for the calculation of levelized CO_2 emission rates that can be accessed at https://data.nrel.gov/submissions/183.

[9] (Normative Note) RESNET provides hourly emission factors and ZIP code mappings that shall be used to determine emission factors that can be accessed at https://www.resnet.us/about/standards/other-standards-resources/.

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