

MINHERS Addendum 66f

CO₂e 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 CO₂ Index. The addendum establishes criteria and identifies data for the calculation of the CO₂ Index necessary for software providers to revise energy rating software to produce the new CO₂ rating and to print it on the rating label. Development of the CO₂ 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 CO₂ Index rating is the Mandatory Compliance Date (MCD) indicated above.

Amendment:

Exception: RESNET Home Energy Ratings shall be calculated using the modifications of Standard ANSI/RESNET/ICC 301-2019 as follows:

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

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

not provide procedures for determining Energy Ratings for whole buildings containing more than one unit.

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 CO₂e 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 CO₂e 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 database² for electricity generation shall be used to calculate emissions-³ except CO₂e emissions, which shall be calculated using the provisions of Section 6.2 to calculate the annual hourly CO₂e 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 Fuels⁴

Fuel Type	Units	MBtu per Unit	CO₂ CO ₂ e lb/MBtu	NOx lb/MBtu	SO ₂ lb/MBtu
Natural Gas	Therm	0.1000	117.61 147.3	93.00 0.0922	0.0006 0
Fuel Oil #2	Gallon	0.1385	159.41 195.9	127.80 0.1300	0.5066 0.0015
Liquid Petroleum Gas (LPG)	Gallon	0.0915	136.46 177.8	153.40 0.1421	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.

² (Informative Reference) <http://www.epa.gov/cleanenergy/energy-resources/egrid/index.html>
<https://www.epa.gov/egrid>

³ (Informative Note) RESNET will compile and publish annual total output ~~pollution~~-emission rate data for NO_x, 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.

⁴ (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-emissions-factors-and-quantification/ap-42-fifth-edition-volume-i-chapter-1-external-0>

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 5.1.2.2.15-1.2.2.2.1~~ 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 ~~078~~.

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. CO₂e Index for the home, calculated in accordance with Section 6.⁵
- 5.3.4. Projected CO₂e emissions for the home, calculated in accordance with Sections 5.1.2.2.1.1 and 5.1.2.2.1.2.
- ~~5.3.3.~~5.3.4~~5.3.5.~~5.3.5. Projected annual site energy use of the home by fuel type.
- ~~5.3.4.~~5.3.5~~5.3.6.~~5.3.6. Projected annual energy cost of the home,⁶ calculated in accordance with energy price rate provisions of Section **Error! Reference source not found.**
- ~~5.3.5.~~5.3.6~~5.3.7.~~5.3.7. Name and address of the Approved Rating Provider.
- ~~5.3.6.~~5.3.7~~5.3.8.~~5.3.8. Date of the Energy Rating.

Add the following new section and renumber following sections accordingly:

6. **CO₂ Rating Index.** The CO₂e Index shall be calculated for the Rated Home in accordance with equation 6-1 using the provisions of Sections 6.1 through 6.4

$$\underline{\underline{\text{CO}_2\text{e Index} = \text{ACO}_2 / (\text{ARCO}_2 * \text{IAF}_{\text{RH}}) * 100 \quad \text{(Equation 6-1)}}}$$

where:

ACO₂ = Annual hourly CO₂e emissions from the Rated Home

ARCO₂ = Annual hourly CO₂e emissions from the CO₂e Index Reference Home

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

- 6.1. The CO₂e emission factors for household combustion fuel use shall be those given in Table 5.1.2(1).
- 6.2. The CO₂e emission factors for electricity use shall be the levelized CO₂e 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 2021 Cambium database^{7,8} for the Low Renewable Energy Cost Scenario for the Long-Run Marginal month-hour CO₂e emission rates (lrmr_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.^{9,10,11}

⁵ (Normative note) Where Cambium data are not available for the Rated Home location, the CO₂ Index and projected CO₂e emissions shall not be required.

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 (Informative note) <https://cambium.nrel.gov/>

⁸ (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>

⁹ (Informative note) National Renewable Energy Laboratory (NREL) provides a spreadsheet tool for the calculation of levelized CO₂ emission rates that can be accessed at <https://data.nrel.gov/submissions/183>.

¹⁰ (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/>.

¹¹ (Informative Note) These Cambium CO₂e emission data are provided in units of kg/MWh.

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

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 CO₂e emission factors shall be applied to the hourly Purchased Energy by fuel type for both the Rated Home and the CO₂ Index Reference Home.
- 6.4. 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.