

BEUDO TECHNICAL GUIDE: Emission Factors

CITY OF
CAMBRIDGE

Office of
Sustainability

Understanding how your property's greenhouse gas emissions are calculated

The Basics

The Building Energy Use Disclosure Ordinance (BEUDO) requires owners of large buildings to reduce greenhouse gas (GHG) emissions over time. To ensure accuracy of these reductions, the City of Cambridge sets Emission Factors for each fuel type. The City publishes these Emission Factors before each compliance period begins, allowing all properties to calculate emissions using a standard method.

At a high level, your Property's Emissions = Energy Used by your Property * Emission Factor. This guide summarizes Emission Factors for each fuel type, and how they apply to your property.

Note: BEUDO requires that buildings reach "Net Zero" by either 2035 or 2050. While renewable electricity credits can offset electric emissions, no matter what, by 2050, no on-site combustion will be allowed.

How are your property's emissions calculated through BEUDO?

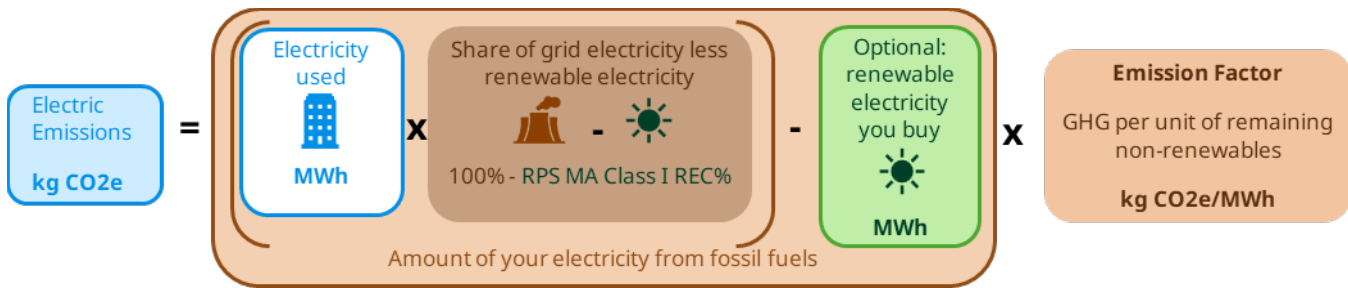
Each fuel type has a formula to convert energy usage to GHG emissions. All Emission Factors are shown in BEAM, and for more detailed explanations of the methodology, refer to the *BEUDO Regulations, Section VIII: Emission Factors*.

Note: there is a Baseline Calculator in BEAM that could help you see your emissions. This tool does not take Renewable Energy Certificates (RECs) into account, and can only review one ESPM account at a time. So, if data for your Covered Property are in multiple accounts, this tool cannot give a full picture of emissions.

For Grid Electricity:

The following formula is used to calculate greenhouse gas (GHG) emissions from electricity purchased from the grid. This method accounts for the clean, renewable [MA Class I RECs](#) that are already required to be used by the grid (i.e., the Renewable Portfolio Standard, or RPS) and fairly estimates emissions to include clean energy purchases without double-counting them.

Want to take a deeper dive and review the history of the history of the development of Emission Factors? Check out [this webinar](#) from 2024.



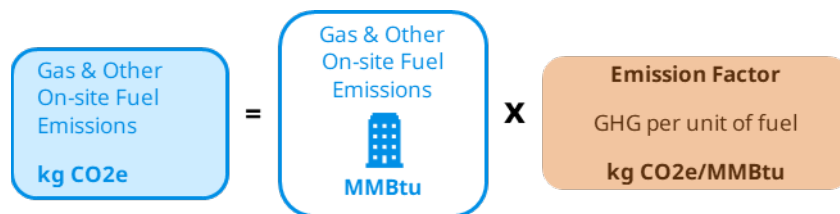
In addition to the renewable electricity already contributing to the grid, you can purchase additional renewable electricity credits that meet BEUDO criteria to lower your property’s electric emissions. More information is available in the [Technical Guide: Renewable Electricity](#).

ENERGY STAR Portfolio Manager does report a version of your building’s emissions, but this estimate does not incorporate BEUDO-specific emission factors for electricity. Specifically, the *ENERGY STAR Portfolio Manager* tool applies default regional Emission Factors to your data. That said, as soon as you connect your ESPM account to BEAM, BEAM automatically applies the correct Emission Factors to your data to help you understand your emissions and BEUDO compliance targets. This [BEUDO Baseline Calculator](#) in BEAM (accessible as a New Ticket in the Help Desk) may be able to help you estimate emissions from your Covered Property.

🔥 For Gas & Other Fuels:

For the use of on-site fossil fuels, including natural gas, propane, fuel oil, diesel oil, and kerosene, BEUDO Emission Factors do align with those used in *ENERGY STAR Portfolio Manager*.

This formula is used to calculate greenhouse gas (GHG) emissions from natural gas and other fuels that are combusted on site:



Emission Factors for Compliance Period 1: 2026-2029

Emission Factors for the first compliance period, from 2026 to 2029, are published in the following table. Note that each year, the City may choose to update the Emission Factor for grid electricity based on more recent data. If the annually published Emission Factor by April 1 is lower than the projected grid Emission Factor in this table, the City will automatically apply the lower Emission Factor to your data in BEAM. (If desired, owners can choose to use the previously published, higher Emission Factor.)

TABLE OF EMISSION FACTORS FOR COMPLIANCE PERIOD 1: 2026-2029

	Unit	Emission Factors by Year				
		2018 & 2019: Default Baseline	2026	2027	2028	2029
Electricity						
Electric Grid Emission Factor	kg CO2e/MWh	379	418	427	435	444
Annual Renewable Portfolio Standard (RPS) Minimum	%	13	30	33	36	39
Emission Factors for Other Fuel Sources						
Natural Gas	kg CO2e/MMBtu	53.11	53.11	53.11	53.11	53.11
Propane	kg CO2e/MMBtu	64.25	61.95	61.95	61.95	61.95
Fuel Oil (No. 1)	kg CO2e/MMBtu	73.50	73.49	73.49	73.49	73.49
Fuel Oil (No. 2)	kg CO2e/MMBtu	74.21	74.20	74.20	74.20	74.20
Fuel Oil (No. 4)	kg CO2e/MMBtu	75.29	75.28	75.28	75.28	75.28
Fuel Oil (No. 5 & No. 6)	kg CO2e/MMBtu	75.35	74.26	74.26	74.26	74.26
Diesel	kg CO2e/MMBtu	74.21	75.16	75.16	75.16	75.16
Kerosene	kg CO2e/MMBtu	77.69	75.44	75.44	75.44	75.44

For example, in calendar year 2026, a building uses 2,000 MWh of electricity and 11,000 MMBtu of gas. The owners purchase and submit documentation of 1,000 MWh of compliant RECs. Their total emissions for year, including purchased RECs, is calculated below, with inputs from the chart underlined. Refer to the equations

$$\text{Electric Emissions} = (2,000 \text{ MWh} * (100\% - \underline{30\% [RPS for 2026]} = 70\%, \text{ or } .70) - 1,000 \text{ MWh}) * \underline{418} \text{ kg CO}_2\text{e} / \text{MWh} = 585,200 \text{ kg CO}_2\text{e}$$

$$\text{Gas Emissions} = 11,000 \text{ MMBtu} * \underline{53.11} \text{ kg CO}_2\text{e/MMBtu} = 584,210 \text{ kg CO}_2\text{e}$$

$$\text{Total Emissions} = \text{Emissions from all fuels} = \text{Electric Emissions} + \text{Gas Emissions}$$

$$\text{Total Emissions} = 585,200 \text{ kg CO}_2\text{e} + 584,210 \text{ kg CO}_2\text{e} = 1,169,410 \text{ kg CO}_2\text{e}$$

The total emissions in 2026 is 1,169,410 kg CO2e, and this is the value to compare to baseline to determine compliance for the year.



Be sure to convert your units first. Your energy data may report electricity in kilowatts (kWh), and 1,000 kWh = 1 MWh. You may see natural gas data in therms, and 10 therms = 1 MMBTU. Emissions are reported in kg CO2e, not tons.

For Generation Facilities (Steam/Hot Water/Chilled Water):

The methodology to calculate emissions for Generation Facilities, or district energy systems, is outlined in *BEUDO Regulations*. This is relevant to campuses who have cogeneration systems to produce electricity or steam, and for customers purchasing Vicinity's steam products. Emission Factors for cogenerated outputs do not align with those used in *ENERGY STAR Portfolio Manager*. The City publishes emission factors for each output based on data provided by the system owners.

Summary for BEUDO Property Owners

By Compliance Period Deadlines

- ▶ **Submit energy data** for your property by following the [BEUDO Reporting Guide](#).
- ▶ Data from *ENERGY STAR Portfolio Manager* will be imported to BEAM, the City's platform for building owners to submit forms and documents. The [BEUDO Baseline Calculator](#) in BEAM may be able to help you estimate emissions from your Covered Property.

If You Own a Generation Facility

- ▶ Generation facilities need to provide data for emission factor calculations every April 1.

For Renewable Electricity

- ▶ If applying renewable energy purchases to reduce electric emissions, retire Renewable Energy Certificates (RECs) during each compliance year per BEUDO rules. See the [Technical Guide: Renewable Electricity](#) for more.

More Information

- ▶ Full methodology and submission process is available in the **BEUDO Regulations, Procedures, and the Reporting Guide** on our website: camb.ma/BEUDO.

Need more help?

If you need additional support, email beudo@cambridgema.gov.

For more detailed information, review BEUDO policy documents on the BEUDO page: camb.ma/BEUDO.



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