A37 Carbon Emissions Calculator

Expanded Guidance

WHAT IS THE CARBON EMISSIONS CALCULATOR

The Carbon Emission Calculator is designed to help Development Teams and users:

1. Easily and consistently calculate and illustrate a building's carbon emissions, carbon emission intensity, and carbon emission limit based on operational energy uses, including the contribution of each building use and energy source.
2. Assess how potential design strategies might reduce the proposed building's carbon emissions, and
3. Provides insights into clean energy generation (solar PV) and procurement strategies for achieving Net Zero Carbon (NZC) performance.

Note: The calculations generated, analyses, and totals are based on the entered information and are for planning purposes only. Modeled and actual building performance and emissions may be different and, in some cases, significantly different.

WHY USE THE CALCULATOR

As the building sector advances toward Boston's Carbon Neutral 2050 goals, having a clear understanding of building carbon emissions and efficacy of mitigation strategies is critical. The Article 37 Carbon Emissions Calculator:

- Establishes a Standard Methodology: Standardized calculations help to ensure consistency and improves clarity across Project Teams and building projects.
- Saves Time: Streamlining carbon emissions calculations reduces work and errors.
- Improves Project Team Decision-Making: Supporting data-driven insights better enables Project Teams to optimize building designs for low carbon performance.
- NZC Operations Compliance: Having a clear understanding of building carbon emissions and clear energy solutions helps projects stay on track with Boston's Net Zero Carbon emissions regulations and future BERDO compliance.

WHEN TO USE THE CALCULATOR

The carbon calculator can be used throughout the project planning and design process. While Project Teams are not required to use the Calculator, building energy use and carbon emission calculations and information are required Article 37 filings.

EARLY DESIGN PHASE and Article 37 Initial Filing: Once a Project Team has completed preliminary building performance modeling, the Building Use Type(s), Square Footage, Energy Uses, and On-site Solar PV generation can be entered into the Calculator. The project team can utilize the Carbon Emission Intensity and Whole Building results to assess the design performance, consider building and system design strategies to reduce carbon emissions, and consider clean energy solutions for achieving NZC emissions. The calculated results for the proposed design should be entered in the Climate Resiliency Checklist (CRC).

Article 37 Design / Building Permit Filing and Construction Completion / COO Filing: As the proposed design is refined, construction documents are finalized, and the building is constructed, the Project Team should utilize updated Building Performance models to continue assessing NZC strategies and performance. Updated results should be entered in corresponding Design and Construction Green Building Reports and CRCs.

HOW TO USE THE EMISSIONS CALCULATOR

Download the current version of the A37 Carbon Emissions Calculator from the Planning Department's Article 37 Green Building web page.

1. First, carefully read the information found in the 'Instructions' sheet and top of 'Input-Output' sheet before using the Calculator.
2. Enter the project's Building Name and anticipated First Compliance Year (or Year of Construction Completion).
3. For up to three Building Use types, enter the Use Square Footage, select the Building Use Type, and for each Building Use, enter all of the energy uses according to energy source. Note the specific energy source unit of measure. Follow Building Performance Modeling standards for determining which use spaces and areas are included in the Use Square Footage.
4. Input any On-site Solar PV generation.

The predicted Carbon Emission Intensity (pCEI) is auto calculated and graphed for the Whole Building and each of the three largest Building Uses for the First Compliance Year, and for years 2035 and 2050.

The Whole Building pCEI and the 'Blended Emissions Intensity Limits' are also auto calculated and graphed. For projects with multiple Building Uses, the 'Blended Emissions Intensity Limits' are a weighted sum of all the Building Uses and emissions. ***For projects filing after July 1, 2025****, the Blended Emissions Intensity Limits will be zero (0.0) kg CO2e/sf-yr* ***except*** *for Healthcare (hospital), Science/Technology (lab), or Manufacturing/Industrial Building Use types, which have declining Emission Intensity Limits; see table below.*

	Emissions standards (kgCO2e/SF/yr)					
Building Use Type	**2025 - 2029**	**2030 - 2034**	**2035 - 2039**	**2040 - 2044**	**2045 - 2049**	**2050**
Assembly	0	0	0	0	0	0
College/University	0	0	0	0	0	0
Education	0	0	0	0	0	0
Food Sales & Service	0	0	0	0	0	0
Healthcare	10	7.4	4.9	2.4	0	0
Lodging	0	0	0	0	0	0
Manufacturing/Industrial	15.3	10.9	6.7	3.2	0	0
Multifamily Housing	0	0	0	0	0	0
Office/ Clinic	0	0	0	0	0	0
Retail	0	0	0	0	0	0
Services	0	0	0	0	0	0
Storage	0	0	0	0	0	0
Technology/Science	5.1	2.5	0	0	0	0

5. Review the Emissions Intensity outputs and graph to assess how well the project complies with the Net Zero Carbon limits for each year. The '*Estimated year of requiring action*' is the first year when the Whole Building Emissions Intensity exceeds the allowable limit.

Whole Building Totals for Fossil Fuel Emissions and Electricity Emissions to be mitigated are auto calculated. Electricity Emissions are reduced by any on-site Solar PV generated.

6. Review the 'Clean Energy Solutions for NZC' results. Separate totals are auto calculated for emissions that must be mitigated from fossil fuel use and electricity use. Emissions are calculated using the BERDO Emission Factors – see 'Emissions factor' tab for details. Grid electricity emissions reflect State requirements that increase the amount of renewable energy in grid electricity.

   Fossil Fuel Emissions must be mitigated by making Alternative Compliance Payments (ACPs). The annual Total is calculated in kilogram (kg) of Carbon Dioxide Equivalent (CO2e). ACPs are paid per metric ton of CO2e.

   Electricity Emissions can be mitigated by any combination of the following options:
   a. Procuring 100% renewable electricity by subscribing to Boston Community Choice's 'Green 100' option or similar local renewable electricity source or utility program.

Green 100 electricity is purchased in Kilowatt Hours (kWh) and replaces Grid Electricity Use in a 1:1 ratio.

b. Purchasing Massachusetts Class One Renewable Energy Certificates (RECs). RECs are purchased in kWh **and** are only needed for the non-renewable portion of Grid Electricity Use. The required quantities are auto calculated and decline over time.
c. Entering into a Power Purchase Agreement (PPA). PPAs, which can vary, are for the purchase of renewable energy in kWh **and** are only needed for the non-renewable portion of Grid Electricity Use. The required quantities are auto calculated and decline over time.
d. Making Alternative Compliance Payments. ACPs are paid per metric ton of CO2e. The required quantities decline over time.

Consider the potential mitigation option(s) and enter quantities sufficient for achieving zero. Any remaining amount of electricity emissions not mitigated is auto calculated.

7. Consider strategies to lower the building pCEI including:
    a. Reduce energy use by improving the building enclosure and using all-efficient-electric space and DHW heating systems.
    b. Eliminate or limit any fossil fuel use.
    c. Add or increase the on-site solar PV system(s) electricity generation.

8. Enter the Building Energy Uses and Building 2035 pCEI data in the Building Climate Resiliency Checklist.

For questions or support, reach out to **harshika.bisht@boston.gov** , **john.dalzell@boston.gov** , **travis.anderson@boston.gov** or **dane.brimmeier@boston.gov**

EMISSIONS CALCULATOR FAQs

1. ***How do I access the calculator if it shows a version check notification?***
   Click 'Enable Content' at the top of the sheet > Click 'Connect' to open the latest version from bostonplans.org.

2. ***How are the Blended Emissions Intensity Limits determined?***
   For all projects, the 'Blended Emissions Intensity Limits' are weighted by each Building Uses Square Footage and auto calculated and graphed regardless of the number of Building Uses. However, **for most projects filing after July 1, 2025**, the specific Building Uses and, as a result, the Blended Emissions Intensity Limits are zero (0.0) kg CO2e/sf-yr.

3. ***If most Building Uses have CO2e limit of zero, why use Blended Emissions Intensity Limits?***
   While the default for determining the Whole Building Carbon Emissions Intensity Limits is the primary Building Use, calculating the Blended Emissions Intensity Limits might be helpful. Specifically, projects that include a Healthcare (hospital), Science/Technology (lab), or Manufacturing/Industrial Building Use types, which have higher initial Emission Intensity Limits, could benefit by using the BERDO Blended Emissions Standard**.** To be eligible, the other Building Use(s) must exceed 10% of a building's total square footage, total annual energy use, or total annual CO2 e emission.

4. ***Why are the limits in the "Emission Standard" all zero?***
   Per Zoning Article 37 – Green Buildings and Net Zero Carbon, Proposed Projects filing after July 1, 2025, are required to have Net Zero Carbon emissions with a few exceptions. Most BERDO limits apply to existing buildings and have declining carbon emissions intensity requirements. More about BERDO can be found here.

5. ***What is the 'estimated year of requiring action'?***
   The year when the project's emissions and onsite offsets are above the emissions limit. The action required refers to off-site renewable procurement.

6. ***Why are the available "Building Use Types" different from the typical zoning Occupancy Use types (.g. R2, B, S2, etc.)?***

   The "Building Use Types" available in the Emissions Standards table are aligned with the BERDO (Building Emissions Reduction and Disclosure Ordinance) reporting requirements, which reference Building Use Types defined by ENERGY STAR Portfolio Manager. These are not directly tied to occupancy classifications like R-2 or B (from building code) but are instead standardized reporting categories used for emissions tracking.

   Not all occupancy types from the zoning code have direct equivalents in ENERGY STAR Portfolio Manager. As a result, Building Use Types in the Calculator are grouped into broader categories consistent with BERDO's reporting framework. If a specific Building Use Type appears missing, it may be grouped into one of the standardized BERDO categories for reporting purposes.

7. ***Should a small unrelated Building Use Type be included in the calculator? For example, our large multifamily residential building has a small ground floor retail space.***
   Yes, the Calculator is intended to provide both Building Use Type and a Whole Building carbon emission intensity and needs to include all Building Use Types in the project.
   Note: Under some circumstances, the energy code performance pathway selected (e.g., Passive House) may have a conditioned floor area calculation that differs from Gross Floor Area. Please input the total GFA as defined above in the calculator, not the interior conditioned floor area

8. ***What about Building Uses and spaces not included in the Building Performance Model? For example, our Passive House Wufi Model does not include the ground floor retail space.***
   Spaces related to a specific Building Use Type (e.g. the active room in a residential building) should be included in the Residential Building Use including the Square Footage and Energy Uses. Generally, for determining conditioned floor area, which spaces and areas are included in a specific Building Use, and related Square Footage, Project Teams should follow the modeling standards of the Building Performance Model that will be used for Energy Code compliance.

9. ***My project includes a Lab /Healthcare (hospital)/ manufacturing Building Use, that is less than 10% of gross floor area but contributes to more than 10% emissions and can be 'primary use' under BERDO. How can I use the tool?***
   Contact your Article 37 Reviewer for assistance with a custom calculation.

10. ***Why does the 'clinic' use type, not previously defined in the BERDO emission tables, appear grouped as part of "Office"?***
    The 'clinic' use type is similar to an office use in terms of energy use and carbon emissions. The 'Healthcare (hospital)' use type has a much higher emissions limits due to the high ventilation needs of hospitals. Hence, it's explicitly mentioned on the 'Use categories' tab.

11. ***Can I see the maximum Carbon Emission Intensity Limits for additional years?***
    In the graph, the Emissions Intensity Limits are illustrated by the green line; hover over the green line to see limits for each year. In the table, the year 2035 is a default selection; change the selection to the desired year.

    For most Building Use types the limit is zero. For Healthcare (hospital), Science/Technology (lab), or Manufacturing/Industrial Building Use types there is a higher initial Emission Intensity Limit that declines over time.

12. ***Are ACPs only for mitigating Fossil Fuel Use emissions; we thought all emissions could be mitigated by ACPs.***
    ACPs can be used to mitigate both Fossil Fuel use and Electricity use emissions, but Fossil Fuel emissions can only be mitigated by ACPs.

13. ***Can you add the cost value of ACPs and other solutions?***
    The variables for determining future clean energy costs are too numerous for the current version of the Calculator. We hope to include costs in a future version.

14. ***Who can use Boston Community Choice Electricity's Green 100 option?***

Residential and commercial accounts are eligible to enroll in the BCC Program if they use less than 1.5 million kWh/year. Please go to Boston Community Choice Electricity for additional details and eligibility conditions.

15. ***Can projects use a combination of solutions such as both Class I RECS and Green 100?***
    You can select either option, but the Green 100 solution applies to 100% of your electricity needs. A custom calculation will be necessary to assess solutions that include purchasing both Green 100 and RECs for the project. Please refer to the BERDO Guide for all formulas.

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