



CITY OF CAMBRIDGE

Community Development Department

To: Planning Board

From: Community Development Department (CDD) Staff

Date: November 16, 2022

Re: **Emissions Accounting Zoning Petition (Version 3)**

IRAM FAROOQ
Assistant City Manager for
Community Development

SANDRA CLARKE
Deputy Director
Chief of Administration

KHALIL MOGASSABI
Deputy Director
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Overview

Petitioner: City Council

Zoning Articles: Article 22.000 Sustainable Design and Development,
Section 22.25.1(c), Net Zero Narrative

Amendment Summary: The proposed amendments would require Green Building Projects to provide, as part of their compliance with the Net Zero Narrative, an Embodied Emissions analysis described as “A full lifecycle analysis of the estimated emissions generated by the construction of the Green Building Project.” The amendments would also specify that the currently required calculation of “energy loads, baseline energy simulation tool assumptions, and proposed energy targets” would be “projected until 2050,” and that the currently required description of a technical framework to transition to net zero emissions would specify “prior to 2050.”

Planning Board Action: Recommendation to City Council

Memo Contents: Summary of the proposed zoning; background information on process to-date; comments on proposed amendment; previous Planning Board reports and CDD memos (as attachments).

Summary of Petition Effects

The Petition would amend the “Net Zero Narrative” requirement (Section 22.25.1(c)), part of the “Green Building Requirements” currently in [Section 22.20 of the Zoning Ordinance](#).

The Green Building Requirements apply to development of 25,000 square feet or more that requires a Planning Board Special Permit or is subject to the Building and Site Plan Requirements in Section 19.50 of the Zoning Ordinance – which includes new construction, additions, and some rehabilitation of buildings that are undertaken to accommodate a change of use.

The required Net Zero Narrative is an advisory report that projects the energy use and greenhouse gas emissions due to the project’s operations, describes efforts made in the project’s design to reduce greenhouse gas emissions, and describes a technical pathway to transition the project to net zero emissions over time. The report is advisory and is only intended to provide information. CDD staff uses this information as a basis to discuss ways to improve the project’s emissions performance with the development team. It also helps inform the City’s longer term policies by providing up-to-date information about design and development practices.

CDD provides a template for completing the required sections of the Net Zero Narrative, which can be viewed on the CDD website: [Net Zero Narrative Template](#)

The Petition would make the following changes to the required parts of a Net Zero Narrative:

- 1) Adding an “Embodied Emissions” section that would be based on a life-cycle analysis of the greenhouse gas emissions resulting from the project’s construction.
- 2) Setting a timeframe of 2050 for the projections of greenhouse gas emissions due to building operations, as well as for the technical pathway for transitioning to net zero greenhouse gas emissions.

Background

Prior versions of this Petition were reviewed by the Planning Board in 2021, and then in March of this year. The Board first made a report with comments but no recommendation, then made a positive recommendation with suggestions for improvement. Both Planning Board reports are attached. CDD memos with additional background information are also attached.

Overall, the Board expressed that it was beneficial and important for the City to collect information that would help advance the Net Zero Action Plan. Board members had concerns about tying this information to requirements that would need to be met, because it is based on estimates and projections which have a degree of uncertainty.

When the previous version of this petition was filed, the Council also considered changes to the Building Energy Use Disclosure Ordinance (BEUDO). Those changes remain under consideration.

Comments on Petition

The current Petition follows from the prior Planning Board recommendations.

The proposed new requirements are more simplified than in prior versions of the Petition. They are incorporated into the Net Zero Narrative section (rather than in a new section), which will make implementation more straightforward.

The required analysis is described at a high level, which provides greater ability to tailor and adapt the submissions over time. This is especially important because the Embodied Emissions analysis is still a new and evolving practice, and requires information about construction materials and methods that is not yet fully standardized and centralized.

It is important that the current version of the proposed zoning focuses on a “lifecycle analysis,” which is meant to include emissions from raw material extraction, manufacturing, transport, building construction, and use, as well as end of life demolition, deconstruction, waste processing, and disposal. The proposed zoning also highlights “major building materials, including but not limited to wood, concrete, steel, aluminum and glass.” Many of the embodied emissions will come from the products and materials that are used.



CITY OF CAMBRIDGE, MASSACHUSETTS

PLANNING BOARD

CITY HALL ANNEX, 344 BROADWAY, CAMBRIDGE, MA 02139

Date: May 17, 2022

Subject: Emissions Accounting Zoning Petition

Recommendation: The Planning Board RECOMMENDS ADOPTION, with additional comments.

To the Honorable, the City Council,

On March 29, 2022, the Planning Board (the “Board”) held a public hearing to discuss a Zoning Petition by the City Council to amend Article 22.000 of the Cambridge Zoning Ordinance to require applicants of most Green Building Projects to provide, as part of their compliance with the Net Zero Narrative in Section 22.25.1(c)2, an accounting of greenhouse gas emissions generated by construction, expected annual emissions generated by routine building operations, lifetime expected emissions until the year 2050, and total expected emissions (the “Petition”). This accounting would be estimated and provided for informational purposes only. As proposed, the requirements would not apply to any residential buildings that include affordable units, and the Petition identifies specific types of emissions that shall and shall not be included in each of these calculations. The Board heard a presentation from Councillor Zondervan and Councillor Carlone, representing the petitioners, and received written materials from staff in the City’s Community Development Department (CDD).

Following the presentation, public comment, and discussion among Board members, the Planning Board voted to transmit a favorable recommendation on this Petition to the City Council, with some additional comments.

Board members agreed that it is important for developers and designers to think about greenhouse gas emissions at the early stages of a project, and it will be helpful to make projections of greenhouse gas emissions available to the Planning Board and the public during a project’s review. Board members also remarked that there is a relatively new awareness of “embodied” greenhouse gas emissions in building materials, which has been identified through the City’s Net Zero planning efforts as a contributor to total emissions that should be studied.

The Board offered the following additional comments:

- Most Planning Board members agreed that because the intent of the Petition is to provide accurate information at the early design stage, it would be preferable to make the requirement applicable to all projects subject to Green Building Requirements, instead of excluding certain residential developments.

- Most Planning Board members also agreed that for the information to be most useful, the fullest possible accounting of greenhouse gas emissions should be undertaken, not necessarily excluding features such as renewable energy systems, electric vehicle infrastructure, and landscaping. Although such features may provide a positive environmental benefit, the embodied emissions for the whole project should be included to the extent practicable to provide a full picture of the project's net impacts.

Board members recommended that City staff provide a detailed review of the Petition text, and suggest any modifications that would improve its clarity and application.

The Planning Board voted with seven members in favor of transmitting the above recommendation. Two members were absent.

Respectfully submitted for the Planning Board,

A handwritten signature in black ink that reads "Mary T. Flynn". The signature is written in a cursive style with a large, looped initial "M".

Mary Flynn, Vice Chair.



CITY OF CAMBRIDGE

Community Development Department

To: Planning Board

From: Community Development Department (CDD) Staff

Date: March 24, 2022

Re: **2022 Article 22.000 Emissions Accounting Zoning Petition**

IRAM FAROOQ
Assistant City Manager for
Community Development

SANDRA CLARKE
Deputy Director
Chief of Administration

KHALIL MOGASSABI
Deputy Director
Chief of Planning

Overview

Petitioner: City Council

Zoning Articles: Article 22.000 Sustainable Design and Development

Amendment Summary: The proposed amendments would require applicants of most Green Building Projects to provide, as part of their compliance with the Net Zero Narrative in Zoning section 22.25.1(c)2, an accounting of greenhouse gas emissions generated by construction, the expected annual emissions generated by routine building operations, lifetime expected emissions until the year 2050, and total expected emissions. This requirement would not apply to any residential buildings that include affordable units. The Zoning Petition identifies specific types of emissions that shall and shall not be included in each of these calculations.

Planning Board Action: Recommendation to City Council

Memo Contents: Summary of the proposed zoning; background information on current planning for Net Zero buildings in Cambridge; and comments on proposed amendment.

Summary of Petition Effects

The Petition would add a section entitled “Emissions Accounting” (Section 22.24.4) to the “Green Building Requirements” currently in [Section 22.20 of the Zoning Ordinance](#).

The Green Building Requirements apply to development of 25,000 square feet or more that requires a Planning Board Special Permit or is subject to the Building and Site Plan Requirements in Section 19.50 of the Zoning Ordinance – which includes new construction, additions, and some rehabilitation of buildings that are undertaken to accommodate a change of use.

The proposed Emissions Accounting section would not apply to any residential buildings that include affordable units. As written, all existing Green Building Requirements will continue to apply to residential buildings with affordable units, but these applicants will not be required to comply with the specific emissions accounting standards proposed in this Petition.

The Petition requires that “Emissions Accounting” is incorporated into the existing “Net Zero Narrative” requirement. Applicants would need to document four emission categories:

- 1) Embodied Emissions.
- 2) Expected Annual Emissions.
- 3) Lifetime Expected Emissions.
- 4) Total Emissions.

The petition does not provide explicit definitions for these four emission categories, and they are not currently defined in zoning article 2.000 Definitions. The petition lists the types of emissions that must be included in these calculations, while excluding other categories of emissions associated with development. These exclusions appear to be based on policy priorities, such as the creation of affordable housing, the installation of renewable energy systems and electric vehicle infrastructure, and protection of the tree canopy and other landscaping features that mitigate the heat island effect.

Background – Existing Green Building Requirements

The Green Building Requirements ([CDD GBR website](#)) were first adopted in 2010, following the recommendations of a Green Building/Zoning Task Force. They are intended to supplement other design and development standards that apply to larger-scale development by establishing threshold standards for environmentally sustainable and energy-efficient design and development.

The Green Building Requirements were amended in 2019 as recommended by the City’s Net Zero Action Plan, and amended again in 2020 pursuant to a City Council zoning petition to require a technical and financial feasibility assessment of energy systems that would not consume carbon-based fuels on-site.

Developments subject to Green Building Requirements must demonstrate that they are designed to meet the standards of one of the following Green Building Rating Systems:

- [LEED \(U.S. Green Building Council\)](#)
 - “Gold” rating required for projects 50,000 square feet or more, “Silver” rating required for projects 25,000-50,000 square feet.
- [Passive House Institute, U.S. \(PHIUS\)](#) or [Passivhaus Institut \(PHI\)](#)

- [Enterprise Green Communities](#)

Compliance is reviewed at the special permit, building permit, and certificate of occupancy stage. Certification by the rating agency is not required, but the developer must provide certification that the standards are being met from a qualified and credentialed “Green Building Professional.”

Developments subject to Green Building Requirements must also implement an enhanced commissioning program.

Net Zero Narrative

The Green Building Requirements submission must include a “Net Zero Narrative” at the preliminary and final stage of review, reporting on initial and future projections for energy use and greenhouse gas emissions and discussing how the project aligns with the City’s [Net Zero Action Plan](#). The Net Zero Narrative does not create new standards for development but is intended to provide a reliable assessment of a building’s energy performance and GHG emissions at the early design stage. It is meant to ensure that developers of Green Building Projects are considering the City’s Net Zero targets in their project design and can demonstrate how they would transition to Net Zero emissions.

At a minimum, Section 22.25.1(c)2 requires the inclusion of “anticipated energy loads, baseline energy simulation tool assumptions, and proposed energy targets, expressed in terms of site energy use intensity (“EUI”), source EUI, and total greenhouse gas emissions” in the Net Zero Narrative.

Background – Planning for a Net Zero Cambridge

Net Zero Action Plan

The Cambridge Getting to Net Zero Action Plan was adopted by the City Council in July 2015 following a stakeholder-driven process to formulate a comprehensive plan to phase out GHG emissions from buildings throughout the Cambridge community. The Plan included a set of actions for existing buildings, new buildings, low carbon energy supply, and enabling actions to set Cambridge buildings on the pathway to zero GHG emissions by mid-century. Actions for new buildings included strengthening the Article 22 Green Building Requirements, which led to the 2019 amendments described above.

A full review and update of the Net Zero Action Plan by city staff and an expanded stakeholder group was recently completed. The review considered the impact of the Net Zero Action Plan to date and current science, technology, and policy context for GHG emissions reductions from buildings and led to a recommended set of updates to the Plan. Two updated actions relevant to this zoning petition are the recommendations to seek to adopt the state-level net zero stretch energy code for newly constructed buildings, which is anticipated to be made available in 2022, and to require the measurement and increasingly greater reductions of “embodied” greenhouse gas emissions from building construction over time.

Building Energy Use Disclosure Ordinance

The Cambridge Building Energy Use Disclosure Ordinance (BEUDO), adopted in 2014, currently requires commercial properties over 25,000 square feet and residential properties over 50 units to annually

report and disclose their energy and water usage. Per the Ordinance, beginning in 2018 CDD conducted a review of the effect of the Ordinance on the energy performance of covered buildings and concluded that the energy performance had not improved significantly. In response to this, CDD worked with affected property owners and operators and, in November 2021, proposed amendments to the BEUDO which would require covered buildings to progressively reduce their operational GHG emissions over time. These performance requirements would also apply to newly constructed buildings as they go into operation. The proposed amendments are currently under consideration by City Council, along with an alternative proposal by some Council members which would significantly truncate the GHG reduction timeline, require high emitting buildings to reduce emissions at a faster pace, require new buildings to achieve zero emissions, and charge buildings a fee for the lifetime emissions calculated as a result of this zoning petition.

Background – Data Collection for Existing Buildings Subject to Green Building Requirements

The Article 22 Open Data Set and Dashboard are designed to profile all projects that have been subject to the City's Green Building Requirements since its adoption. It is the City's intention that the data presented will provide insight as to how buildings are being designed in keeping with the City's initiatives on building energy use and efficiency, sustainability, and resiliency.

- [Green Building Dashboard](#)
- [Green Building Open Data](#)

Background – 2021 Emissions Accounting Zoning Petition

The current Petition has similarities to a 2021 City Council zoning petition that would have required a calculation of emissions from the construction process (embodied emissions) and from annual building operations, as well as a “lifetime emissions” calculation. In addition to documenting emissions, the 2021 petition would have tied a “payment schedule for how to zero out the Total Emissions of the building” over a period of up to 10 years. The petition did not precisely explain how the “payment” would be satisfied, but it listed potential “offsets” including green jobs development programs, energy efficiency upgrades to existing buildings, payment into “the City of Cambridge Renewable Energy and Greenhouse Gas Reduction Revolving Fund,” installation of solar photovoltaic systems, and direct supply contracts for 100% renewable electricity.

The 2021 petition was not adopted by the City Council. The Planning Board’s recommendation (attached) suggested that some parts of the petition could be appropriate to include in zoning, especially the embodied emissions analysis that could be incorporated into the early design stage of a Green Building Project. However, the Board noted that many aspects of the petition were not appropriately within the purview of zoning, and that the parts that were appropriate could be better integrated into the current Green Building Review procedures and timelines. The Board’s recommendation also suggested that new components of the Green Building Requirements should be applied to all Green Building Projects, not just selected types.

Comments on Petition

In general, the current Petition follows from the Planning Board recommendation on the prior petition by incorporating a broader greenhouse gas emissions accounting – including embodied emissions – into the Green Building Review process beginning at the early design stage. This approach also generally aligns with the recommendations of the recent Net Zero Action Plan update.

There are some detailed issues that should be considered more carefully.

Exclusions

The current Green Building Requirements do not include reporting exclusions for specific features of a project’s planning, design, and construction (e.g., affordable housing units, renewable energy systems, electric vehicle infrastructure, and landscaping). The Green Building Requirements instead require an accurate accounting of the proposed design and operational elements of a project, using accepted industry standards. Staff use this information to certify compliance with the applicable design standards and to advise applicants on how they can better meet the City’s design objectives. Ongoing review ensures that the design standards continue to be met as a project is developed. Excluding development types or project elements based on policy considerations might relieve some of the cost burden of having to provide the analysis, but could also make it more difficult to collect consistent and meaningful information in the review process.

Other Ordinances

Although the current Petition does not require “offsets” for the emissions accounting through zoning, the parallel discussion around BEUDO amendments has suggested that the required calculations in the Net Zero Narrative could be used as the basis for other requirements. The emissions accounting provided through Green Building Review would only be a projection, and would be primarily used to inform project design, so it is helpful if that information is as reliable as possible at that early design stage. Tying these early projections to a requirement that would be imposed later on could affect the way in which developers calculate their projections, and raise concerns about the reliability of the information and whether such a requirement would be legally permissible. It could also disincentivize building owners from seeking improvements to energy performance later on through the detailed design and eventual operation of the building.

Implementing Embodied Emissions Calculations

The Petition proposes to address the GHG emissions from building materials and construction processes. The practice of quantifying lifecycle emissions from building construction and operations is a relatively new and developing field, and there are a number of technical issues that need to be considered to ensure that the information received will be consistent and reliable. To perform a whole building embodied carbon calculation, data is required on every material that is utilized, from concrete and steel to wood, finishes, insulation, mechanicals, wiring, and glass. Builders rely on product manufacturers to provide information on the content and sustainability of their products. Many manufacturers do not provide this information and there is no system to verify the data when it is available.

There are various industry tools available to account for the upfront supply chain emissions of construction materials and products, including LEED’s Life-Cycle Impact assessments (LCA), TRACI, Tally, Athena Impact Estimator, OneClick LCA, and Embodied Carbon in Construction Calculator (EC3). These tools allow project teams to compare materials through manufacturing/production, transportation, and end of life stage (“cradle-to-grave”) against a baseline building model, referencing a building life span typically of 65 years. However, due to differences in the tools and inconsistent data availability, a standardized approach to calculating embodied emissions would need to be established.

Text Improvements

Staff believe the proposed structure of the ordinance language could be improved to better integrate with the existing “Green Building Requirements.” The petition calls for the creation of a new section 22.24.4 “Emissions Accounting.” However, the petition language itself modifies section 22.25.1(c)2. If the Planning Board were to submit a favorable recommendation, City staff could assist in making improvements to the text before the Council considers adoption.



CITY OF CAMBRIDGE, MASSACHUSETTS

PLANNING BOARD

CITY HALL ANNEX, 344 BROADWAY, CAMBRIDGE, MA 02139

Date:	July 27, 2021 (CORRECTED)
Subject:	Article 22.000 Emissions Accounting Zoning Petition
Recommendation:	The Planning Board makes the following report with no positive or negative recommendation.

To the Honorable, the City Council,

On June 29, 2021, the Planning Board (the “Board”) held a public hearing to discuss the City Council Zoning Petition to amend Article 22.000 of the Zoning Ordinance to create requirements related to Emissions Accounting (the “Petition”). City Councillors Dennis Carlone and Quinton Zondervan, with other community representatives, presented the proposal. Staff from the City’s Community Development Department (CDD) also attended the hearing and answered questions from the Board.

The Petition would require most Green Building Projects, with the exception of residential projects that include affordable units, to provide an accounting of the emissions generated by construction to CDD as a condition of receiving an occupancy permit. The submission would include information about expected embodied carbon, annual emissions, lifetime expected emissions, and total emissions. The Petition identifies specific types of emissions that shall and shall not be included in each of these calculations. The amendments would also require applicants to present a payment schedule for how to zero out the total emissions of the building, using a social cost of carbon formula approved by CDD, with the outstanding balance acting as a lien on the property in case it is sold, and a specified list of acceptable offsets.

Following presentation, public comment, and discussion among Board members, the Planning Board voted to transmit a report with comments to the City Council but no recommendation. Board members expressed general support for the goals of the Petition, but raised a number of concerns related to the administration and enforcement of the Petition that could make it impractical. Board members were not convinced that the goals of the Petition would be achieved and suggested that further discussion was needed to create a more effective proposal.

The Planning Board voted to transmit a summary of its discussion, provided below.

Scope of Petition

Some Board members questioned whether the Petition attempted to address too many different issues and encompass too many different concepts that perhaps should be studied more carefully and advanced as separate initiatives. Some Board members expressed confusion about whether

the purpose of the Petition was to incentivize reductions in greenhouse gas emissions or to raise funding for job programs, since it is not clear how much funding would be raised compared to what the funding needs would be, and the funding would be more limited if buildings reduce their emissions. Other Board members expressed the view that building a workforce to address the issues of climate change is something that will need to be addressed at a regional level.

Board members also noted that the procedures laid out in the Petition are completely different from the procedures in the current Green Building Requirements, and some concepts in the Petition may not be within the scope of zoning at all. Some Board members commented that zoning standards ought to be applied earlier in the design process of a building (as with the current Green Building Requirements) rather than just before or after a project receives an occupancy permit. Other aspects of the Petition, such as funding for job programs, may need to be addressed through separate ordinances or other policy tools. Board members suggested that the City Council consult with the City's Law Department to determine which policies can be pursued through zoning and which policies require other approaches.

Board members also pointed out that some aspects of the Petition affect topics that are addressed in the City's Net Zero Action Plan. Although the Petition identifies some topics that have not been contemplated until recently (including embodied energy, discussed below), some Board members expressed concerns about circumventing the process laid out in that plan.

Clarity of Petition

Board members found the language of the Petition difficult to understand, pointing out that while it refers to "Emissions Accounting" and a "payment schedule," it does not explicitly state that the developer has to make a specific payment or how the payment is made. The method of calculating the payment is also not clearly explained, with many of the substantive details delegated to CDD staff. Given the complexity of the analysis, Board members questioned whether so many aspects of the requirement can be delegated to CDD staff rather than being spelled out in the Zoning Ordinance. If any new requirements are adopted, Board members emphasized the need for clarity about exactly what will be required and how the requirements will be enforced.

Embodied Energy

Several Board members were supportive of the idea of considering "embodied energy" or "embodied carbon emissions" – referring to the energy consumed and greenhouse gases emitted as a result of the production and transport of building materials – as part of the environmental performance of buildings. Board members cited increasing awareness in recent years of the environmental impacts of embodied energy, particularly in the production of steel, concrete, aluminum, and glass. Some Board members asked that more detailed information about the embodied energy of various types of materials be provided to fully understand the impacts before new requirements are imposed, including materials that might have other environmental benefits such as solar panels and insulation. Some Board members believed that this was a topic area that could be advanced more quickly with more focused study.

Applicability

Several Board members questioned why additional Green Building Requirements should not apply to most residential buildings, since they are also subject to the same development review standards and given the City's plans to accommodate more housing construction in the future. Board members also noted that in meeting the City's greenhouse gas emissions goals, the existing housing stock will need to be addressed, and it would be helpful to know more about cumulative citywide greenhouse gas emissions resulting from both new buildings (which are subject to more stringent standards) and existing buildings.

Respectfully submitted for the Planning Board,

Catherine Preston Connolly

Catherine Preston Connolly, Chair.