

## **Embodied Carbon FAQs**

### **What is embodied carbon?**

- Embodied carbon is the sum of carbon dioxide and other greenhouse gas emissions associated with raw material extraction, manufacturing, and transportation for materials production and the emissions associated with the construction, maintenance, renovation, and end-of-life of buildings and infrastructure. Greenhouse gas emissions are calculated relative to the impact of one molecule of carbon dioxide and reported as carbon dioxide equivalent (CO<sub>2</sub>e) with units of mass. In Life Cycle Assessment reports and Environmental Product Declarations (EPDs), embodied carbon is equivalent to Global Warming Potential (GWP).

### **To which buildings would the proposed standards apply?**

- The proposed standards would apply to projects subject to the Sustainability Requirements of the Zoning Ordinance: any proposed development in any zoning district that includes the construction or substantial reconstruction of one or more buildings totaling 20,000 sf or more of gross floor area.

### **What is the cost of the analysis requirements in the proposed ordinance language?**

- There are two levels of analysis stipulated in the proposed ordinance language. For buildings between 20,000 and 50,000 square feet, the analysis is required to estimate the embodied carbon of the structural elements of the building that is already in design. Such analysis would likely be conducted by structural engineers already contracted for the project. In conversations with some Newton-area professionals, this is a cost add of \$1,500 to \$5,000. This represents under 0.1% of the construction value of a typical project of this size.
- For projects over 50,000 square feet, the analysis is also to include a Life Cycle Assessment of the structural and envelope (enclosure) systems of the building. This assessment is based on a credit in the LEED Rating System. Costs for this level of analysis and additional design might range between \$8,000 and \$25,000, representing a cost from under 0.1% to as much as 0.25% of the construction cost.

### **What is the difference between an embodied carbon assessment and a life-cycle assessment?**

- Embodied carbon assessment is a more limited analysis than a life-cycle assessment. An embodied carbon assessment estimates only the global warming potential over the life of a project. A life-cycle assessment also includes other environmental impacts such as acidification and smog formation potential.

### **What is the cost/time difference between an embodied carbon assessment and a life-cycle assessment?**

- The embodied carbon of most structural and envelope materials is well understood and the data are widely available, so in many cases simplified tools may be used to estimate embodied carbon. The data for other environmental impacts evaluated in a life-cycle

assessment are not as widely available and more specialized LCA tools must be used to estimate these impacts.

- In addition, for projects under 50,000 square feet, the proposed ordinance language only requires the design team to evaluate the structural materials, which are limited in number and for which data are widely available. For projects over 50,000 square feet, the proposed ordinance language requires evaluation of both structural and envelope materials, and also requires that the developer compare design alternatives. Costs for the more encompassing life-cycle assessment are about 3 to 20 times the cost of a simple embodied carbon assessment of the structural materials measured as a percentage of the cost of construction. As indicated above, all costs associated with this ordinance requirement would be less than 0.25% of the construction value.

**Who performs the embodied carbon assessment and the life-cycle assessment? Are these individuals or companies readily available?**

- The project designers typically provide embodied carbon and/or life-cycle assessments. Professionals who would conduct these assessments are likely already contracted for projects of these sizes and most are well-versed in the topic. Some projects in Newton subject to the 5.13 Sustainability Requirements currently going through the special permit process have already committed to doing embodied carbon analyses.

**Does the City have staff who can evaluate the embodied carbon assessments?**

- City staff will review the reports submitted by the project team, similar to many other submittals required through the special permitting process.

**How available are lower-carbon concrete mixes? How do we know they are structurally safe?**

- Lower-carbon concrete mixes are readily available and already in wide use for specialty applications. The structural properties of the lower-carbon concrete usually equal or exceed the properties of conventional concrete. More detail can be found on the Carbon Leadership Forum and SE 2050 website.

**What level of analysis can be reasonably expected of a project team at the special permit stage? At the building permit stage?**

- Embodied carbon assessments can be conducted at any stage of project development. The closer the design is to completion, the more precise the computations become. That is why we are asking for an initial commitment for what type of analysis will be undertaken at the special permit stage, to start the conversation early, but not requiring the work of doing the analysis until the building permit stage – after the special permit has been approved.

**Do we have sample embodied carbon assessments?**

- The Carbon Leadership Forum and [SE 2050](#) websites include case studies. We hope to develop some local case studies as current projects are completed.

**What resources do developers who do not know about embodied carbon have to learn more about this topic/how to meet the proposed requirements?**

- The [Carbon Leadership Forum](#) and [SE 2050](#) websites both offer a wealth of information about embodied carbon and how to calculate it, including descriptions of available tools.

**What is Newton doing about embodied carbon in its own building projects?**

- The City has conducted embodied carbon analyses on its recent new construction projects, and will continue to do so for projects moving forward.

**What are other cities and towns doing related to embodied carbon?**

- Boston's efforts to address embodied carbon are part of the City's Zero Net Carbon Building Zoning Initiative, which is now in draft form out for public comment. The City has established a Technical Advisory Group that has presented a report and suggested avenues for how to address embodied carbon, including requiring life-cycle analyses for large projects.
- Cambridge is looking to first require reporting, then 20% reductions, and eventually 50% reductions as outlined in the City's Net Zero Action Plan.
- Brookline passed a resolution last year for the Town to use low-carbon concrete products (reduction of 10% emissions) in Town projects, including sidewalks.

**Why are we focused on large new construction rather than smaller residential buildings, which make up the majority of the building stock in Newton?**

- We have the ability to address embodied carbon in large projects through the special permit process; we do not have the same sort of oversight in by-right projects.