



# NYC EO 23 Whole Project Life Cycle Assessment (LCA) Guidance

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Prepared by the Mayor's Office of Climate & Environmental Justice

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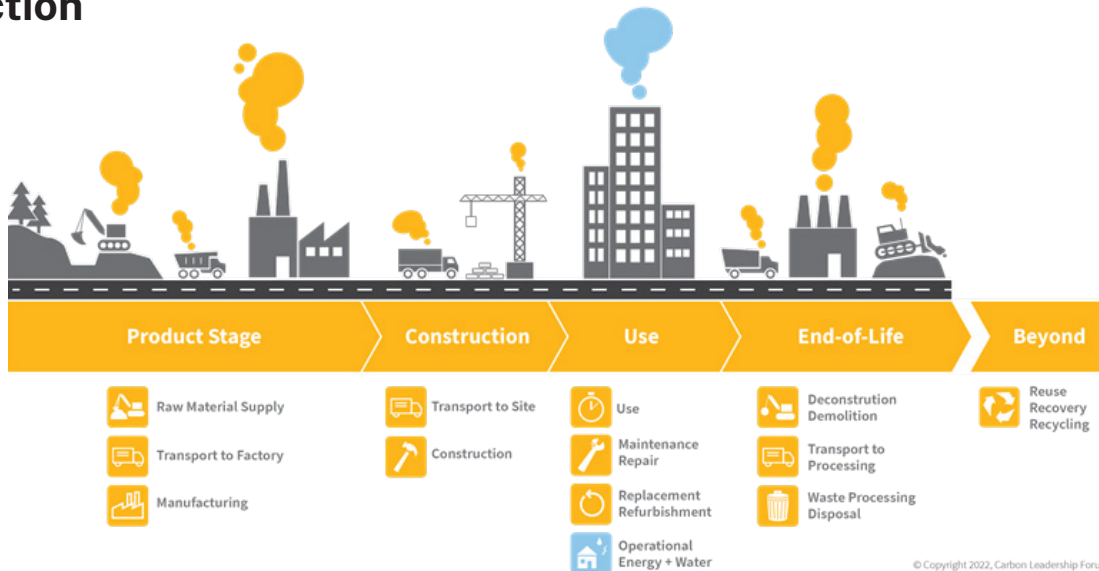
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# Introduction



Whole Life Carbon is comprised of the embodied and operational carbon emissions associated with a project.<sup>1</sup>

There are two kinds of building and infrastructure greenhouse gas (GHG) emissions that exacerbate the impacts of the climate crisis in our communities: (1) embodied carbon, and (2) operational carbon.

**Embodied carbon** refers to the GHGs associated with materials and construction processes over the whole life cycle of a building.<sup>2</sup>

**Operational carbon** refers to the emissions associated with the energy used to operate a building.

Reduction of embodied carbon should start early in design, informed by a preliminary Whole Project Life Cycle Assessment (LCA) that identifies the materials that contribute the greatest GHG emissions. This often includes materials such as concrete, steel, aluminum, and insulation, and building elements such as foundation systems, floor slabs, exterior walls, etc. At this stage, alternative structural systems, layouts, and envelopes should be evaluated and compared in terms of embodied and operational carbon impact.<sup>3</sup>

New York City [Executive Order 23 of 2022](#) (EO 23) establishes LCA targets to provide transparency and reduce embodied carbon in capital projects. Section 5 of EO 23 states:

*“Capital project agencies shall endeavor to achieve, to the extent practicable, credits related to life cycle assessments (LCA) for capital projects that are required to comply with the green building standards (Charter Section 224.1: Local Law 51) and, where applicable, shall annually submit each project’s final LCA report to the office of environmental coordination. This section applies to new construction, additions, and substantial reconstructions with substantial work on the building envelope.”*

Capital project agencies include the Department of Design and Construction, Department of Citywide Administrative Services, Department of Environmental Protection, Department of Transportation, and the Department of Parks and Recreation. Other agencies, such as the Department of Sanitation, the School Construction Authority, and the Economic Development Corporation, are encouraged to follow this guidance as well.

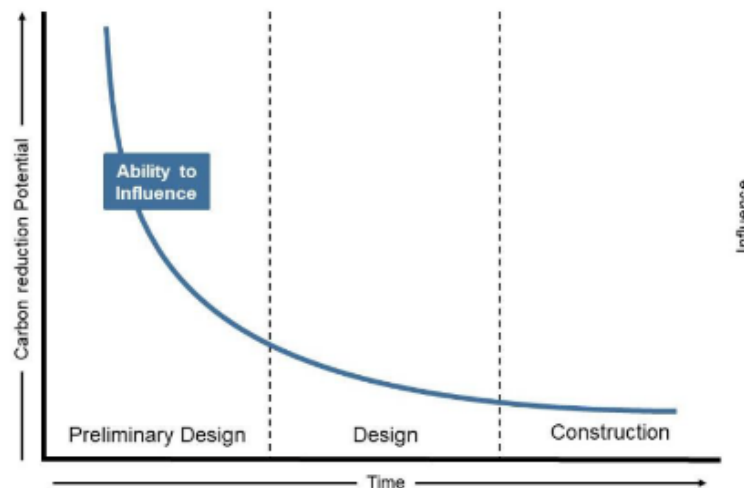


## Embodied Carbon Reduction Potential vs. Project Phase

Because embodied carbon is generated by the manufacturing, transportation, installation, maintenance, and disposal of construction materials used in buildings and infrastructure, it's important to use a holistic accounting method to measure and manage all sources of emissions, also known as a Whole Project **Life Cycle Assessment (LCA)**.<sup>4</sup>

LCA is a method to compile and examine the environmental impacts of a project's raw materials and manufactured products throughout their life cycle. LCAs sometimes evaluate the impacts of operational energy and other environmental impact indicators. LCAs vary in complexity. Depending on the materials included in the analysis, an LCA can capture ~80%-100% of the entire embodied carbon impact of a project.

LCAs are conveyed by predetermined environmental impact metrics summarizing the results of the assessment, including Global Warming Potential (GWP), which allows comparisons of the global warming impacts of different greenhouse gases and can be used to measure and track embodied carbon.



Carbon Reduction Potential vs Project Phase

During a project, it is best practice to conduct a preliminary LCA and assess embodied carbon potential at the beginning of the design stage. This allows the project team to measure avoided emissions from a baseline building and incorporate project elements and design decisions to reduce embodied carbon. These could include maximizing the useful life of existing buildings and materials, optimizing material efficiency, and designing with low-carbon materials.

This Executive Order 23 guidance document suggests best practices for LCAs on City projects based on the best available information in 2024. Given the LCA industry is rapidly evolving, this guidance document provides flexibility to City agencies and only prescribes high-level mandates and LCA reporting tasks for projects. This document will be updated in the future to incorporate evolving best practices. Mayor's Office of Climate & Environmental Justice (MOCEJ) staff are available to work with City agencies to develop agency-specific LCA policies upon request. For more information regarding best practices for integrating LCAs into the entire design process, please refer to the following resources:

- Carbon Leadership Forum's [Embodied Carbon Checklist](#)
- Building Transparency's [Embodied Carbon Action Plan](#)

# NYC EO 23 LCA Implementation

## Covered Projects

Section 5 of EO 23 applies to all City-owned capital projects covered in Chapter 9, Section 210 of the New York City Charter, including new buildings, additions, or substantial reconstructions with substantial work on the building envelope and that are subject to the provisions of Charter Section 224.1: Green Building Standards (amended by Local Law 51 of 2023).

In addition, this guidance clarifies that any capital project, including infrastructure projects pursuing Envision Verified<sup>6</sup> or greater, shall also be covered projects of the LCA section of EO 23.

Other laws, rules, and guidance apply to City construction projects in addition to EO 23. The City's Green Building standards, set forth in Local Law 51 of 2023, require new capital projects over certain monetary thresholds--including buildings, additions, and substantial reconstructions--to achieve environmental performance criteria, including significantly reduced energy consumption, compared to similar existing projects.

## Acceptable LCAs

New York City's Green Building Standards, set forth by the Mayor's Office of Environmental Coordination (MOEC), require the completion of a Whole Project Life Cycle Assessment Report and provide different methodologies for unique Green Building standard credits, or an equivalent.

To comply with Local Law 51 and EO 23, covered City capital projects must complete an LCA according to one of the following standards and complete and submit an EO 23 LCA report template to MOEC:

- LEED v4 Materials and Resources Credit -Building Life Cycle Impact Reduction: Option 4. Whole-Building Life-Cycle Assessment; or LEED's equivalent v4.1 credit
- Envision v3 Credit CR1.1 -Reduce Net Embodied Carbon, and/or LD3.3 -Conduct Life Cycle Economic Evaluation; or
- NYC Green Schools Guide (GSG) 2019 credit M3.1A –Life-Cycle Impact Reduction, Whole Building LCA.

All agency project teams should follow the requirements of the corresponding credits in LEED, Envision, or GSG, which includes at a minimum conducting assessments of structure and envelope systems if these systems are altered. In addition, this guidance proposes that projects must all demonstrate a minimum 10% reduction in overall embodied carbon compared to the Baseline LCA. Project teams are encouraged to go beyond those requirements pursuant to their internal processes and goals.

**Project Envelope System:** LEED, Envision, and GSG scopes all require an LCA to include an assessment of a building’s envelope system. However, these scopes leave up to interpretation what is included in the envelope system. This guidance suggests that the project’s LCA should cover the exterior cladding, including roof, through to the finish of exterior walls (i.e., rain screen system). Building projects that do not alter the building envelope are excepted from this reporting requirement.

**Project Structural System:** This guidance proposes that a project’s LCA should include the project’s foundation (i.e., slabs on grade, foundation walls, column footings, steel reinforcement) and superstructure (i.e., floor slabs, columns, beams, load-bearing walls, steel reinforcement). Projects that do not alter the structural system are excepted from this reporting requirement.

**Minimum 10% reduction in embodied carbon:** EO 23 references LEED and GSG credits that require a project to demonstrate 10% overall embodied carbon reduction compared to baseline. Even though Envision does not require a percentage reduction in the embodied carbon goal, this guidance proposes that all EO 23 LCA reports submitted by agencies for buildings and infrastructure include both a Baseline LCA and Final LCA demonstrating the 10% reduction. See the LCA Scope of Work section for more information regarding this requirement.

(Note: LEED also requires that projects demonstrate a reduction in GWP and at least two other environmental impact indicators.<sup>7</sup> Currently, EO 23 LCA compliance focuses on demonstrating reductions in GWP, but future iterations of this guidance may expand upon compliance pathways by adding requirements for other environmental impact indicators.)

## LCA Scope of Work

This guidance proposes that project teams for EO 23-covered projects should scope in contracting and then complete a baseline LCA early in the design process (Baseline Model) and a final LCA at the end of design (Final Model) to compare and calculate the overall embodied carbon reduction achieved by the project. The Baseline and Final Models should assume projects of comparable size, function, and orientation.

The **Baseline Model** should be based on an early-stage design model for that project. Ideally, the materials and construction emissions assumed in the baseline model should be based on real materials, but industry averages are acceptable, meaning that the assumed embodied carbon intensity of products included in the model should align with either Industry-wide Type III Environmental Product Declarations (EPDs)<sup>8</sup> or Product-specific Type III EPDs that align with Carbon Leadership Forum’s current [material baseline Global Warming Potential \(GWP\) intensities](#).

The **Final Model** should be based on the project’s final design (100% CD). The materials and construction included in the final model should be based on the project’s final (100% CD) specifications, with Product-specific Type III EPDs where possible, and industry average EPDs where Product-specific Type III EPDs are not possible.

# Recommended LCA Design Process

## At RFP / Contracting:

1. Identify an LCA modeler.
  - a. This LCA modeler is often the architect.
  - b. The project RFP should include LCA scope (life cycle stages) and boundary, the appropriate LCA tool, and LCA Baseline and Final Modeling requirements as stated in the project's LEED credit (or Envision/Green Schools Guide).

## Early Design / Schematic Design:

1. Produce Baseline Model for use in comparing massing options, structural systems and materials, and envelope systems and materials.
  - a. Hold a Sustainability Charrette / Integrative Design Workshop that aligns with the 10% or more reduction target of the project and any other project sustainability goals.

## Activities to Take in Design Development:

1. Conduct a hot spot analysis of the Baseline Model to identify the materials and systems in the project's early design that contribute the most GHG emissions, or disproportionately high GHG emissions relative to cost of mitigation.
2. Calculate impact of corresponding embodied carbon reduction strategies to identify highest impact strategies and low-hanging fruit. (i.e., building/material reuse, cement content reductions, high recycled content structural steel, low carbon insulation, biogenic materials.)
3. The LCA modeler should track different reduction scenarios (packages of compatible reduction strategies) for comparison against baseline and against each other.

## Construction Documents Should:

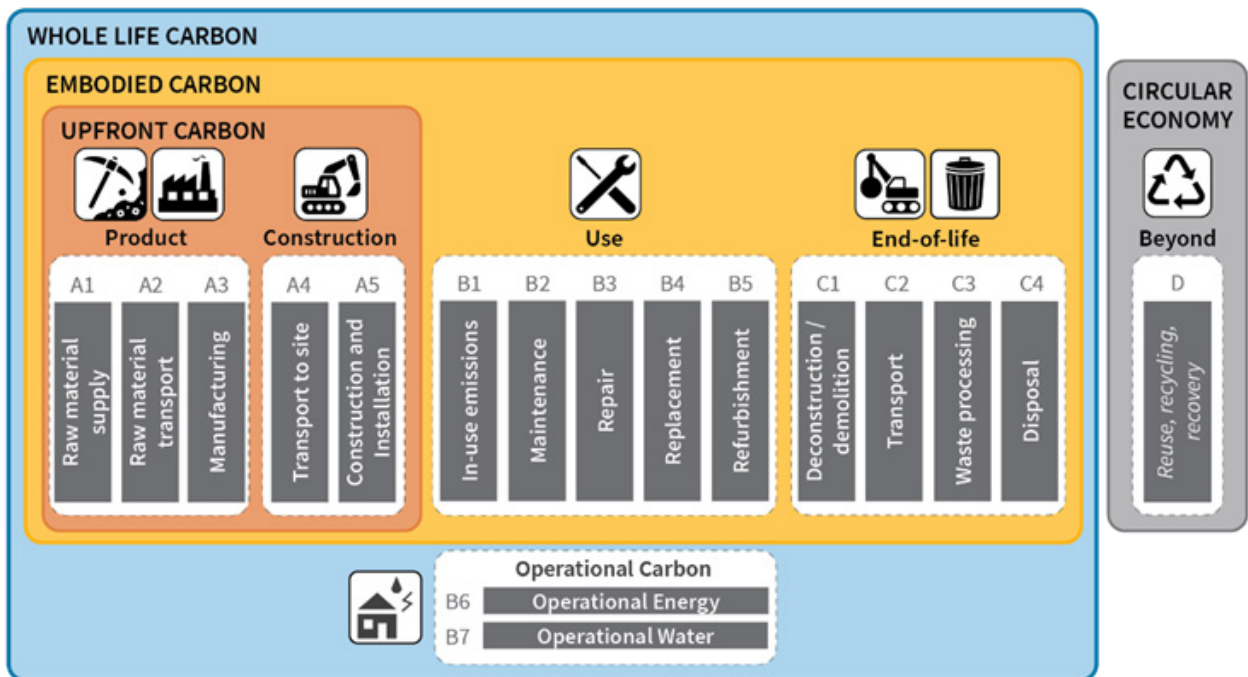
1. Confirm the project-level emissions reduction strategies and integrate them into project specifications.
2. At 100% CD, projects should complete the Final Model, demonstrating the integration of the 10% embodied carbon reduction and any other selected reduction strategies into the project.

## In the Fiscal Year Following 100% CD:

1. Complete "EO 23 Life Cycle Assessment an Embodied Carbon Design Report" template (EO 23 Reporting Template). See the Disclosure Process for Covered Projects section for more information.
  - a. For building projects, project teams should submit the Baseline and Final LCA Models along with the template to the managing agency's Capital Green Building Program liaison, who must submit to MOEC after review and approval.
  - b. For infrastructure projects, projects should submit the Baseline and Final LCA Report along with the template to that Agency's Chief Decarbonization Officer or alternate point of contact designated by the agency, who after review and approval must submit to MOCEJ.

## Covered Life Cycle Stages

For covered projects, MOCEJ recommends including Life Cycle Stages A1-C4, as illustrated below, in the LCA whenever possible, but not including Life Cycle Stages B6 and B7.



Life cycle stages for projects.<sup>9</sup>

Under this guidance, at a minimum, EO 23 LCAs are required to include the embodied carbon emissions from the structure and enclosure of a project from Stages A1-A5, B1-B5, and C1-C4 of the project life cycle. MOCEJ recommends but is not requiring the use of the following EO 23-compliant North American LCA tools: Athena Impact Estimator, OneClick LCA, and tallyLCA.

It is optional to report emissions and benefits from biogenic carbon and concrete carbonation in the EO 23 Reporting Template. If a project decides to report this data, it should be reported separately from the rest of the LCA for MOCEJ data collection purposes.



## Disclosure Process for Covered Projects

For all covered buildings, capital project agencies will provide both the Baseline and Final LCA input and output information outlined in the EO 23 Reporting Template to MOEC during the annual reporting period. For all covered infrastructure projects, project teams should submit both the Baseline and Final LCA input and output information to their Agency Chief Decarbonization Officer or alternate point of contact for eventual submission to MOCEJ.

MOEC has incorporated the EO 23 Reporting Template into agencies' annual Green Building Law reporting form, and requests that agencies report baseline embodied GWP and final embodied GWP for covered projects and submit both the Baseline LCA and Final LCA Report to MOEC during the reporting period that begins in the fiscal year following the completion of 100% CD. Similarly, for infrastructure projects, MOCEJ requests that agencies report on and submit both the Baseline LCA and Final LCA Report to MOCEJ in the fiscal year following the completion of 100% CD.

The EO 23 Reporting Template includes several sections to be completed by the project team (including the managing agency team and consultants). The template is in a Microsoft Excel document format, to be submitted to the project's managing agency, and then MOEC or MOCEJ.

For buildings, during each year's Capital Green Building Program (CGBP) reporting period (Phase 2, May through July), MOEC will require managing agency CGBP liaisons (CGBP Liaisons) to compile the following LCA data, where applicable, for all projects that have completed construction in the closing fiscal year within their agency's CGBP Portfolio Reporting Form (Phase 2):

- Baseline building embodied carbon intensity (kg CO<sub>2</sub>e/m<sup>2</sup>)
- Proposed building embodied carbon intensity (kg CO<sub>2</sub>e/m<sup>2</sup>)

MOEC will also require CGBP Liaisons to submit the associated completed "EO 23 Life Cycle Assessment and Embodied Carbon Design Report" to MOEC as part of their overall annual CGBP reporting submission package, to be reviewed and verified by MOEC.

## EO 23 Reporting Instructions

The EO 23 Reporting Template includes detailed instructions on which information to include in reporting of a covered project. Please note this template is subject to future changes. For example, MOCEJ will release an update to this guidance in 2025 to reflect New York State's forthcoming release of NYS EO 22<sup>10</sup> LCA guidance for State Capital Agencies. Any and all future revisions will be communicated to agencies.

For any outstanding questions, please contact [capitalgreenbuilding@moec.nyc.gov](mailto:capitalgreenbuilding@moec.nyc.gov) and copy MOCEJ.

# Additional Resources

## Whole Project LCA Tools:

- [Tools for Measuring Embodied Carbon - Carbon Leadership Forum](#)
- [Biogenic Carbon Accounting in WBLCA Tools - WoodWorks](#)
- Sample LCA Report / template for LEED MR credit Building Life-Cycle Impact Reduction, Option 4
  - [From One Click LCA](#)
  - [From tallyLCA](#)
    - [Example tallyLCA Design Option Comparison Report](#)
    - [tallyLCA LEED WBLCA Credit Documentation Template](#)

## Agencies, Owners, Developers, and Design Teams:

- [AIA-CLF Embodied Carbon Toolkit for Architects, Part 1](#)
- [Resources and Specification Guidance - SE2050](#)
- [CLF Embodied Carbon Toolkit for Building Owners, Primer 2](#)
- Rocky Mountain Institute – [Reducing Embodied Carbon in the Built Environment](#)
- [Embodied Carbon Reduction Checklist - CLF](#)
- [Hines Embodied Carbon Reduction Guide](#)
- Building Transparency – [ownersCAN Embodied Carbon Action Plan, Specifications, and Basis of Design Contract Language](#)
- [Embodied Carbon in Real Estate and the Materials Movement - Urban Land Institute \(ULI\)](#)
- [A Primer on Embodied Carbon in Climate Disclosure - RMI](#)

## Design Teams (Architects, Engineers, & Consultants):

- [AIA-CLF Embodied Carbon Toolkit for Architects, Part 2](#)
- [AIA-CLF Embodied Carbon Toolkit for Architects, Part 3](#)

## Endnotes

<sup>1</sup> Carbon Leadership Forum.

<sup>2</sup> The embodied carbon of concrete, steel, and aluminum are responsible for approximately 23% of total global emissions. (Source: Architecture 2030, EIA)

<sup>3</sup> This approach is in line with the Integrative Design Process that NYC DDC uses and directs design consultants to use in many of their City-managed projects.

<sup>4</sup> In this guidance, whole project life cycle assessment and life cycle assessment are meant interchangeably.

<sup>5</sup> NYC DEP SOP 060.

<sup>6</sup> Envision provides project teams with information on the sustainability performance of infrastructure projects and outlines possibilities for improvement. Under the Envision framework, projects that have completed Envision verification receive sustainability awards depending on their sustainability performance (levels: Verified–Bronze–Silver–Gold–Platinum).

<sup>7</sup> Environmental Impact Indicators include global warming potential (greenhouse gases), in kg CO<sub>2</sub>e; depletion of the stratospheric ozone layer, in kg CFC-11e; acidification of land and water sources, in moles H<sup>+</sup> or kg SO<sub>2</sub>e; eutrophication, in kg nitrogen eq or kg phosphate eq; formation of tropospheric ozone, in kg NO<sub>x</sub>, kg O<sub>3</sub> eq, or kg ethene; and depletion of nonrenewable energy resources, in MJ using CML / depletion of fossil fuels in TRACI. ([LEED](#))

<sup>8</sup> EPDs are quantifies environmental information on the life cycle of a product to enable comparisons between products fulfilling the same function ([ISO](#)).

<sup>9</sup> Carbon Leadership Forum.

<sup>10</sup> [No. 22: Leading by Example: Directing State Agencies to Adopt a Sustainability and Decarbonization Program | Governor Kathy Hochul \(ny.gov\)](#)