
45 Mystic Ave
Somerville, MA 02145

Green Building Report
LEED V4 Core & Shell
October 2023

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Project Introduction

Sustainability informs every design decision. Enduring and efficient buildings conserve embodied energy and preserve natural resources. We are working to minimize our energy use as much as possible by evaluating every possible efficiency measure.

The urban location of the project takes advantage of existing infrastructure while convenient access to public transportation will reduce dependence on single occupant vehicle trips and minimize transportation impacts. Bicycle storage will be provided on-site along with many nearby transportation alternatives, including a nearby Blue Bikes station.

The Project is sited at 45 Mystic Avenue in the Assembly Square neighborhood of Somerville, Massachusetts. The lot is approximately 8,640 SF and is adjacent to numerous commercial and industrial-use buildings. The all-electric Core & Shell Lab Project is approximately 52,185 sf and consists of a ten-story building with over 2,000 sf of outdoor civic space.

Affidavit

I, Colleen Soden, do hereby affirm that I have thoroughly reviewed the supporting documents for LEED v4 BD+C: Core & Shell and confirm that the 45 Mystic Ave Project meets the requirement for Platinum certifiability, with 80 points and 18 possible points. The project is being designed to meet the base sustainability requirements, as well as the Net Zero Ready building requirements, under the Somerville Zoning Ordinance.



Colleen Soden, LEED AP
Principal and Director of Technical Assistance
Soden Sustainability Consulting

LEED Building Design and Construction Core & Shell Checklist

The LEED v4 for Building Design and Construction (BD&C) rating system tracks the sustainable features of a Project by achieving points in following categories: Integrative Process; Location & Transportation; Sustainable Sites; Water Efficiency; Energy and Atmosphere; Materials and Resources; Indoor Environmental Quality; and Innovation and Design Process.

The project is anticipated to achieve 80 credits and a LEED Platinum Certification level.

LEED v4 for BD+C (Core and Shell)									
Project Name: 45 Mystic Ave					Project Address: 45 Mystic Ave, Somerville, MA 02145				
Date: 1/17/2023					Projected Points: 80 PLATINUM				
Yes	Y?	N?	No	Total Project Score (Certification Estimate)					
80	15	4	13	Certified: 40 - 49 points, Silver: 50 - 59 points, Gold: 60 - 79 points, Platinum: 80+ points					
1 0 0 0 Integrative Process				1	Cost				
1				Integrative Process	1				
15 0 0 5 Location & Transportation				20	Cost				
0	0	0	0	LEED for Neighborhood Development Location	(16)				
2				Sensitive Land Protection	2				
3				High Priority Site	3				
4		2		Surrounding Density + Diverse Uses (LEED v4.1)	6				
4		2		Access to Quality Transit (LEED 4.1)	6				
1				Bicycle Facilities (LEED v4.1)	1				
1				Reduced Parking Footprint (LEED v4.1)	1				
		1		Green Vehicles	1				
6 3 0 2 Sustainable Sites				11	Cost				
Req				Construction Activity Pollution Prevention	Required				
1				Site Assessment	1				
	1		1	Site Development - Protect or Restore Habitat	2				
			1	Open Space (LEED 4.1)	1				
1	2			Rainwater Management (LEED 4.1)	3				
2				Heat Island Reduction	2				
1				Light Pollution Reduction	1				
1				Tenant Design and Construction Guidelines	1				
10 1 1 1 Water Efficiency				11	Cost				
Req				Outdoor Water Use Reduction	Required				
Req				Indoor Water Use Reduction	Required				
Req				Building-Level Water Metering	Required				
3				Outdoor Water Use Reduction	3				
4	1	1		Indoor Water Use Reduction	6				
2			1	Cooling Tower Water Use	3				
1				Water Metering	1				
27 6 0 0 Energy & Atmosphere				33	Cost				
Req				Fundamental Commissioning and Verification	Required				
Req				Minimum Energy Performance	Required				
Req				Building-Level Energy Metering	Required				
Req				Fundamental Refrigerant Management	Required				
4	2			Enhanced Commissioning	6				
16	2			Optimize Energy Performance	18				
1				Advanced Energy Metering	1				
1	1			Demand Response	2				
5				Renewable Energy Production (LEED v4.1)	5				
	1			Enhanced Refrigerant Management	1				
				Green Power and Carbon Offsets (LEED v4.1)	2				
4 4 2 4 Materials & Resources				14	Cost				
Req				Storage and Collection of Recyclables	Required				
Req				Construction and Demolition Waste Management Planning	Required				
	2		4	Building Life-Cycle Impact Reduction (LEED 4.1)	5				
1		1		BPDO - Environmental Product Declarations (LEED 4.1)	2				
1		1		BPDO - Sourcing of Raw Materials (LEED 4.1)	2				
1	1			BPDO - Material Ingredients (LEED 4.1)	2				
1	1			Construction and Demolition Waste Management (LEED v4.1)	2				
7 1 1 1 Indoor Environmental Quality				10	Cost				
Req				Minimum Indoor Air Quality Performance	Required				
Req				Environmental Tobacco Smoke Control (LEED v4.1)	Required				
2				Enhanced Indoor Air Quality Strategies	2				
3				Low-Emitting Materials (LEED 4.1)	3				
1				Construction Indoor Air Quality Management Plan	1				
	1	1	1	Daylight (LEED 4.1)	3				
1				Quality Views (LEED 4.1)	1				
6 0 0 0 Innovation				6	Cost				
1				Sustainable Purchasing - Low Mercury Lamps	1				
1				Verified Construction & Demolition Recycling Rates	1				
1				BPDO - EPDs (EP)	1				
1				Low Emitting (EP)	1				
1				Education	1				
1				LEED Accredited Professional	1				
4 0 0 0 Regional Priority				4	Cost				
1				Optimize Energy (8)	1				
1				High Priority Site (2)	1				
1				Indoor Water Use (4)	1				
1				Renewables (2)/Rainwater Management (2)/BLC (2)	1				

Massachusetts Stretch Energy Code Compliance

The project is expected to demonstrate compliance against the forthcoming 2023 10th Edition of the Massachusetts Stretch Energy Code. The model considers current design assumptions about occupancy, hours of operation, internal loads, envelope criteria, and mechanical system design. Tenant areas were modeled assuming a 60/40 distribution of office and lab areas with generic space layouts, consistent with the building design criteria

Minimum Program Requirements

MPR1 - Permanent Structure on existing land

Is the building a permanent structure?

Yes, the building will be a permanent structure.

MPR2 - Must use reasonable LEED boundaries

Are there any issues with the site that need to be resolved?

No.

MPR3 - Project size requirements

Projects must meet requirements of corresponding LEED rating system

LEED BD+C and LEED O+M Rating Systems the LEED project must include a minimum of 1,000 square feet (93 square meters) of gross floor area.

This building will have 52,185 of gross floor area.

Integrated Design Process

Integrated Design Process

As early as practical and preferably before schematic design, conduct a preliminary LEED meeting with a minimum of four key project team members and the owner or owner's representative. As part of the meeting, create a LEED® action plan that, at a minimum:

- Determines the LEED certification level to pursue (Certified, Silver, Gold, or Platinum);*
- Selects the LEED credits to meet the targeted certification level; and*
- Identifies the responsible parties to ensure the LEED requirements for each prerequisite and selected credit are met.*

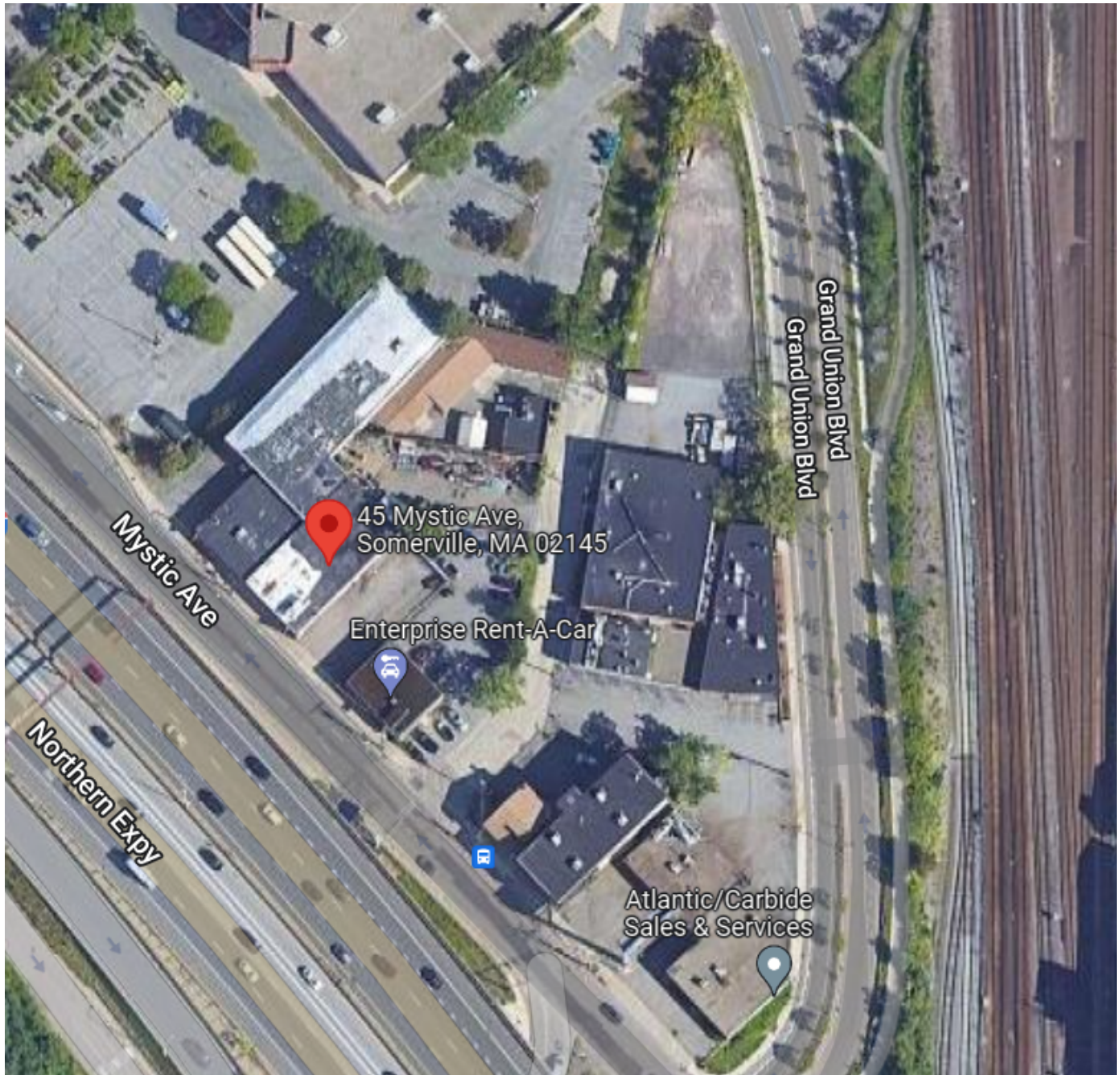
The design team is pursuing an integrated design process that includes continuous participation from the technical experts to enhance and improve the overall design. This comprehensive approach allows the development to incorporate sustainability best practices in design and operation, stormwater capture and reuse, transportation, and landscape strategies.

Location and Transportation

Sensitive Land Protection

OPTION 1. Locate the development footprint on land that has been previously developed.

The development footprint of this project is located on land that has been previously developed.
Please see google images of the preexisting site conditions:



High-Priority Site

OPTION 2. PRIORITY DESIGNATION (BD+C, CORE AND SHELL). Locate the project on one of the following: · a site listed by the EPA National Priorities List; · a Federal Empowerment Zone site; · a Federal Enterprise Community site; · a Federal Renewal Community site; · a Department of the Treasury Community Development Financial Institutions Fund Qualified Low-Income Community (a subset of the New Markets Tax Credit Program); · a site in a U.S. Department of Housing and Urban Development's Qualified Census Tract (QCT) or Difficult Development Area (DDA); or · a local equivalent program administered at the national level for projects outside the U.S.

Response: The Project is located in a HUD Difficult Development Area. Contamination is believed to be present on site. Remediation will be completed in accordance with LEED requirements, and to the satisfaction of the local authority.

Surrounding Density and Diverse Uses (Upgraded to version 4.1)

Option 3. Walkable Location






Locate on a site with a Walk Score® or equivalent third-party walkability assessment for the following thresholds, as listed below.

Table 1. Points for walkable location (1-5 points BD+C except Healthcare, 1 point Healthcare)


Table 1. Points for walkable location (1-5 points BD+C except Healthcare, 1 point Healthcare)


Walk Score®	Points	Points (Healthcare)
90 to 100	5	-
80 to 89	4	-
70 to 79	3	-
60 to 69	2	-
50 to 59	1	-

This project has received a Walk Score of 85, achieving 4 points for this credit. Please see below.


45 Mystic Avenue
Somerville, Massachusetts, 02145
Commute to **Downtown Somerville** 
 4 min  19 min  7 min  29 min [View Routes](#)

[Favorite](#) [Map](#) [Nearby Somerville Apartments on Redfin](#)


[Looking for a home for sale in Somerville?](#) 

**Walk Score**
85

Very Walkable
Most errands can be accomplished on foot.

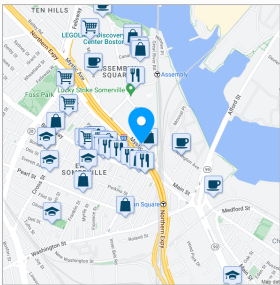
**Transit Score**
69

Good Transit
Many nearby public transportation options.

**Bike Score**
82

Very Bikeable
Biking is convenient for most trips.

[About your score](#)
[Add scores to your site](#)



Access to Quality Transit [Upgraded to v4.1]

This credit applies to: New Construction, Core and Shell, Schools

Locate any functional entry of the project within a ¼-mile (400-meter) walking distance of existing or planned bus, streetcar, or informal transit stops, or within a ½-mile (800-meter) walking distance of existing or planned bus rapid transit stops, passenger rail stations (i.e. light, heavy, or commuter rail) or commuter ferry terminals. The transit service at those stops and stations in aggregate must meet the minimums listed in Table 1. Planned stops and stations may count if they are sited, funded, and under construction by the date of the certificate of occupancy and are complete within 24 months of that date.

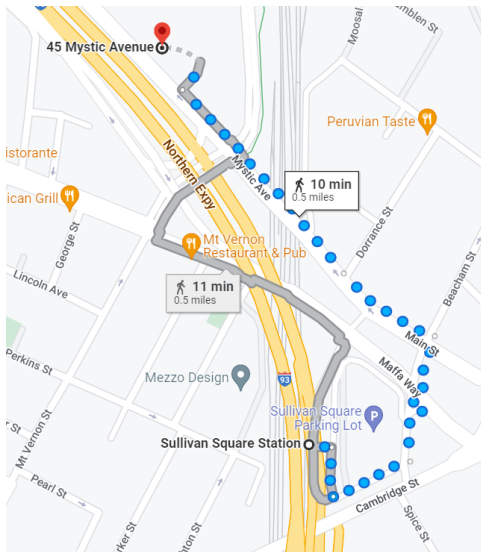
Both weekday and weekend trip minimums must be met.

- *For each qualifying transit route, only trips in one direction are counted towards the threshold.*
- *For weekend trips, only trips on the day with the higher number of trips are counted towards the threshold.*
- *If a qualifying transit route has multiple stops within the required walking distance, only trips from one stop are counted towards the threshold.*
- *Privately-run shuttles are only acceptable if the service is also made available to the public.*

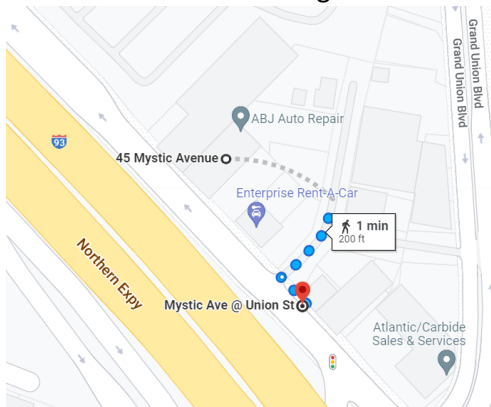
Weekday trips	Weekend trips	Points BD&C (except Core and Shell)	Points BD&C (Core and shell)
72	30	1	1
100	70	2	2
144	108	3	3
250	160	4	4
360	216	5	6

Response: The Project will achieve 4 points in the access to quality transit credit having access to the Orange Line rail service and 89, 90, 95, and 101 bus services. The transit services currently available within walking distance of the site provide 341 daily weekday trips and 236 daily weekend trips.

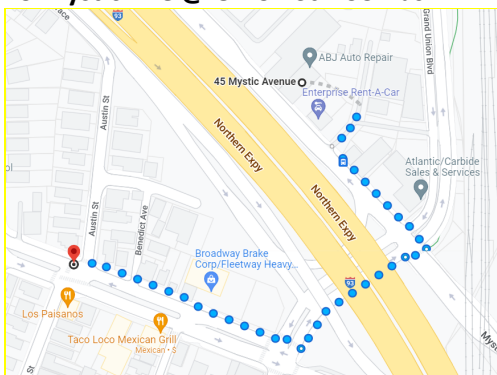
Transit Line	Route	Weekday Trips	Saturday Trips	Sunday Trips
Orange Line		165	145	105
89	Sullivan Square Station	71	36	27
90	Davis Station	21	15	8
95	Arlington Center	23	12	9
101	Sullivan Square Station	61	28	19
TOTAL		341	236	168



To Sullivan Station – Orange line



To Mystic Ave @ Union St – 95 Bus



To Broadway @ Austin St – 89, 90, 101 Bus

Bicycle Facilities (Upgraded to version 4.1)

NEW CONSTRUCTION, CORE AND SHELL

Bicycle Network

Design or locate the project such that a functional entry or bicycle storage is within a 200-yard (180-meter) walking distance or bicycling distance from a bicycle network that connects to at least one of the following:

- *at least 10 diverse uses;*
- *a school or employment center, if the project total floor area is 50% or more residential; or*
- *a bus rapid transit stop, light or heavy rail station, commuter rail station, or ferry terminal.*

All destinations must be within a 3-mile (4800-meter) bicycling distance of the project boundary. Planned bicycle trails or lanes may be counted if they are fully funded by the date of the certificate of occupancy and are scheduled for completion within one year of that date.

Case 1. Commercial or Institutional Projects

Provide short-term bicycle storage for at least 2.5% of all peak visitors, but no fewer than four storage spaces per building.

Provide long-term bicycle storage for at least 5% of all regular building occupants, but no fewer than four storage spaces per building in addition to the short-term bicycle storage spaces.

Provide at least one on-site shower with changing facility for the first 100 regular building occupants and one additional shower for every 150 regular building occupants thereafter.

Case 2. Residential Projects

Provide short-term bicycle storage for at least 2.5% of all peak visitors but no fewer than four storage spaces per building.

Provide long-term bicycle storage for at least 15% of all regular building occupants, but no less than one storage space per three residential units.

FOR ALL PROJECTS

Short-term bicycle storage must be within 200 feet (60meters) walking distance of any main entrance. Long-term bicycle storage must be within 300 feet (90 meters) walking distance of any functional entry. Vertical distances travelled by elevator are exempt from counting towards the walking distance requirements.

Response: The project meets and exceeds the LEED requirement of secured bicycle parking spaces for 2.5% of all peak visitors and 5% of all regular building occupants. The Project has been designed with 18 interior bike parking spaces and 12 exterior visitor spaces. The project also has a Blue Bikes station on Washington Street. A plan will be included in a later submission.

Reduced Parking (Upgraded to version 4.1)

REQUIREMENTS

Do not exceed the minimum local code requirements for parking capacity.

Provide parking capacity that is a 30% reduction below the base ratios recommended by the Parking Consultants Council, as shown in the Institute of Transportation Engineers' Transportation Planning Handbook, 4th edition, Table 11-12.

Response: The Project does not provide parking, and therefore achieves this credit.

Sustainable Sites

Prerequisite: Construction Activity Pollution Prevention

This prerequisite applies to:

New Construction, Core and Shell, Schools

Create and implement an erosion and sedimentation control plan for all construction activities associated with the project. The plan must conform to the erosion and sedimentation requirements of the 2012 U.S. Environmental Protection Agency (EPA) Construction General Permit (CGP) or local equivalent, whichever is more stringent. Projects must apply the CGP regardless of size. The plan must describe the measures implemented.

Response: The Project will follow an Erosion and Sedimentation Control plan conforming to the erosion and sedimentation requirements of the 2012 U.S. Environmental Protection Agency (EPA) Construction General Permit (CGP).

Site Assessment

This credit applies to:

New Construction, Core and Shell, Schools, Retail, Data Centers, Warehouses and Distribution Centers, Hospitality, Healthcare

REQUIREMENTS

Complete and document a site survey or assessment¹ that includes the following information:

- Topography. Contour mapping, unique topographic features, slope stability risks.*
- Hydrology. Flood hazard areas, delineated wetlands, lakes, streams, shorelines, rainwater collection and reuse opportunities, TR-55 initial water storage capacity of the site (or local equivalent for projects outside the U.S.).*
- Climate. Solar exposure, heat island effect potential, seasonal sun angles, prevailing winds, monthly precipitation and temperature ranges.*
- Vegetation. Primary vegetation types, greenfield area, significant tree mapping, threatened or endangered species, unique habitat, invasive plant species.*
- Soils. Natural Resources Conservation Service soils delineation, U.S. Department of Agriculture prime farmland, healthy soils, previous development, disturbed soils (local equivalent standards may be used for projects outside the U.S.).*
- Human use. Views, adjacent transportation infrastructure, adjacent properties, construction materials with existing recycle or reuse potential.*
- Human health effects. Proximity of vulnerable populations, adjacent physical activity opportunities, proximity to major sources of air pollution.*

The survey or assessment should demonstrate the relationships between the site features and topics listed above and how these features influenced the project design; give the reasons for not addressing any of those topics.

Response: The civil and landscape teams are in the process of conducting a comprehensive site survey to study topography, hydrology, climate, vegetation, soils, human use, and human health effects to achieve credit requirements. We are recording our findings and will report them in a later submission.

Site Development - Protect or Restore Habitat

This credit applies to:

New Construction, Core and Shell, Schools, Retail, Data Centers, Warehouses and Distribution Centers, Hospitality, Healthcare

REQUIREMENTS

Preserve and protect from all development and construction activity 40% of the greenfield area on the site (if such areas exist).

OPTION 2. FINANCIAL SUPPORT (1 POINT)

Provide financial support equivalent to at least \$0.40 per square foot (US\$4 per square meter) for the total site area (including the building footprint).

Financial support must be provided to a nationally or locally recognized land trust or conservation organization within the same EPA Level III ecoregion or the project's state (or within 100 miles of the project [160 kilometers] for projects outside the U.S.). For U.S. projects, the land trust must be accredited by the Land Trust Alliance.

Response: The design strives to restore landscape by maximizing opportunities for native and adapted vegetation while improving tree canopy. Green roofs are studied to further add green space to the site. The Proponents is considering a donation to a local, land trust.

Rainwater Management (Upgraded to version 4.1)

This credit applies to:

New Construction, Core and Shell, Schools, Retail, Data Centers, Warehouses and Distribution Centers, Hospitality, Healthcare

Treat run-off from pollutant-generating impervious surfaces (i.e. vehicle pavement, service courts, trash enclosures) using low-impact development (LID) practice.

Percentile of Rainfall Events (1-3 points except Healthcare, 1-2 points Healthcare)

Table 1. Points for percentile of rainfall retained

Percentile of Rainfall Retained	Points	Points Healthcare
80 th Percentile	1	1
85 th Percentile	2	2
90 th Percentile	3	-

In a manner best replicating natural site hydrology processes, retain (i.e. infiltrate, evapotranspire, or collect and reuse) on site the runoff from the developed site for, at minimum, the 80th percentile of regional or local rainfall events using low-impact development (LID) and green infrastructure (GI) practices. GI and LID strategies can be either structural or non-structural. Points are awarded according to Table 1.

For all projects, the use of coal tar sealants shall be prohibited in any application exposed to stormwater, wash waters, condensates, irrigation water, snowmelt, or icemelt.

Examples of acceptable techniques include the following:

- planting rain gardens with native or adapted plant material (e.g. trees shrubs);*
- installing a vegetated roof;*
- using permeable paving, consisting of porous above-ground materials (e.g., open pavers, engineered products), a base layer designed to drain water away from the building, and (often) a 6-inch-deep (150 millimeters) subbase; and*
- installing permanent infiltration or collection features (e.g., vegetated swale, rain garden, rainwater cistern) that can retain 100% of the runoff from at minimum, the 80th percentile of regional or local rainfall events.*

A combination of LID approaches are recommended (but not required) as they are holistic measures which maximize benefits. In contrast to LID, conventional stormwater techniques include grey infrastructure, such as detention or

retention ponds, pipes, and vaults. Conventional grey infrastructure devices may be accepted only if integrated within a holistic LID system (i.e. a combination of LID techniques).

TABLE 1. Example percentiles of rainfall events

Rainfall amount	Percentile of rainfall events
1.33 inches (34 millimeters)	99
1.29 (33)	98
1.22 (31)	97
1.15 (29)	96
1.1 (28)	95
1.05 (27)	94
1.01 (26)	93
0.96 (24)	92

Response: The Project is claiming 1 point for this credit as it is capturing and recharging an 80th percentile storm event. The project proposes to use infiltration and collection devices around the site to mitigate and treat the stormwater runoff.

Heat Island Reduction (Upgraded to version 4.1)

This credit applies to:

New Construction, Core and Shell, Schools, Retail, Data Centers, Warehouses and Distribution Centers, Hospitality, Healthcare

Intent

To minimize effects on microclimates and human and wildlife habitats by reducing heat islands.

Requirements

NC, CS, SCHOOLS, RETAIL, DATA CENTERS, WAREHOUSES & DISTRIBUTION CENTERS, HOSPITALITY, HEALTHCARE

Choose one of the following options:

Option 1. Nonroof and Roof (2 points except Healthcare, 1 point Healthcare) Meet the following criterion:

Area of Nonroof Measures	+	Area of High- Reflectance Roof	+	Area of Vegetated Roof	≥	Total Site Paving Area	+	Total Roof Area
-----		-----		-----				
0.5		0.75		0.75				

Alternatively, an SRI and SR weighted average approach may be used to calculate compliance.

Use any combination of the following strategies.

Nonroof Measures

- *Use the existing plant material or install plants that provide shade over paving areas (including playgrounds) on the site within 10 years of planting. Install vegetated planters. Plants must be in place at the time of occupancy permit and cannot include artificial turf.*
- *Provide shade with structures covered by energy generation systems, such as solar thermal collectors, photovoltaics, and wind turbines.*
- *Provide shade with architectural devices or structures. If the device or structure is a roof, it shall have an aged solar reflectance (SR) value of at least 0.28 as measured in accordance with ANSI/CRRC S100. If the device or structure is not a roof, or if aged solar reflectance information is not available, it shall have at installation an initial SR of at least 0.33 as measured in accordance with ANSI/CRRC S100.*
- *Provide shade with vegetated structures.*
- *Use paving materials with an initial solar reflectance (SR) value of at least 0.33.*
- *Use an open-grid pavement system (at least 50% unbound).*

High-Reflectance Roof

Use roofing materials that have an aged SRI equal to or greater than the values in Table 1. If aged SRI is not available, the roofing material shall have an initial SRI equal to or greater than the values in Table 1.

Table 1. Initial SRI Aged SRI

Low-sloped roof	≤ 2:12	82	64
Steep-sloped roof	> 2:12	39	32

Roof area that consists of functional, usable spaces (such as helipads, recreation courts, and similar amenity areas) may meet the requirements of nonroof measures. Applicable roof area excludes roof area covered by mechanical equipment, solar energy panels, skylights, and any other appurtenances.

Vegetated Roof

Install a vegetated roof using native or adapted plant species.

Response: Roofs are designed with a light colored TPO to reflect heat and mitigate urban heat island effects. The site design includes high SRI and permeable pavers, which complies with the credit's requirements. Trees and shading elements are optimized to further reduce heat island effects on hard scape areas. See the heat island

calculator below:

Option 1. Nonroof and Roof

Nonroof Measures

Table: Contributing nonroof measures

Complete the table below for all nonroof materials contributing to lowering the heat island effect on the project. If one or more strategies were not used, enter "0" for these rows.

	Material Description	SR ¹	Initial or 3-Yr Aged Value	Weighted Area (sq ft)	Area (sq ft)		
Architectural shading structure or device			▼			+	-
Paving material	Concrete	0.28	Initial ▼	556.61	656	+	-
Paving material	SRI 9	0.09	Initial ▼	1.09	4	+	-
Paving material	SRI 27	0.27	Initial ▼	66.27	81	+	-
Paving material	SRI 34	0.34	Initial ▼	83.45	81	+	-
Paving material	Asphalt	0.1	Initial ▼	3.64	12	+	-
Area shaded by plant canopy within 10 years of planting and/or vegetated planters (sq ft)					0		
Area shaded by structures with energy generation systems (sq ft)					0		
Area shaded by vegetated structures (sq ft)					0		
Area covered by open-grid pavement system (sq ft)					0		
Total standard area of qualifying nonroof measures (sq ft)					81		
Total weighted area of qualifying nonroof measures (sq ft)					711.06		

Notes:

¹ Materials must have a 3-year aged SR value of at least 0.28 or an initial SR value of at least 0.33 in order to count toward total standard area of qualifying nonroof measures. Materials with a lower SR will contribute to weighted area.

High-Reflectance Roof

Table: Contributing high-reflectance roof

Complete the table below for all high-reflectance roof materials used on the project, as applicable.

Roof Slope	Material Description	SRI ¹	Initial or 3-Yr Aged Value	Weighted Area (sq ft)	Area (sq ft)		
Low ▼	White roof	78	3-year aged ▼	8,143.69	6,682	+	-
Total standard area of qualifying high-reflectance roof (sq ft)					6,682		
Total weighted area of qualifying high-reflectance roof (sq ft)					8,143.69		

Notes:

¹ Low-sloped roof must have a 3-year aged SRI value of at least 64 or an initial SRI value of at least 82 in order to count toward total standard area of qualifying high-reflectance roof. Steep-sloped roof must have a 3-year aged SRI value of at least 32 or an initial SRI value of at least 39 in order to count. Materials with a lower SRI will contribute to weighted area.

Summary of Heat Island Reduction Measures

Table: Summary of nonroof and roof

	Total Weighted Area (sq ft)	Total Standard Area (sq ft)
Contributing nonroof measures	711.06	81
Contributing high-reflectance roof	8,143.69	6,682
Vegetated roof		0
Weighted sum of nonroof and roof measures (sq ft)	12,280.37	9,071.33
Total project paving area (sq ft)		834
Total project roof area (sq ft)		6,682
Sum of project paving and roof area (sq ft)		7,516

Light Pollution Reduction

This credit applies to:

Data Centers (1 point), Warehouses and Distribution Centers (1 point), Hospitality (1 point), Healthcare (1 point), New Construction (1 point), Core and Shell (1 point), Schools (1 point), Retail (1 point)

REQUIREMENTS

Meet uplight and light trespass requirements, using either the backlight-uplight-glare (BUG) method (Option 1) or the calculation method (Option 2). Projects may use different options for uplight and light trespass.

Meet these requirements for all exterior luminaires located inside the project boundary (except those listed under "Exemptions"), based on the following:

- the photometric characteristics of each luminaire when mounted in the same orientation and tilt as specified in the project design; and*
- the lighting zone of the project property (at the time construction begins). Classify the project under one lighting zone using the lighting zones definitions provided in the Illuminating Engineering Society and International Dark Sky Association (IES/IDA) Model Lighting Ordinance (MLO) User Guide.*

Additionally, meet the internally illuminated signage requirement.

Uplight

OPTION 1. BUG RATING METHOD

Do not exceed the following luminaire backlight and glare ratings (based on the specific light source installed in the luminaire), as defined in IES TM-15-11, Addendum A, based on the mounting location and distance from the lighting boundary.

The lighting boundary is located at the property lines of the property, or properties, that the LEED project occupies. The lighting boundary can be modified under the following conditions:

- When the property line abuts a public area that includes, but is not limited to, a walkway, bikeway, plaza, or parking lot, the lighting boundary may be moved to 5 feet (1.5 meters) beyond the property line.*
- When the property line abuts a public street, alley, or transit corridor, the lighting boundary may be moved to the center line of that street, alley, or corridor.*
- When there are additional properties owned by the same entity that are contiguous to the property, or properties, that the LEED project is within and have the same or higher MLO lighting zone designation as the LEED project, the lighting boundary may be expanded to include those properties.*

Orient all luminaires less than two mounting heights from the lighting boundary such that the backlight points toward the nearest lighting boundary line. Building-mounted luminaires with the backlight oriented toward the building are exempt from the backlight rating requirement.

Response: All exterior luminaires are carefully selected and designed to improve nighttime visibility, and to avoid light pollution.

Tenant Design and Construction Guidelines

REQUIREMENTS

Publish for tenants an illustrated document with the following content, as applicable:

- a description of the sustainable design and construction features incorporated in the core and shell project and the project's sustainability goals and objectives, including those for tenant spaces;*
- recommendations, including examples, for sustainable strategies, products, materials, and services; and*
- information that enables a tenant to coordinate space design and construction with the building systems when pursuing the following LEED v4 for Interior Design and Construction prerequisites and credits:*

WE Prerequisite: Indoor Water Use Reduction

WE Credit: Indoor Water Use Reduction

- EA Prerequisite: Minimum Energy Performance*
- EA Prerequisite: Fundamental Refrigerant Management*

- *EA Credit: Optimize Energy Performance*
- *EA Credit: Advanced Energy Metering*
- *EA Credit: Renewable Energy Production*
- *EA Credit: Enhanced Refrigerant Management*
- *MR Prerequisite: Storage and Collection of Recyclables*
- *EQ Prerequisite: Minimum Indoor Air Quality Performance*
- *EQ Prerequisite: Environmental Tobacco Smoke Control*
- *EQ Credit: Enhanced Indoor Air Quality Strategies*
- *EQ Credit: Low-Emitting Materials*
- *EQ Credit: Construction Indoor Air Quality Management Plan*
- *EQ Credit: Indoor Air Quality Assessment*
- *EQ Credit: Thermal Comfort*
- *EQ Credit: Interior Lighting*
- *EQ Credit: Daylight*
- *EQ Credit: Quality Views*
- *EQ Credit: Acoustic Performance*

Provide the guidelines to all tenants before signing the lease.

Response: The team will be developing Tenant Design and Construction guidelines to ensure a sustainable fit-out.

Water Efficiency

Prerequisite Outdoor Water Use Reduction

This prerequisite applies to:

Data Centers, Warehouses and Distribution Centers, Hospitality, Healthcare, New Construction, Core and Shell, Schools, Retail

REQUIREMENTS

Reduce outdoor water use through one of the following options. Non-vegetated surfaces, such as permeable or impermeable pavement, should be excluded from the landscape area calculations. Athletic fields and playgrounds (if vegetated) and food gardens may be included or excluded at the project team's discretion.

OPTION 2. REDUCED IRRIGATION

Reduce the project's landscape water requirement by at least 30% from the calculated baseline for the site's peak watering month. Reductions must be achieved through plant species selection and irrigation system efficiency, as calculated by the Environmental Protection Agency (EPA) WaterSense Water Budget Tool.

Response: The project will reduce potable water used for irrigation by 100%. The WaterSense Tool will be submitted once the system has been selected.

Prerequisite Indoor Water Use Reduction

This prerequisite applies to:

Data Centers, Warehouses and Distribution Centers, Hospitality, Healthcare, New Construction, Core and Shell, Schools, Retail

REQUIREMENTS

Building Water Use

For the fixtures and fittings listed in Table 1, as applicable to the project scope, reduce aggregate water consumption by 20% from the baseline. Base calculations on the volumes and flow rates shown in Table 1. All newly installed toilets, urinals, private lavatory faucets, and showerheads that are eligible for labeling must be WaterSense labeled (or a local equivalent for projects outside the U.S.).

TABLE 1. Baseline water consumption of fixtures and fittings

Fixture or fitting	Baseline (IP units)	Baseline (SI units)
Toilet (water closet)*	1.6 gpf	6 lpf
Urinal*	1.0 gpf	3.8 lpf
Public lavatory (restroom) faucet	0.5 gpm at 60 psi all others except private applications	1.9 lpm at 415 kPa, all others except private applications
Private lavatory faucets	2.2 gpm at 60 psi	8.3 lpm at 415 kPa
Kitchen faucet (excluding faucets used exclusively for filling operations)	2.2 gpm at 60 psi	8.3 lpm at 415 kPa
Showerhead*	2.5 gpm at 80 psi per shower stall	9.5 lpm at 550 kPa per shower stall

*WaterSense label available for this product type

gpf = gallons per flush

gpm = gallons per minute

psi = pounds per square inch

lpf = liters per flush

lpm = liters per minute

kPa = kilopascals

Appliance and Process Water Use

Install appliances, equipment, and processes within the project scope that meet the requirements listed in the tables below.

TABLE 2. Standards for appliances

Appliance	Requirement
Residential clothes washers	ENERGY STAR or performance equivalent
Commercial clothes washers	CEE Tier 3A
Residential dishwashers (standard and compact)	ENERGY STAR or performance equivalent
Prerinse spray valves	≤ 1.3 gpm (4.9 lpm)
Ice machine	ENERGY STAR or performance equivalent and use either air-cooled or closed-loop cooling, such as chilled or condenser water system

gpm = gallons per minute lpm = liters per minute

TABLE 3. Standards for processes

Process	Requirement
Heat rejection and cooling	No once-through cooling with potable water for any equipment or appliances that reject heat
Cooling towers and evaporative condensers	Equip with <ul style="list-style-type: none"> • makeup water meters • conductivity controllers and overflow alarms • efficient drift eliminators that reduce drift to maximum of 0.002% of recirculated water volume for counterflow towers and 0.005% of recirculated water flow for cross-flow towers

gpm = gallons per minute lpm = liters per minute

Response: The project employed strategies that in aggregate use a minimum of 20% less water than the water use baseline calculated for the building. The Project will incorporate water conservation strategies that include low flow plumbing fixtures for water closets and faucets.

Prerequisite Building-Level Water Metering

This prerequisite applies to:

Data Centers, Warehouses and Distribution Centers, Hospitality, Healthcare, New Construction, Core and Shell, Schools, Retail

REQUIREMENTS

Building Water Use

Install permanent water meters that measure the total potable water use for the building and associated grounds. Meter data must be compiled into monthly and annual summaries; meter readings can be manual or automated. Commit to sharing with USGBC the resulting whole-project water usage data for a five-year period beginning on the date the project accepts LEED certification or typical occupancy, whichever comes first.

Response: The owner will commit to sharing water use data for over 5 years or until the building changes ownership or lessee. The Project will install permanent water meters that measure the total potable water use for the building and associated grounds in addition to evaluating water meters for two or more of the following water sub-systems, as applicable to the project: irrigation, indoor plumbing fixtures and fittings, domestic hot water and the boiler for additional metering. Metering data will be compiled into monthly and annual summaries, and the resulting whole-project water usage data will be shared with USGBC.

Outdoor Water Use Reduction

REQUIREMENTS

Reduce outdoor water use through one of the following options. Nonvegetated surfaces, such as permeable or impermeable pavement, should be excluded from landscape area calculations. Athletic fields and playgrounds (if vegetated) and food gardens may be included or excluded at the project team's discretion.

OPTION 2. REDUCED IRRIGATION (2 POINTS EXCEPT HEALTHCARE, 1 POINT HEALTHCARE)

Reduce the project's landscape water requirement (LWR) by at least 50% from the calculated baseline for the site's peak watering month. Reductions must first be achieved through plant species selection and irrigation system efficiency as calculated in the Environmental Protection Agency (EPA) WaterSense Water Budget Tool.

Additional reductions beyond 30% may be achieved using any combination of efficiency, alternative water sources, and smart scheduling technologies.

Response: The project will reduce potable water used for irrigation by 100%. The WaterSense Tool will be submitted once the system has been selected.

Indoor Water Use Reduction

This credit applies to:

Data Centers (1–6 points), Warehouses and Distribution Centers (1–6 points), Hospitality (1–6 points), Healthcare (1–7 points), New Construction (1–6 points), Core and Shell (1–6 points), Schools (1–7 points), Retail (1–7 points)

REQUIREMENTS

Further reduce fixture and fitting water use from the calculated baseline in WE Prerequisite Indoor Water Use Reduction. Additional potable water savings can be earned above the prerequisite level using alternative water sources. Include fixtures and fittings necessary to meet the needs of the occupants. Some of these fittings and fixtures may be outside the project boundary. Points are awarded according to Table 1.

TABLE 1. Points for reducing water use

Percentage reduction	Points (BD+C)	Points (Schools, Retail, Hospitality, Healthcare)
25%	1	1
30%	2	2
35%	3	3
40%	4	4
45%	5	5
50%	6	—

Response: The Project will incorporate water conservation strategies that include low-flow plumbing fixtures for water closets and faucets. The project is expected to achieve a 40% water use reduction.

Cooling Tower Water Use

REQUIREMENTS

For cooling towers and evaporative condensers, conduct a one-time potable water analysis, measuring at least the five control parameters listed in Table 1.

TABLE 1. Maximum concentrations for parameters in condenser water

Parameter	Maximum level
Ca (as CaCO ₃)	1000 ppm
Total alkalinity	1000 ppm
SiO ₂	100 ppm
Cl ⁻	250 ppm
Conductivity	2000 μ S/cm

ppm = parts per million

μ S/cm = micro siemens per centimeter

Calculate the number of cooling tower cycles by dividing the maximum allowed concentration level of each parameter by the actual concentration level of each parameter found in the potable makeup water. Limit cooling tower cycles to avoid exceeding maximum values for any of these parameters.

TABLE 2. Points for cooling tower cycles

Cooling tower cycles	Points
Maximum number of cycles achieved without exceeding any filtration levels or affecting operation of condenser water system (up to maximum of 10 cycles)	1
Achieve a minimum 10 cycles by increasing the level of treatment in condenser or make-up water OR Meet the minimum number of cycles to earn 1 point and use a minimum 20% recycled nonpotable water	2

Response: The project will conduct a potable water analysis within 5 years of submission for certification

Water Metering

This credit applies to:

Data Centers (1–6 points), Warehouses and Distribution Centers (1–6 points), Hospitality (1–6 points), Healthcare (1–7 points), New Construction (1–6 points), Core and Shell (1–6 points), Schools (1–7 points), Retail (1–7 points)

REQUIREMENTS

Install permanent water meters for two or more of the following water subsystems, as applicable to the project:

• *Irrigation. Meter water systems serving at least 80% of the irrigated landscaped area. Calculate the percentage of irrigated landscape area served as the total metered irrigated landscape area divided by the total irrigated landscape area. Landscape areas fully covered with xeriscaping or native vegetation that requires no routine irrigation may be excluded from the calculation.*

• *Indoor plumbing fixtures and fittings. Meter water systems serving at least 80% of the indoor fixtures and fitting described in WE Prerequisite Indoor Water Use Reduction, either directly or by deducting all other measured water use from the measured total water consumption of the building and grounds.*

• *Domestic hot water. Meter water use of at least 80% of the installed domestic hot water heating capacity (including both tanks and on-demand heaters).*

• *Boiler with aggregate projected annual water use of 100,000 gallons (378 500 liters) or more, or boiler of more than 500,000 BtuH (150 kW). A single makeup meter may record flows for multiple boilers.*

• *Reclaimed water. Meter reclaimed water, regardless of rate. A reclaimed water system with a makeup water connection must also be metered so that the true reclaimed water component can be determined.*

.. Other process water. Meter at least 80% of expected daily water consumption for process end uses, such as humidification systems, dishwashers, clothes washers, pools, and other subsystems using process water.

Response: The Project will install permanent water meters that measure the total potable water use for the building and associated grounds in addition to evaluating water meters for two or more of the following water sub-systems, as applicable to the project: irrigation, indoor plumbing fixtures and fittings, domestic hot water and the boiler for additional metering. Metering data will be compiled into monthly and annual summaries, and the resulting whole-project water usage data will be shared with USGBC.

Prerequisite Fundamental Commissioning and Verification

This prerequisite applies to:

New Construction, Core and Shell, Schools, Retail, Data Centers, Warehouses and Distribution Centers, Hospitality, Healthcare

REQUIREMENTS

Commissioning Process Scope

Complete the following commissioning (Cx) process activities for mechanical, electrical, plumbing, and renewable energy systems and assemblies, in accordance with ASHRAE Guideline 0-2005 and ASHRAE Guideline 1.1-2007 for HVAC&R Systems, as they relate to energy, water, indoor environmental quality, and durability.

Requirements for exterior enclosures are limited to inclusion in the owner's project requirements (OPR) and basis of design (BOD), as well as the review of the OPR, BOD and project design. NIBS Guideline 3-2012 for Exterior Enclosures provides additional guidance.

- *Develop the OPR.*
- *Develop a BOD.*
- *The commissioning authority (CxA) must do the following:*
- *Review the OPR, BOD, and project design.*
- *Develop and implement a Cx plan.*
- *Confirm incorporation of Cx requirements into the construction documents.*
- *Develop construction checklists.*
- *Develop a system test procedure.*
- *Verify system test execution.*
- *Maintain an issues and benefits log throughout the Cx process.*
- *Prepare a final Cx process report.*
- *Document all findings and recommendations and report directly to the owner throughout the process.*

The review of the exterior enclosure design may be performed by a qualified member of the design or construction team (or an employee of that firm) who is not directly responsible for design of the building envelope.

SYSTEMS TO BE COMMISSIONED

The rating system refers to commissioning of HVAC&R systems "as they relate to energy, water, indoor environmental quality, and durability." That is, energy- and water-consuming equipment must operate efficiently and according to the design intent and owner's operational needs.

Efficient operations can be defined as the controlling of equipment such that it uses the minimum amount of energy or water to maintain setpoints and comfort levels. Control is generally accomplished via a building automation system and per the sequences of operation, with setpoints that are correct for the design and equipment schedules.

For indoor environmental quality, the equipment must meet the OPR, BOD, and environmental codes and standards. For durability, the equipment must not cause unnecessary wear and tear on the system.

Systems that must be commissioned for this prerequisite include the following:

- *Mechanical, including HVAC&R equipment and controls*
- *Plumbing, including domestic hot water systems, pumps, and controls*
- *Electrical, including service, distribution, lighting, and controls, including daylighting controls*
- *Renewable energy systems*

The envelope must be covered in the OPR and BOD, but full envelope commissioning is not required unless the project team pursues EA Credit Enhanced Commissioning, Option 2.

TABLE 1. Who can be the CxA?

Can ...	who is ...	be CxA for ...	
		fundamental Cx?	enhanced Cx?
an employee of the architecture or engineering firm	a member of the design team (e.g., a project architect, engineer, or energy modeler who is also the HVAC designer)	No, unless project is under 20,000 ft ² (1 860 m ²)	No
	not a member of the design team (e.g., a LEED administrator or energy modeler who is not participating in the design)	Yes	No
a subconsultant to the architecture or engineering firm	a member of the design team (e.g., a project engineer subcontracted to the architect)	No, unless project is under 20,000 ft ² (1 860 m ²)	No
	not a member of the design team (e.g., a LEED administrator, Cx specialist, energy modeler)	Yes	Yes
an employee or subcontractor of the general contractor or construction manager	a member of the construction team	No, unless project is under 20,000 ft ² (1 860 m ²)	No
	not a member of the construction team	Yes	No
an employee of the owner or an independent consultant contracted to the owner		Yes	Yes

Response: This project will achieve both the Fundamental Commissioning prerequisite and the Enhanced Commissioning credit. The commissioning process will begin before the Design Development phase and it will be completed for the following energy-related systems, at a minimum:

- Heating, ventilating, air conditioning and refrigeration (HVAC&R) systems (mechanical and passive) and associated controls.
- Lighting and daylighting controls.
- Domestic hot water systems.
- Renewable energy systems (wind, solar, etc.).

Prerequisite Minimum Energy Performance

This prerequisite applies to:

New Construction, Core and Shell, Schools, Retail, Data Centers, Warehouses and Distribution Centers, Hospitality, Healthcare

REQUIREMENTS

NEW CONSTRUCTION, CORE AND SHELL, SCHOOLS, RETAIL, HEALTHCARE, WAREHOUSES AND DISTRIBUTION CENTERS, HOSPITALITY

OPTION 1. WHOLE-BUILDING ENERGY SIMULATION

Demonstrate an improvement of 5% for new construction, 3% for major renovations, or 2% for core and shell projects in the proposed building performance rating compared with the baseline building performance rating. Calculate the baseline building performance according to ANSI/ASHRAE/IESNA Standard 90.1–2010, Appendix G, with errata (or a USGBC-approved equivalent standard for projects outside the U.S.), using a simulation model. Projects must meet the minimum percentage savings before taking credit for renewable energy systems. The proposed design must meet the following criteria:

- *compliance with the mandatory provisions of ANSI/ASHRAE/IESNA Standard 90.1–2010, with errata (or a USGBC-approved equivalent standard for projects outside the U.S.);*
- *inclusion of all energy consumption and costs within and associated with the building project; and*
- *comparison against a baseline building that complies with Standard 90.1–2010, Appendix G, with errata (or a USGBC-approved equivalent standard for projects outside the U.S.).*

Document the energy modeling input assumptions for unregulated loads. Unregulated loads should be modeled accurately to reflect the actual expected energy consumption of the building. If unregulated loads are not identical for both the baseline and the proposed building performance rating, and the simulation program cannot accurately model the savings, follow the exceptional calculation method (ANSI/ASHRAE/IESNA Standard 90.1–2010, G2.5). Alternatively, use the COMNET Modeling Guidelines and Procedures to document measures that reduce unregulated loads.

Response: An energy model was performed to evaluate the project's compliance with the Massachusetts Stretch Energy Code requirements, and the LEED v4 minimum and optimize energy performance criteria. See summary results below. Please see the entire energy model in the Appendix at the end of the submission.

Results

Table 3: Energy Model Results Summary

0	Proposed	Baseline	% Savings
Electricity Usage (Kwh)	1,953,883	1,831,980	
Gas Usage (Therms)	0	101,421	
EUI (kBtu/sf-yr)	133.8	328.9	
Annual Energy Cost	\$372,410	\$511,651	27%
Source Energy Usage (Million Btu/yr)	18,667	28,151	34%
GHG Emissions (kg CO2e/yr)	437,665	949,004	54%
Savings % for LEED (EApc95)	45%*		
LEED Points Estimate	17		

**Per EApc95, the average of the highest two savings metrics between energy cost, source energy, and greenhouse gas emissions is used to determine LEED energy points. LEED v4 typically requires that 90.1-2010 be used as the baseline comparison. However, per LEED Interpretation #10481, LEED CS projects that use 90.1-2013 rather than 90.1-2010 may add an additional 1% savings to the performance improvement vs. 90.1-2013 to establish equivalent savings vs. 90.1-2010. The savings presented above includes this additional 1%.*

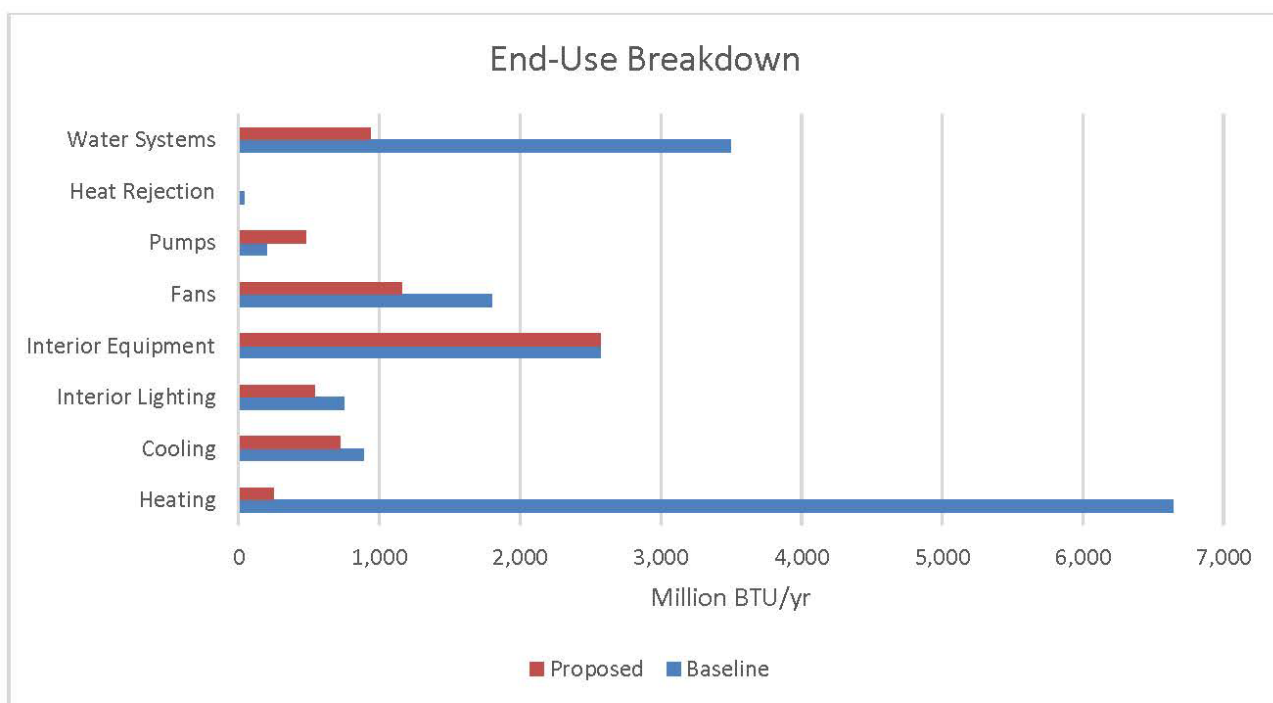


Figure 1: End-Use Breakdown - Proposed Design vs. 90.1-2013 Baseline

Prerequisite Building-Level Energy Metering

This prerequisite applies to:

New Construction, Core and Shell, Schools, Retail, Data Centers, Warehouses and Distribution Centers, Hospitality, Healthcare

REQUIREMENTS

NEW CONSTRUCTION, SCHOOLS, RETAIL, DATA CENTERS, WAREHOUSES AND DISTRIBUTION CENTERS, HOSPITALITY, HEALTHCARE

Install new or use existing building-level energy meters, or submeters that can be aggregated to provide building level data representing total building energy consumption (electricity, natural gas, chilled water, steam, fuel oil, propane, biomass, etc). Utility-owned meters capable of aggregating building-level resource use are acceptable. Commit to sharing with USGBC the resulting energy consumption data and electrical demand data (if metered) for a five-year period beginning on the date the project accepts LEED certification. At a minimum, energy consumption must be tracked at one-month intervals. This commitment must carry forward for five years or until the building changes ownership or lessee.

Commit to sharing with USGBC the resulting energy consumption data and electrical demand data (if metered) for a five-year period beginning on the date the project accepts LEED certification or typical occupancy, whichever comes first. At a minimum, energy consumption must be tracked at one-month intervals. This commitment must carry forward for five years or until the building changes ownership or lessee.

Response: The project intends to be proactive in energy use management and identifying opportunities for additional energy savings through installation of energy meters and smart building controls. The project will provide electricity meters to monitor all whole- building energy sources used by the building as well as sub-metering all end uses that comprise 10 percent or more of total building energy use.

Prerequisite Fundamental Refrigerant Management

This prerequisite applies to:

New Construction, Core and Shell, Schools, Retail, Data Centers, Warehouses and Distribution Centers, Hospitality, Healthcare

REQUIREMENTS

Do not use chlorofluorocarbon (CFC)-based refrigerants in new heating, ventilating, air-conditioning, and refrigeration (HVAC&R) systems. When reusing existing HVAC&R equipment, complete a comprehensive CFC phase-out conversion before project completion. Phase-out plans extending beyond the project completion date will be considered on their merits. Existing small HVAC&R units (defined as containing less than 0.5 pound [225 grams] of refrigerant) and other equipment, such as standard refrigerators, small water coolers, and any other equipment that contains less than 0.5 pound (225 grams) of refrigerant, are exempt.

Response: The Project will not use chlorofluorocarbon (CFC)-based refrigerants in new heating, ventilating, air-conditioning, and refrigeration (HVAC&R) systems. The Project will target the use of refrigerants used in heating, ventilating, air-conditioning, and refrigeration (HVAC&R) equipment that minimize or eliminate the emission of compounds that contribute to ozone depletion and climate change.

Enhanced Commissioning

This credit applies to:

New Construction, Core and Shell, Schools, Retail, Data Centers, Warehouses and Distribution Centers, Hospitality, Healthcare

REQUIREMENTS

Implement, or have in place a contract to implement, the following commissioning process activities in addition to those required under EA Prerequisite Fundamental Commissioning and Verification.

Commissioning Authority

- . The CxA must have documented commissioning process experience on at least two building projects with a similar scope of work. The experience must extend from early design phase through at least 10 months of occupancy;*
- . The CxA may be a qualified employee of the owner, an independent consultant, or a disinterested subcontractor of the design team.*

OPTION 1. ENHANCED SYSTEMS COMMISSIONING (3-4 POINTS)

Path 1: Enhanced Commissioning (3 points)

Complete the following commissioning process (CxP) activities for mechanical, electrical, plumbing, and renewable energy systems and assemblies in accordance with ASHRAE Guideline 0–2005 and ASHRAE Guideline 1.1–2007 for HVAC&R systems, as they relate to energy, water, indoor environmental quality, and durability.

The commissioning authority must do the following:

- . Review contractor submittals.*
- . Verify inclusion of systems manual requirements in construction documents.*
- . Verify inclusion of operator and occupant training requirements in construction documents.*
- . Verify systems manual updates and delivery.*
- . Verify operator and occupant training delivery and effectiveness.*
- . Verify seasonal testing.*
- . Review building operations 10 months after substantial completion.*
- . Develop an on-going commissioning plan.*

Include all enhanced commissioning tasks in the OPR and BOD.

OR

Path 2: Enhanced and Monitoring-Based Commissioning (4 points)

Achieve Path 1.

AND

Develop monitoring-based procedures and identify points to be measured and evaluated to assess performance of energy- and water-consuming systems.

Include the procedures and measurement points in the commissioning plan. Address the following:

- . roles and responsibilities;*
- . measurement requirements (meters, points, metering systems, data access);*
- . the points to be tracked, with frequency and duration for trend monitoring;*
- . the limits of acceptable values for tracked points and metered values (where appropriate, predictive algorithms may be used to compare ideal values with actual values);*
- . the elements used to evaluate performance, including conflict between systems, out-of-sequence operation of systems components, and energy and water usage profiles;*
- . an action plan for identifying and correcting operational errors and deficiencies;*
- . training to prevent errors;*
- . planning for repairs needed to maintain performance; and*
- . the frequency of analyses in the first year of occupancy (at least quarterly).*

Update the systems manual with any modifications or new settings, and give the reason for any modifications from the original design.

Response: This project will achieve 4 out of 6 of the Enhanced Commissioning credits. The proponent will pursue monitoring based commissioning and is considering envelope commissioning.

Optimize Energy Performance

This credit applies to:

New Construction, Core and Shell, Schools, Retail, Data Centers, Warehouses and Distribution Centers, Hospitality, Healthcare

REQUIREMENTS

NEW CONSTRUCTION, CORE AND SHELL, SCHOOLS, RETAIL, WAREHOUSES AND DISTRIBUTION CENTERS, HOSPITALITY, HEALTHCARE

Establish an energy performance target no later than the schematic design phase. The target must be established as kBtu per square foot-year (kW per square meter-year) of source energy use.

Choose one of the options below.

OPTION 1. WHOLE-BUILDING ENERGY SIMULATION (1–18 POINTS EXCEPT SCHOOLS AND HEALTHCARE, 1–16 POINTS SCHOOLS, 1–20 POINTS HEALTHCARE)

Analyze efficiency measures during the design process and account for the results in design decision-making. Use energy simulation of efficiency opportunities, past energy simulation analyses for similar buildings, or published data (e.g., Advanced Energy Design Guides) from analyses for similar buildings. Analyze efficiency measures, focusing on load reduction and HVAC-related strategies (passive measures are acceptable) appropriate for the facility. Project potential energy savings and holistic project cost implications related to all affected systems.

Project teams pursuing the Integrative Process credit must complete the basic energy analysis for that credit before conducting the energy simulation. Follow the criteria in EA Prerequisite Minimum Energy Performance to demonstrate a percentage improvement in the proposed building performance rating compared with the baseline. Points are awarded according to Table 1.

TABLE 1. Points for percentage improvement in energy performance

New Construction	Major Renovation	Core and Shell	Points (except Schools, Healthcare)	Points (Healthcare)	Points (Schools)
6%	4%	3%	1	3	1
8%	6%	5%	2	4	2
10%	8%	7%	3	5	3
12%	10%	9%	4	6	4
14%	12%	11%	5	7	5
16%	14%	13%	6	8	6
18%	16%	15%	7	9	7
20%	18%	17%	8	10	8
22%	20%	19%	9	11	9
24%	22%	21%	10	12	10
26%	24%	23%	11	13	11
29%	27%	26%	12	14	12
18%	16%	15%	7	9	7
20%	18%	17%	8	10	8
22%	20%	19%	9	11	9
24%	22%	21%	10	12	10
26%	24%	23%	11	13	11
29%	27%	26%	12	14	12
32%	30%	29%	13	15	13
35%	33%	32%	14	16	14
38%	36%	35%	15	17	15
42%	40%	39%	16	18	16
46%	44%	43%	17	19	-
50%	48%	47%	18	20	-

Response: The Project is set to achieve 45% energy savings, equating to 17 points for the Optimize Energy Credit. For more details, see the section for the Minimum Energy Performance Credit above or the Energy Model in the Appendix.

Renewable Energy (Upgraded to version 4.1)

This credit applies to:

New Construction, Core and Shell, Schools, Retail, Data Centers, Warehouses and Distribution Centers, Hospitality, Healthcare

Requirements

NC, CS, SCHOOLS, RETAIL, DATA CENTERS, WAREHOUSES & DISTRIBUTION CENTERS, HOSPITALITY, HEALTHCARE

Use on-site renewable energy systems, procure renewable energy from offsite sources, or offset the greenhouse gas emissions from all or a portion of the building's annual energy use.

Choose one or more strategies for renewable energy procurement from the categories below. Points achieved in each category may be added for a total of 5 points.

- *Tier 1: On-site renewable energy generation*
- *Tier 2: Off-site renewable energy produced by a generation asset(s) built within the last 5 years, or contracted to be operational within one year of building occupancy, and generated by either:*
 - ☐ *an asset(s) in the project's grid subregion*
 - or
 - ☐ *an asset(s) in a grid subregion with higher greenhouse gas emissions rates***
- *Tier 3: Off-site renewable energy that is produced by a generation asset(s) built within the last 5 years or contracted to be operational within one year of building occupancy*
- *Tier 4: Off-site renewable energy that is Green-e Energy certified or equivalent*
- *Tier 5: Off-site renewable energy that is produced by a generation asset(s) that meet Green-e's certification criteria (or equivalent) for eligible renewables, has a mechanism to prevent double counting in place, and is third-party certified to an ecolabel standard.*

***Grid subregions with average emissions rates that are higher than the national average emissions rate OR subregions with average marginal emissions rates that are higher than the national average marginal emissions rate. For all tiers, renewable energy must be contracted, owned or leased for a period of time between 1 and 15 years. Contract lengths less than 15 years are pro-rated linearly based on 1 and 15 year values in Table 1. Shorter contract lengths may require procurement of renewable energy in quantities that exceed the annual energy use of the building. For all tiers, the attributes (age, grid subregion, etc.) of the generation asset(s) are assessed at the beginning of the contract, and the generation asset(s) retain these attributes for the duration of the initial contract or lease term. All eligible renewable electricity generation used to comply with this credit shall be substantiated through Energy Attribute Certificates (EACs); the project owner must contract for renewable energy and demonstrate that the EACs are retained on behalf of the LEED project.*

EACs must be purchased from renewable energy projects located in the same country or region where the LEED project is located.

Tier 1, Tier 2, and Tier 3 renewable energy may contribute to GHG reductions in EA credit Optimize Energy Performance. When claiming credit in EA credit Optimize Energy Performance, projects are required to calculate GHG emissions and avoided emissions using hourly electricity GHG emissions factors for the project's grid subregion. Points are awarded according to Table 1, based on the percentage of total site energy use.

Table 1. Points for Renewable Energy Procurement

Points	Tier 1	Tier 2		Tier 3		Tier 4		Tier 5	
		15-Year	1-Year	15-Year	1-Year	15-Year	1-Year	15-Year	1-Year
1	2%	20%	150%	30%	225%	40%	300%	50%	375%
2	5%	30%	225%	40%	300%	60%	450%	75%	562.5%
3	10%	40%	300%	50%	375%	80%	600%		
4	20%	50%	375%	60%	450%				
5	40%	60%	450%	70%	525%				
EP	60%	70%	525%	80%	600%	100%	750%	100%	750%

AND/OR

Carbon Offsets

Procure carbon offsets to offset annual building greenhouse gas emissions from energy use.

Carbon offsets must be contracted for at least 15 years. Points are awarded according to Table 2, based on the percentage of total annual energy emissions offset by the purchase of carbon offsets.

Table 2. Points for Carbon Offsets Procurement

Points	Green-e Climate certified or equivalent Carbon Offsets
1	100%
2	200%

Response: The team will purchase enough RECs to achieve 5 LEED credits. The Proponent is evaluating engaging in a contract to purchase the equivalent of 450 percent of the Project's annual energy use as renewable energy certificates (RECs).

Enhanced Refrigerant Management

This credit applies to:

New Construction, Core and Shell, Schools, Retail, Data Centers, Warehouses and Distribution Centers, Hospitality, Healthcare

REQUIREMENTS

OPTION 2. CALCULATION OF REFRIGERANT IMPACT (1 POINT)

Select refrigerants that are used in heating, ventilating, air-conditioning, and refrigeration (HVAC&R) equipment to minimize or eliminate the emission of compounds that contribute to ozone depletion and climate change. The combination of all new and existing base building and tenant HVAC&R equipment that serve the project must comply with the following formula:

IP Units	SI Units
$LCGWP + LCODP \times 10^5 \leq 100$	$LCGWP + LCODP \times 10^5 \leq 13$
Calculation definitions for $LCGWP + LCODP \times 10^5 \leq 100$ (IP units)	Calculation definitions for $LCGWP + \text{kg CFC 11}/(\text{kW}/\text{year}) \times 10^5 \leq 13$ (SI units)
$LCODP = [\text{ODPr} \times (\text{Lr} \times \text{Life} + \text{Mr}) \times \text{Rc}] / \text{Life}$	$\text{kg CFC 11}/(\text{kW}/\text{year}) = [\text{ODPr} \times (\text{Lr} \times \text{Life} + \text{Mr}) \times \text{Rc}] / \text{Life}$
$LCGWP = [\text{GWPr} \times (\text{Lr} \times \text{Life} + \text{Mr}) \times \text{Rc}] / \text{Life}$	$LCGWP = [\text{GWPr} \times (\text{Lr} \times \text{Life} + \text{Mr}) \times \text{Rc}] / \text{Life}$
LCODP: Lifecycle Ozone Depletion Potential (lb CFC 11/Ton-Year)	kg CFC 11/(kW/year): Lifecycle Ozone Depletion Potential (lb CFC 11/Ton-Year)
LCGWP: Lifecycle Direct Global Warming Potential (lb CO ₂ /Ton-Year)	LCGWP: Lifecycle Direct Global Warming Potential (kg CO ₂ /kW-year)
GWPr: Global Warming Potential of Refrigerant (0 to 12,000 lb CO ₂ /lbr)	GWPr: Global Warming Potential of Refrigerant (0 to 12,000 kg CO ₂ /kg r)
ODPr: Ozone Depletion Potential of Refrigerant (0 to 0.2 lb CFC 11/lbr)	ODPr: Ozone Depletion Potential of Refrigerant (0 to 0.2 kg CFC 11/kg r)
Lr: Refrigerant Leakage Rate (2.0%)	Lr: Refrigerant Leakage Rate (2.0%)
Mr: End-of-life Refrigerant Loss (10%)	Mr: End-of-life Refrigerant Loss (10%)
Rc: Refrigerant Charge (0.5 to 5.0 lbs of refrigerant per ton of gross AHRI rated cooling capacity)	Rc: Refrigerant Charge (0.065 to 0.65 kg of refrigerant per kW of AHRI rated or Eurovent Certified cooling capacity)
Life: Equipment Life (10 years; default based on equipment type, unless otherwise demonstrated)	Life: Equipment Life (10 years; default based on equipment type, unless otherwise demonstrated)

Response: The project is tentatively going to achieve this credit and will provide calculations in a later submission.

Demand Response [v4.1 Upgrade]

REQUIREMENTS

Design building and equipment for participation in demand response programs through load shedding or shifting. On-site electricity generation does not meet the intent of this credit.

Case 1. Demand Response Program Available (2 points)

.. *Participate in an existing demand response (DR) program and complete the following activities. Design a system with the capability for real-time, fully-automated DR based on external initiation by a DR Program Provider. Semi-automated DR may be utilized in practice*

.. *Enroll in a minimum one-year DR participation amount contractual commitment with a qualified DR program provider, with the intention of multiyear renewal, for at least 10% of the estimated peak electricity demand. Peak demand is determined under EA Prerequisite Minimum Energy Performance.*

.. *Develop a comprehensive plan for meeting the contractual commitment during a Demand Response event.*

.. *Include the DR processes in the scope of work for the commissioning authority, including participation in at least one full test of the DR plan.*

Case 2. Demand Response Program Not Available (1 point)

Provide infrastructure to take advantage of future demand response programs or dynamic, real-time pricing programs and complete the following activities.

.. *Install interval recording meters with communications and ability for the building automation system to accept an external price or control signal.*

- Develop a comprehensive plan for shedding at least 10% of building estimated peak electricity demand. Peak demand is determined under EA Prerequisite Minimum Energy Performance.
- Include the DR processes in the scope of work for the commissioning authority, including participation in at least one full test of the DR plan.
- Contact local utility representatives to discuss participation in future DR programs.

Response: The Project will achieve 1 point for this credit as it will be Demand Response-Ready.

Advanced Energy Metering

REQUIREMENTS

This credit applies to:

New Construction, Schools, Retail, Data Centers, Warehouses and Distribution Centers, Hospitality, Healthcare

Install advanced energy metering for the following:

- *all whole-building energy sources used by the building; and*
- *any individual energy end uses that represent 10% or more of the total annual consumption of the building.*

The advanced energy metering must have the following characteristics.

- *Meters must be permanently installed, record at intervals of one hour or less, and transmit data to a remote location.*
- *Electricity meters must record both consumption and demand. Whole-building electricity meters should*
- *record the power factor, if appropriate.*
- *The data collection system must use a local area network, building automation system, wireless network, or comparable communication infrastructure.*
- *The system must be capable of storing all meter data for at least 36 months.*
- *The data must be remotely accessible.*
- *All meters in the system must be capable of reporting hourly, daily, monthly, and annual energy use.*

Response: The will install permanent meters on all individual energy end uses the represent 10% or more of the total annual consumption of the building.

Materials and Resources

Prerequisite Storage and Collection of Recyclables

This prerequisite applies to:

Data Centers, Warehouses and Distribution Centers, Hospitality, Healthcare, New Construction, Core and Shell, Schools, Retail

REQUIREMENTS

NEW CONSTRUCTION, CORE AND SHELL, SCHOOLS, DATA CENTERS, WAREHOUSES AND DISTRIBUTION CENTERS, HOSPITALITY, HEALTHCARE

Provide dedicated areas accessible to waste haulers and building occupants for the collection and storage of recyclable materials for the entire building. Collection and storage areas may be separate locations. Recyclable materials must include mixed paper, corrugated cardboard, glass, plastics, and metals. Take appropriate measures for the safe collection, storage, and disposal of two of the following: batteries, mercury containing lamps, and electronic waste.

Response: The Project will provide dedicated areas accessible to waste haulers and building occupants for the collection and storage of recyclable materials for the entire building. Collection and storage areas may be separate locations. Recyclable materials will include mixed paper, corrugated cardboard, glass, plastics, and metals. The Project will also take appropriate measures for the safe collection, storage, and disposal of two of the following: batteries, mercury-containing lamps, and electronic waste.

Prerequisite Construction and Demolition Waste Management Planning

This prerequisite applies to:

New Construction, Core and Shell, Schools, Retail, Data Centers, Warehouses and Distribution Centers, Hospitality, Healthcare

REQUIREMENTS

Develop and implement a construction and demolition waste management plan:

- Establish waste diversion goals for the project by identifying at least five materials (both structural and nonstructural) targeted for diversion. Approximate a percentage of the overall project waste that these materials represent.*
 - Specify whether materials will be separated or commingled and describe the diversion strategies planned for the project. Describe where the material will be taken and how the recycling facility will process the material.*
- Provide a final report detailing all major waste streams generated, including disposal and diversion rates. Alternative daily cover (ADC) does not qualify as material diverted from disposal. Land-clearing debris is not considered construction, demolition, or renovation waste that can contribute to waste diversion.*

Response: The Project will develop and implement a construction and demolition waste management plan that will identifying at least five materials (both structural and nonstructural) targeted for diversion and approximate a percentage of the overall Project waste that these materials represent. The Project will divert a minimum of 50 percent of the total construction and demolition material.

Building Life Cycle Impact Reduction [v4.1 Upgrade]

REQUIREMENTS

Demonstrate reduced environmental effects during initial project decision-making by reusing existing building resources or demonstrating a reduction in materials use through life-cycle assessment. Achieve one of the following options.

TABLE 1. Points for reuse of building materials

Percentage of completed project surface area reused	Points BD+C	Points BD+C (Core and Shell)
25%	2	2
50%	3	3
75%	4	5

WHOLE-BUILDING LIFE-CYCLE ASSESSMENT

Option 2. Whole-Building Life-Cycle Assessment (1-4 points)

For new construction (buildings or portions of buildings), conduct a cradle-to-grave life-cycle assessment of the project's structure and enclosure and select one or more of the following paths below to earn up to 4 points:

Path 1: Conduct a life cycle assessment of the project's structure and enclosure (1 point).

Path 2: Conduct a life cycle assessment of the project's structure and enclosure that demonstrates a minimum of 5% reduction, compared with a baseline building in at least three of the six impact categories listed below, one of which must be global warming potential (2 points).

Path 3: Conduct a life cycle assessment of the project's structure and enclosure that demonstrates a minimum of 10% reduction, compared with a baseline building, in at least three of the six impact categories listed below, one of which must be global warming potential (3 points).

Response: The team is evaluating performing a Life Cycle Assessment to determine the embodied carbon reduction that will be achieved by the design, focusing on the project's foundation structure, and enclosure in alignment with the LEED Life Cycle Impact Reduction Credit.

Embodied carbon reduction strategies that will be explored include, but are not limited to:

- Reduced carbon steel products
- Increased supplementary cementitious materials (SCMs) in the concrete
- Reduced carbon insulative materials
- Identifying locally-sourced products

Building Product Disclosure and Optimization—Environmental Product Declarations

This credit applies to:

New Construction, Core and Shell, Schools, Retail, Data Centers, Warehouses and Distribution Centers, Hospitality, Healthcare

REQUIREMENTS

Achieve one or more of the options below, for a maximum of 2 points.

OPTION 1. ENVIRONMENTAL PRODUCT DECLARATION (EPD) (1 POINT)

Use at least 20 different permanently installed products sourced from at least five different manufacturers that meet one of the disclosure criteria below.

Product-specific declaration.

°° Products with a publicly available, critically reviewed life-cycle assessment conforming to ISO 14044 that have at least a cradle to gate scope are valued as one quarter (1/4) of a product for the purposes of credit achievement calculation.

·· Environmental Product Declarations which conform to ISO 14025, 14040, 14044, and EN 15804 or ISO 21930

and have at least a cradle to gate scope.

°° Industry-wide (generic) EPD – Products with third-party certification (Type III), including external verification, in which the manufacturer is explicitly recognized as a participant by the program operator are valued as one half (1/2) of a product for purposes of credit achievement calculation.

°° Product-specific Type III EPD – Products with third-party certification (Type III), including external verification in which the manufacturer is explicitly recognized as the participant by the program operator are valued as one whole product for purposes of credit achievement calculation.

· USGBC approved program – Products that comply with other USGBC approved environmental product declaration frameworks.

OPTION 2. MULTI-ATTRIBUTE OPTIMIZATION (1 POINT)

Use products that comply with one of the criteria below for 50%, by cost, of the total value of permanently installed products in the project. Products will be valued as below.

· Third party certified products that demonstrate impact reduction below industry average in at least three of the following categories are valued at 100% of their cost for credit achievement calculations.

°° global warming potential (greenhouse gases), in CO₂e;

°° depletion of the stratospheric ozone layer, in kg CFC-11;

°° acidification of land and water sources, in moles H⁺ or kg SO₂;

°° eutrophication, in kg nitrogen or kg phosphate;

°° formation of tropospheric ozone, in kg NO_x, kg O₃ eq, or kg ethene; and depletion of nonrenewable energy resources, in MJ.

· USGBC approved program – Products that comply with other USGBC approved multi-attribute frameworks.

For credit achievement calculation, products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at 200% of their base contributing cost.

Structure and enclosure materials may not constitute more than 30% of the value of compliant building products.

Response: The Project will evaluate products that have Environmental Product Declarations (EPDs) to meet the LEED Criteria. The team plans on utilizing at least 20 products with EPD's to achieve Exemplary Performance for this credit.

Building Product Disclosure and Optimization—Sourcing of Raw Materials

REQUIREMENTS

OPTION 1. RAW MATERIAL SOURCE AND EXTRACTION REPORTING (1 POINT)

Use at least 20 different permanently installed products from at least five different manufacturers that have publicly released a report from their raw material suppliers which include raw material supplier extraction locations, a commitment to long-term ecologically responsible land use, a commitment to reducing environmental harms from extraction and/or manufacturing processes, and a commitment to meeting applicable standards or programs voluntarily that address responsible sourcing criteria.

· Products sourced from manufacturers with self-declared reports are valued as one half (1/2) of a product for credit achievement.

· Third-party verified corporate sustainability reports (CSR) which include environmental impacts of extraction operations and activities associated with the manufacturer's product and the product's supply chain, are valued as one whole product for credit achievement calculation. Acceptable CSR frameworks include the following:

· Global Reporting Initiative (GRI) Sustainability Report

· **Organization** for Economic Co-operation and Development (OECD) Guidelines for Multinational Enterprises

· U.N. Global Compact: Communication of Progress

· ISO 26000: 2010 Guidance on Social Responsibility

· USGBC approved program: Other USGBC approved programs meeting the CSR criteria.

OPTION 2. LEADERSHIP EXTRACTION PRACTICES (1 POINT)

Use products that meet at least one of the responsible extraction criteria below for at least 25%, by cost, of the total value of permanently installed building products in the project.

- *Extended producer responsibility. Products purchased from a manufacturer (producer) that participates in an extended producer responsibility program or is directly responsible for extended producer responsibility. Products meeting extended producer responsibility criteria are valued at 50% of their cost for the purposes of credit achievement calculation.*
- *Bio-based materials. Bio-based products must meet the Sustainable Agriculture Network's Sustainable Agriculture Standard. Bio-based raw materials must be tested using ASTM Test Method D6866 and be legally harvested, as defined by the exporting and receiving country. Exclude hide products, such as leather and other animal skin material. Products meeting bio-based materials criteria are valued at 100% of their cost for the purposes of credit achievement calculation.*
- *Wood products. Wood products must be certified by the Forest Stewardship Council or USGBC-approved equivalent. Products meeting wood products criteria are valued at 100% of their cost for the purposes of credit achievement calculation.*
- *Materials reuse. Reuse includes salvaged, refurbished, or reused products. Products meeting materials reuse criteria are valued at 100% of their cost for the purposes of credit achievement calculation.*
- *Recycled content. Recycled content is the sum of post-consumer recycled content plus one-half the Pre-consumer recycled content, based on cost. Products meeting recycled content criteria are valued at 100% of their cost for the purposes of credit achievement calculation.*
- *USGBC approved program. Other USGBC approved programs meeting leadership extraction criteria. For credit achievement calculation, products sourced (extracted, manufactured, and purchased) within 100 miles (160 km) of the project site are valued at 200% of their base contributing cost. For credit achievement calculation, the base contributing cost of individual products compliant with multiple responsible extraction criteria is not permitted to exceed 100% its total actual cost (before regional multipliers) and double counting of single product components compliant with multiple responsible extraction criteria is not permitted and in no case is a product permitted to contribute more than 200% of its total actual cost.*

Structure and enclosure materials may not constitute more than 30% of the value of compliant building products.

Response: The project will evaluate products with high recycled content to meet the LEED Criteria.

Building Product Disclosure and Optimization—Material Ingredients

This credit applies to:

New Construction, Core and Shell, Schools, Retail, Data Centers, Warehouses and Distribution Centers, Hospitality, Healthcare

REQUIREMENTS

OPTION 1. MATERIAL INGREDIENT REPORTING (1 POINT)

Use at least 20 different permanently installed products from at least five different manufacturers that use any of the following programs to demonstrate the chemical inventory of the product to at least 0.1% (1000 ppm).

- *Manufacturer Inventory. The manufacturer has published complete content inventory for the product following these guidelines:*

- °° *A publicly available inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)*

- °° *Materials defined as trade secret or intellectual property may withhold the name and/or CASRN but must disclose role, amount and GreenScreen benchmark, as defined in GreenScreen v1.2.*

- *Health Product Declaration. The end use product has a published, complete Health Product Declaration with full disclosure of known hazards in compliance with the Health Product Declaration open Standard.*

- *Cradle to Cradle. The end use product has been certified at the Cradle to Cradle v2 Basic level or Cradle to Cradle v3 Bronze level.*

- *USGBC approved program. Other USGBC approved programs meeting the material ingredient reporting criteria.*

AND/OR

OPTION 2. MATERIAL INGREDIENT OPTIMIZATION (1 POINT)

Use products that document their material ingredient optimization using the paths below for at least 25%, by cost, of the total value of permanently installed products in the project.

· GreenScreen v1.2 Benchmark. Products that have fully inventoried chemical ingredients to 100 ppm that have no Benchmark 1 hazards:

° If any ingredients are assessed with the GreenScreen List Translator, value these products at 100% of cost.

° If all ingredients have undergone a full GreenScreen Assessment, value these products at 150% of cost.

· Cradle to Cradle Certified. End use products are certified Cradle to Cradle. Products will be valued as follows:

° Cradle to Cradle v2 Gold: 100% of cost

° Cradle to Cradle v2 Platinum: 150% of cost

° Cradle to Cradle v3 Silver: 100% of cost

° Cradle to Cradle v3 Gold or Platinum: 150% of cost

· International Alternative Compliance Path – REACH Optimization. End use products and materials that do not contain substances that meet REACH criteria for substances of very high concern. If the product contains no ingredients listed on the REACH Authorization or Candidate list, value at 100% of cost.

· USGBC approved program. Products that comply with USGBC approved building product optimization criteria.

AND/OR

OPTION 3. PRODUCT MANUFACTURER SUPPLY CHAIN OPTIMIZATION (1 POINT)

Use building products for at least 25%, by cost, of the total value of permanently installed products in the project that:

· Are sourced from product manufacturers who engage in validated and robust safety, health, hazard, and risk programs which at a minimum document at least 99% (by weight) of the ingredients used to make the building product or building material, and

· Are sourced from product manufacturers with independent third party verification of their supply chain that at a minimum verifies:

° Processes are in place to communicate and transparently prioritize chemical ingredients along the supply chain according to available hazard, exposure and use information to identify those that require more detailed evaluation

° Processes are in place to identify, document, and communicate information on health, safety and environmental characteristics of chemical ingredients

° Processes are in place to implement measures to manage the health, safety and environmental hazard and risk of chemical ingredients

° Processes are in place to optimize health, safety and environmental impacts when designing and improving chemical ingredients

° Processes are in place to communicate, receive and evaluate chemical ingredient safety and stewardship information along the supply chain

° Safety and stewardship information about the chemical ingredients is publicly available from all points along the supply chain Products meeting Option 3 criteria are valued at 100% of their cost for the purposes of credit achievement calculation.

For credit achievement calculation of options 2 and 3, products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at 200% of their base contributing cost. For credit achievement calculation, the value of individual products compliant with either option 2 or 3 can be combined to reach the 25% threshold but products compliant with both option 2 and 3 may only be counted once.

Structure and enclosure materials may not constitute more than 30% of the value of compliant building products.

Response: The project will evaluate products with Material Ingredients disclosures to meet the LEED Criteria.

Construction and Demolition Waste Management

This credit applies to:

Data Centers, Warehouses and Distribution Centers, Hospitality, Healthcare, New Construction, Core and Shell, Schools, Retail

REQUIREMENTS

Recycle and/or salvage nonhazardous construction and demolition materials. Calculations can be by weight or volume but must be consistent throughout.

Exclude excavated soil, land-clearing debris, and alternative daily cover (ADC). Include wood waste converted to fuel (biofuel) in the calculations; other types of waste-to-energy are not considered diversion for this credit.

However, for projects that cannot meet credit requirements using reuse and recycling methods, waste-to-energy systems may be considered waste diversion if the European Commission Waste Framework Directive 2008/98/EC and Waste Incineration Directive 2000/76/EC are followed and Waste to Energy facilities meet applicable European Committee for Standardization (CEN) EN 303 standards.

OPTION 1. DIVERSION (1–2 POINTS)

Path 2. Divert 75% and Four Material Streams (2 points)

Divert at least 75% of the total construction and demolition material; diverted materials must include at least four material streams.

Response: The Project will divert a minimum of 50 percent of the total construction and demolition material.

Indoor Environmental Quality

Prerequisite Minimum Indoor Air Quality Performance

This prerequisite applies to:

New Construction, Core and Shell, Schools, Retail, Data Centers, Warehouses and Distribution Centers, Hospitality, Healthcare

REQUIREMENTS

NEW CONSTRUCTION, CORE AND SHELL, SCHOOLS, RETAIL, DATA CENTERS, WAREHOUSES AND DISTRIBUTION CENTERS, HOSPITALITY

Meet the requirements for both ventilation and monitoring.

Ventilation Mechanically Ventilated Spaces

OPTION 1. ASHRAE STANDARD 62.1–2010

For mechanically ventilated spaces (and for mixed-mode systems when the mechanical ventilation is activated), determine the minimum outdoor air intake flow for mechanical ventilation systems using the ventilation rate procedure from ASHRAE 62.1–2010 or a local equivalent, whichever is more stringent. Meet the minimum requirements of ASHRAE Standard 62.1–2010, Sections 4–7, Ventilation for Acceptable Indoor Air Quality (with errata), or a local equivalent, whichever is more stringent.

OPTION 2. CEN STANDARDS EN 15251–2007 AND EN 13779–2007

Projects outside the U.S. may instead meet the minimum outdoor air requirements of Annex B of Comit. Europ .en de Normalisation (CEN) Standard EN 15251–2007, Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics; and meet the requirements of CEN Standard EN 13779–2007, Ventilation for nonresidential buildings, Performance requirements for ventilation and room conditioning systems, excluding Section 7.3, Thermal environment; 7.6, Acoustic environment; A.16; and A.17.

All Spaces

The indoor air quality procedure defined in ASHRAE Standard 62.1–2010 may not be used to comply with this prerequisite.

Mechanically Ventilated Spaces

For mechanically ventilated spaces (and for mixed-mode systems when the mechanical ventilation is activated), provide a direct outdoor airflow measurement device capable of measuring the minimum outdoor air intake flow. This device must measure the minimum outdoor air intake flow with an accuracy of $\pm 10\%$ of the design minimum outdoor airflow rate defined by the ventilation requirements above. An alarm must alert staff whenever the outdoor airflow value varies by 15% or more from the outdoor airflow setpoint.

Response: The Project will meet the minimum requirements of ASHRAE Standard 62.1–2010, Sections 4–7, Ventilation for Acceptable Indoor Air Quality (with errata), or a local equivalent, whichever is more stringent.

Prerequisite Environmental Tobacco Smoke Control

This prerequisite applies to:

New Construction, Core and Shell, Schools, Retail, Data Centers, Warehouses and Distribution Centers, Hospitality, Healthcare

REQUIREMENTS

NEW CONSTRUCTION, CORE AND SHELL, RETAIL, DATA CENTERS, WAREHOUSES AND DISTRIBUTION CENTERS, HOSPITALITY, HEALTHCARE

Prohibit smoking inside the building. Prohibit smoking outside the building except in designated smoking areas located at least 25 feet (7.5 meters) from all entries, outdoor air intakes, and operable windows. Also prohibit smoking outside the property line in spaces used for business purposes. If the requirement to prohibit smoking within 25 feet (7.5 meters) cannot be implemented because of code, provide documentation of these regulations. Signage must be posted within 10 feet (3 meters) of all building entrances indicating the no-smoking policy.

RESIDENTIAL ONLY

OPTION 1. NO SMOKING

Meet the requirements above.

45 Brighton - Example No Smoking Sign



Response: No smoking signs will be posted within 10 ft of all building entrances.

Enhanced Indoor Air Quality Strategies

This prerequisite applies to:

New Construction, Core and Shell, Schools, Retail, Data Centers, Warehouses and Distribution Centers, Hospitality, Healthcare

REQUIREMENTS

OPTION 1. ENHANCED IAQ STRATEGIES (1 POINT)

Comply with the following requirements, as applicable.

Mechanically ventilated spaces:

- A. entryway systems;*
- B. interior cross-contamination prevention; and*
- C. filtration.*

Naturally ventilated spaces:

- A. entryway systems; and*
- D. natural ventilation design calculations.*

Mixed-mode systems:

- A. entryway systems;*
- B. interior cross-contamination prevention;*
- C. filtration;*
- D. natural ventilation design calculations; and*
- E. mixed-mode design calculations*

Response: The Project will provide entryway systems, interior cross-contamination prevention, and MERV-13 filtration. The Project will also provide CO2 sensors in all densely occupied spaces.

Low-Emitting Materials

This credit applies to:

New Construction, Core and Shell, Schools, Retail, Data Centers, Warehouses and Distribution Centers, Hospitality, Healthcare

REQUIREMENTS

This credit includes requirements for product manufacturing as well as project teams. It covers volatile organic compound (VOC) emissions into indoor air and the VOC content of materials, as well as the testing methods by which indoor VOC emissions are determined. Different materials must meet different requirements to be considered compliant for this credit. The building interior and exterior are organized in seven categories, each with different thresholds of compliance. The building interior is defined as everything within the waterproofing membrane. The building exterior is defined as everything outside and inclusive of the primary and secondary weatherproofing system, such as waterproofing membranes and air- and water-resistive barrier materials.

OPTION 1. PRODUCT CATEGORY CALCULATIONS

Achieve the threshold level of compliance with emissions and content standards for the number of product categories listed in Table 2.

TABLE 1. Thresholds of compliance with emissions and content standards for 7 categories of materials		
Category	Threshold	Emissions and content requirements
Interior paints and coatings applied on site	At least 90%, by volume, for emissions; 100% for VOC content	<ul style="list-style-type: none">• General Emissions Evaluation for paints and coatings applied to walls, floors, and ceilings• VOC content requirements for wet applied products
Interior adhesives and sealants applied on site (Including flooring adhesive)	At least 90%, by volume, for emissions; 100% for VOC content	<ul style="list-style-type: none">• General Emissions Evaluation• VOC content requirements for wet applied products
Flooring	100%	General Emissions Evaluation
Composite wood	100% not covered by other categories	Composite Wood Evaluation
Ceilings, walls, thermal, and acoustic insulation	100%	<ul style="list-style-type: none">• General Emissions Evaluation• Healthcare, Schools only Additional Insulation requirements
Furniture (Include in calculations if part of scope of work)	At least 90%, by cost	Furniture Evaluation
Healthcare and Schools Projects only: Exterior applied products	At least 90%, by volume	Exterior Applied Products

TABLE 2. Points for number of compliant categories of products	
Compliant categories	Points
New Construction, Core and Shell, Retail, Data Centers, Warehouses and Distribution Centers, Hospitality projects without furniture	
2	1
4	2
5	3
New Construction, Core and Shell, Retail, Data Centers, Warehouses and Distribution Centers, Hospitality projects with furniture	
3	1
5	2
6	3
Schools, Healthcare without furniture	
3	1
5	2
6	3
Schools, Healthcare with furniture	
4	1
6	2
7	3

Please see reference guide for emissions and content requirements.

Response: The Project will ensure the use of low emitting materials and, at minimum, meet the threshold level of compliance with emissions and VOC content standards for 4 product categories for 3 points. The Team will also achieve 90% in 3 categories for an additional Exemplary performance point. The categories tracked will be detailed in a later submission. The specifications will include requirements for products with compliant VOC content and general emissions limits. Compliance will be confirmed during the construction phase.

Construction Indoor Air Quality Management Plan

This credit applies to:

New Construction, Core and Shell, Schools, Retail, Data Centers, Warehouses and Distribution Centers, Hospitality, Healthcare

REQUIREMENTS

NEW CONSTRUCTION, CORE AND SHELL, SCHOOLS, RETAIL, DATA CENTERS, WAREHOUSES AND DISTRIBUTION CENTERS, HOSPITALITY

Develop and implement an indoor air quality (IAQ) management plan for the construction and preoccupancy phases of the building. The plan must address all of the following. During construction, meet or exceed all applicable recommended control measures of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guidelines for Occupied Buildings under Construction, 2nd edition, 2007, ANSI/SMACNA 008–2008, Chapter 3. Protect absorptive materials stored on-site and installed from moisture damage. Do not operate permanently installed air-handling equipment during construction unless filtration media with a minimum efficiency reporting value (MERV)

of 8, as determined by ASHRAE 52.2–2007, with errata (or equivalent filtration media class of F5 or higher, as defined by CEN Standard EN 779–2002, Particulate Air Filters for General Ventilation, Determination of the Filtration Performance), are installed at each return air grille and return or transfer duct inlet opening such that there is no bypass around the filtration media. Immediately before occupancy, replace all filtration media with the final design filtration media, installed in accordance with the manufacturer’s recommendations. Prohibit the use of tobacco products inside the building and within 25 feet (7.5 meters) of the building entrance during construction.

filtration media class of F5 or higher, as defined by CEN Standard EN 779–2002, Particulate Air Filters for General Ventilation, Determination of the Filtration Performance), are installed at each return air grille and return or transfer duct inlet opening such that there is no bypass around the filtration media. Immediately before occupancy, replace all filtration media with the final design filtration media, installed in accordance with the manufacturer’s recommendations.

Response: The Project will develop and implement an indoor air quality (IAQ) management plan for the construction and preoccupancy phases of the building, meeting or exceeding all applicable recommended control measures of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guidelines for Occupied Buildings under Construction, 2nd edition, 2007, ANSI/SMACNA 008–2008, Chapter 3. The Project will follow strict IAQ guidelines and protect absorptive materials stored on-site from moisture damage.

Daylight

REQUIREMENTS

Provide manual or automatic (with manual override) glare-control devices for all regularly occupied spaces. Select one of the following three options.

OPTION 1. SIMULATION: SPATIAL DAYLIGHT AUTONOMY AND ANNUAL SUNLIGHT EXPOSURE (2–3 POINTS, 1-2 POINTS HEALTHCARE)

Demonstrate through annual computer simulations that spatial daylight autonomy_{300/50%} (sDA_{300/50%}) of at least 55%, 75%, or 90% is achieved. Use regularly occupied floor area. Healthcare projects should use the perimeter area determined under EQ Credit Quality Views. Points are awarded according to Table 1.

TABLE 1. Points for daylight floor area: Spatial daylight autonomy			
New Construction, Core and Shell, Schools, Retail, Data Centers, Warehouses and Distribution Centers, Hospitality		Healthcare	
sDA (for regularly occupied floor area)	Points	sDA (for perimeter floor area)	Points
55%	2	75%	1
75%	3	90%	2

AND

Demonstrate through annual computer simulations that annual sunlight exposure_{1000,250} (ASE_{1000,250}) of no more than 10% is achieved. Use the regularly occupied floor area that is daylight per the sDA_{300/50%} simulations. The sDA and ASE calculation grids should be no more than 2 feet (600 millimeters) square and laid out across the regularly occupied area at a work plane height of 30 inches (76 millimeters) above finished floor (unless otherwise defined). Use an hourly time-step analysis based on typical meteorological year data, or an equivalent, for the nearest available weather station. Include any permanent interior obstructions. Moveable furniture and partitions may be excluded.

OR

OPTION 2. SIMULATION: ILLUMINANCE CALCULATIONS (1–2 POINTS)

Demonstrate through computer modeling that illuminance levels will be between 300 lux and 3,000 lux for 9 a.m. and 3 p.m., both on a clear-sky day at the equinox, for the floor area indicated in Table 2. Use regularly occupied floor

area. Healthcare projects should use the perimeter area determined under EQ Credit Quality Views.

TABLE 2. Points for daylight floor area: Illuminance calculation

New Construction, Core and Shell, Schools, Retail, Data Centers, Warehouses and Distribution Centers, Hospitality		Healthcare	
Percentage of regularly occupied floor area	Points	Percentage of perimeter floor area	Points
75%	1	75%	1
90%	2	90%	2

Calculate illuminance intensity for sun (direct component) and sky (diffuse component) for clear-sky conditions as follows:

- Use typical meteorological year data, or an equivalent, for the nearest available weather station.
- Select one day within 15 days of September 21 and one day within 15 days of March 21 that represent the clearest sky condition.
- Use the average of the hourly value for the two selected days.

Exclude blinds or shades from the model. Include any permanent interior obstructions. Moveable furniture and partitions may be excluded.

OR

OPTION 3. MEASUREMENT (2-3 POINTS, 1-2 POINTS HEALTHCARE)

Achieve illuminance levels between 300 lux and 3,000 lux for the floor area indicated in Table 3.

TABLE 3. Points for daylight floor area: Measurement

New Construction, Core and Shell, Schools, Retail, Data Centers, Warehouses and Distribution Centers, Hospitality		Healthcare	
Percentage of regularly occupied floor area	Points	Percentage of perimeter floor area	Points
75	2	75	1
90	3	90	2

With furniture, fixtures, and equipment in place, measure illuminance levels as follows:

- Measure at appropriate work plane height during any hour between 9 a.m. and 3 p.m.
- Take one measurement in any regularly occupied month, and take a second as indicated in Table 4.
- For spaces larger than 150 square feet (14 square meters), take measurements on a maximum 10 foot (3 meter) square grid.
- For spaces 150 square feet (14 square meters) or smaller, take measurements on a maximum 3 foot (900 millimeters) square grid

TABLE 4. Timing of measurements for illuminance

If first measurement is taken in ...	take second measurement in ...
January	May-September
February	June-October
March	June-July, November-December
April	August-December
May	September-January
June	October-February
July	November-March
August	December-April
September	December-January, May-June
October	February-June
November	March-July
December	April-August

Response: The project team will run a daylight analysis but is not expecting to achieve any points.

Quality Views

REQUIREMENTS

NEW CONSTRUCTION, CORE AND SHELL, SCHOOLS, RETAIL, DATA CENTERS,
HOSPITALITY

Achieve a direct line of sight to the outdoors via vision glazing for 75% of all regularly occupied floor area. View glazing in the contributing area must provide a clear image of the exterior, not obstructed by frits, fibers, patterned glazing, or added tints that distort color balance. Additionally, 75% of all regularly occupied floor area must have at least two of the following four kinds of views:

- .. multiple lines of sight to vision glazing in different directions at least 90 degrees apart;*
- .. views that include at least two of the following: (1) flora, fauna, or sky; (2) movement; and (3) objects at least 25 feet (7.5 meters) from the exterior of the glazing;*
- .. unobstructed views located within the distance of three times the head height of the vision glazing; and*
- .. views with a view factor of 3 or greater, as defined in "Windows and Offices; A Study of Office Worker Performance and the Indoor Environment." Include in the calculations any permanent interior obstructions. Movable furniture and partitions may be excluded. Views into interior atria may be used to meet up to 30% of the required area.*

Response: The Project will evaluate the ability to provide views with a direct line of sight to the outdoors for at least 75 percent of all regularly occupied floor area.

Innovation

Innovation

INNOVATION CREDITS 1-5

REQUIREMENTS

Project teams can use any combination of innovation, pilot, and exemplary performance strategies.

OPTION 1. INNOVATION (1 POINT)

Achieve significant, measurable environmental performance using a strategy not addressed in the LEED green building rating system. Identify the following:

- the intent of the proposed innovation credit;*
- proposed requirements for compliance;*
- proposed submittals to demonstrate compliance; and*
- the design approach or strategies used to meet the requirements.*

The team will be working to document the following credits in the construction submission:

- Innovation in Design- Sustainable Purchasing - Low Mercury Lamps
- Innovation in Design: Verified Construction & Demolition Recycling Rates
- Innovation in Design: EP BPDO - EPD's
- Innovation in Design: EP Low Emitting Materials
- Innovation in Design: Education

LEED Accredited Professional

Colleen Ryan Soden from Soden Sustainability Consulting is a LEED Accredited Professional.



10011278-AP-BD+C

CREDENTIAL ID

10 AUG 2010

ISSUED

08 AUG 2024

VALID THROUGH

GREEN BUSINESS CERTIFICATION INC. CERTIFIES THAT

Colleen Ryan-Soden

HAS ATTAINED THE DESIGNATION OF

LEED AP[®] Building Design + Construction

by demonstrating the knowledge and understanding of
green building practices and principles needed to
support the use of the LEED[®] green building program.

A handwritten signature in black ink, reading "Peter Templeton".

PETER TEMPLETON
PRESIDENT & CEO
U.S. GREEN BUILDING COUNCIL & GREEN BUSINESS CERTIFICATION INC.

Regional Priority

Regional Priority

This credit applies to:

Data Centers (1–4 points), Warehouses and Distribution Centers (1–4 points), Hospitality (1–4 points), Healthcare (1–4 points), New Construction (1–4 points), Core and Shell (1–4 points), Schools (1–4 points), Retail (1–4 points)

REQUIREMENTS

Earn up to four of the Regional Priority credits. These credits have been identified by the USGBC regional councils and chapters as having additional regional importance for the project's region. A database of Regional Priority credits and their geographic applicability is available on the USGBC website, <http://www.usgbc.org/rpc>.

One point is awarded for each Regional Priority credit achieved, up to a maximum of four.

The Regional Priority credits for this site are:

- Regional Priority: Optimize Energy Performance (yes)
- Regional Priority: High Priority Site (yes)
- Regional Priority: Indoor Water Use (yes)
- Regional Priority: Renewable Energy Production (yes)

Response: The project will achieve all 4 Regional Priority credits.

45 Mystic

City of Somerville Sustainable/Resilient Buildings Energy Modeling Memorandum

June 2023

SUBMITTED BY:



(213) 785-4583
robianson@gmail.com

Executive Summary

Robinson Energy Services has completed energy analysis for the 45 Mystic Avenue project to develop a path to compliance with the Massachusetts Stretch Energy Code and LEED v4 Platinum certification per City of Somerville requirements. The proposed project is an 11-story speculative laboratory building. The energy analysis demonstrates that the proposed design as detailed below meets and exceeds the standards of the Massachusetts Stretch Energy Code and achieves enough energy credits to qualify for LEED Platinum certification is part of a comprehensive sustainable design package.

Energy Modeling Approach

Baseline and proposed models were developed per ASHRAE 90.1-2013 Appendix G, which can be used for both the Massachusetts Stretch Energy Code and LEED v4 compliance. The proposed model was built based on the current basis of design as outlined below.

Major parameters for each model are as follows:

Table 1: Major Modeling Parameters

	Proposed Design	Baseline (90.1-2013)
Central Plant	Heat Recovery Chiller + Air-Source Heat Pump	Gas Boiler + Water-Cooled Chiller
Laboratory Ventilation	Variable Volume Demand-Controlled Lab Ventilation System	Constant Volume 9-ACH Lab Ventilation
Space Conditioning	4-pipe fan coils	System 7 VAV
Window-to-Wall Ratio	30%	30%
Energy Recovery	Runaround Coil	None

Laboratory Ventilation System

A major energy efficiency measure in this project is the variable volume contaminant sensing laboratory ventilation system. This system warrants special discussion due to the innovative nature of the system and the relative obscurity of the guidance for laboratory specific baselines in 90.1-2013 Appendix G.

In a laboratory environment, the HVAC system (and especially the ventilation) serves a critical life-safety role. Laboratories can contain hazardous substances which can be harmful to humans if they build up to excessive concentrations in indoor air. The primary safety measure against this occurrence is a strategy of dilution – the HVAC system exhausts large volumes of air from laboratory spaces and replaces it with fresh air from the outdoors. In traditional laboratory design, the ventilation system operates at a constant volume of airflow, sized to keep occupants safe in the event of a spill of a hazardous substance in the lab. These systems are traditionally very energy intense due to the need to move and condition large volumes of outdoor air during all occupied hours, however it's very rare that the full volume of airflow is actually needed to keep the occupants safe – the system simply must operate at full airflow at all times just in case it is needed.

This project intends to use a state-of-the-art contaminant-sensing variable volume laboratory ventilation system. This system improves upon a traditional laboratory ventilation system by continuously monitoring air quality in every space and reducing ventilation rates when it is safe to do so. The system has the ability to sense contaminants and increase ventilation in a targeted fashion, to achieve a similar or greater level of safety at significantly reduced energy and environmental cost. Reducing ventilation leads to reduced fan energy usage and savings in heating and cooling requirements.

In this analysis, the proposed energy model uses a variable volume laboratory ventilation system, and the baseline model uses a traditional laboratory ventilation system. It is recommended that the project team engage a dialogue with GBCI to ensure they agree with the interpretation of ASHRAE 90.1-2013 Appendix G as outlined below. The baseline energy model adheres to the following key guidance and exceptions in ASHRAE 90.1-2013 Appendix G:

- **G3.1.2.6:** Minimum ventilation airflow is identical in the baseline and proposed models. In the case of a laboratory, the minimum ventilation airflow is typically from 6 to 15 air changes per hour and is traditionally delivered constantly.
- **Table G3.1 Item 4 Exception 2:** Schedules may differ between the proposed and baseline models when necessary to model nonstandard efficiency measures including demand control ventilation. In this case, the minimum ventilation schedule is different between the baseline and proposed models.
- **Exception to G3.1.3.13:** Baseline laboratory spaces shall reduce exhaust and makeup air to 50% of peak airflow when unoccupied.
- **G3.1.1 Exception 3:** HVAC for laboratory spaces in the baseline is modeled as a single, 100% outdoor air System 7. Baseline laboratory exhaust fan shall be modeled as constant horsepower reflecting constant-volume stack discharge with outdoor air bypass.
- **Section 6.5.7.2:** Laboratory exhaust systems capable of reducing airflow to 50% or less of design airflow do not require energy recovery.

Summary of Model Inputs

The inputs to the baseline and proposed energy models are described in Table 2 below.

Table 2: Detailed Summary of Inputs

Summary of Model Inputs			
		Proposed Design	90.1-2013 Baseline
Envelope	Roofs	R-30 Above-Deck Insulation	R-30 c.i.
	Walls	Above Grade: 4" Metal Stud with R-13 Batt + R-10 Continuous Rigid Insulation Below Grade: R-7.5 c.i.	R-13 + R-10 c.i.
	Floors	R-30 Pinned Batt	Mass: R-14.6 c.i. Steel Joist: R-30
	Glazing Quantity	30% Glazed Area, ~12,500 SF Glazing	Same as Proposed
	Glazing System Performance	Aluminum Glazing System w/ thermal break, dual pane IGU + Low-E coating with argon fill. U-0.32, SHGC 0.38	U-0.42, SHGC 0.40
HVAC	Lab Ventilation	Aircuity or similar contaminant-sensing variable volume laboratory ventilation system	100% Outdoor Air System 7 VAV + Reheat
		Peak design airflow 9 ACH	Design airflow 9 ACH
		Typical occupied airflow 6 ACH	Typical occupied airflow 9 ACH
		Typical unoccupied airflow 3 ACH	50% airflow reduction to 4.5 ACH when unoccupied per 90.1-2013 G3.1.3.13
		Lab Exhaust: contaminant sensing variable plume height exhaust system	Constant volume bypass fixed plume height exhaust system per G3.1.1 Exception 3.
		Supply fan power: <1.45 W/CFM Exhaust fan power: <0.9 W/CFM	Supply fan power: 1.03 W/CFM Exhaust fan power: 0.65 W/CFM
	Lab Supplemental Cooling	Chilled Water fan coils for supplemental cooling beyond ventilation requirement	N/A - All cooling via laboratory VAV system
	Exhaust Air Energy Recovery	Runaround coil, minimum 50% sensible effectiveness	No energy recovery per ASHRAE 90.1-2013 6.5.7.2. System reduces airflow by 50%, therefore no energy recovery coil required.
	Non-Lab HVAC	Dedicated outdoor air via lab ventilation system	System 7 VAV + Reheat
		Space conditioning via 4-pipe fan coils in parallel to ventilation system.	
Central Plant	4-pipe hot water/chilled water system Hot and chilled water provided by Aermec NRP air-to-water heat pump (placeholder selection) Minimum Rated Cooling Efficiency: 2.8 COP Minimum Rated Heating Efficiency: 3.0 COP Minimum Simultaneous Efficiency: 6.3 COP		System 7 Central Plant: 2x water-cooled screw chillers, 0.66 kW/ton 2x gas fired boilers, 82% E _c
Interior Lighting	Per 2020 MA Energy Code Lighting Power Allowance + C406.2 Reduced Lighting Power		Per 90.1-2013
Interior Space Heat Gains	8.0 W/SF		8.0 W/SF
Service Hot Water	Air-to-Water Heat Pump, 3.65 Rated COP @ 44.6 deg. F OAT		Gas storage water heater; 80% Et

Results

Table 3: Energy Model Results Summary

0	Proposed	Baseline	% Savings
Electricity Usage (Kwh)	1,953,883	1,831,980	
Gas Usage (Therms)	0	101,421	
EUI (kBtu/sf-yr)	133.8	328.9	
Annual Energy Cost	\$372,410	\$511,651	27%
Source Energy Usage (Million Btu/yr)	18,667	28,151	34%
GHG Emissions (kg CO2e/yr)	437,665	949,004	54%
Savings % for LEED (EApC95)	45%*		
LEED Points Estimate	17		

**Per EApC95, the average of the highest two savings metrics between energy cost, source energy, and greenhouse gas emissions is used to determine LEED energy points. LEED v4 typically requires that 90.1-2010 be used as the baseline comparison. However, per LEED Interpretation #10481, LEED CS projects that use 90.1-2013 rather than 90.1-2010 may add an additional 1% savings to the performance improvement vs. 90.1-2013 to establish equivalent savings vs. 90.1-2010. The savings presented above includes this additional 1%.*

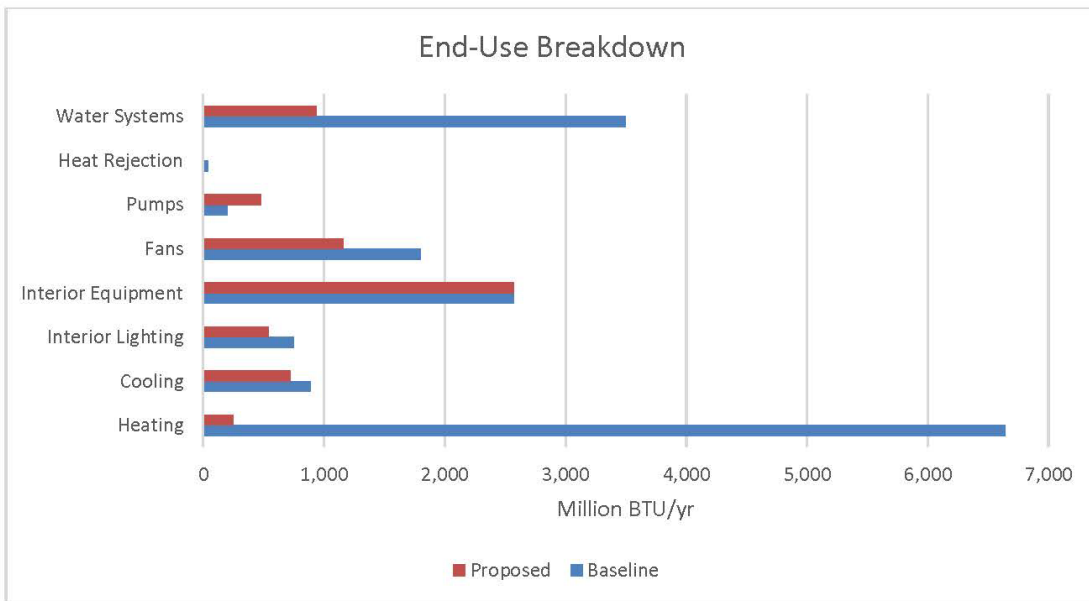


Figure 1: End-Use Breakdown - Proposed Design vs. 90.1-2013 Baseline

Energy Savings Analysis

The primary drivers of energy savings in this design are the contaminant-sensing laboratory ventilation system and the all-electric heat pump heating plant, which provides savings in heating, service hot water, and fan energy usage.

Heating

Heating energy usage is reduced by 94% vs. the baseline model. This savings is due to several compounding factors. The laboratory demand controlled ventilation system reduces ventilation airflow by 33% on average during occupied hours, eliminating a significant portion of heating demand. The 50% effective exhaust air energy recovery system which is not required in the baseline reduces heating demand further. Finally, the baseline case uses 80% efficient natural gas boilers, whereas the proposed model uses heat pumps with an average COP of 2.4 – three times more efficient than the gas boiler.

Service Hot Water

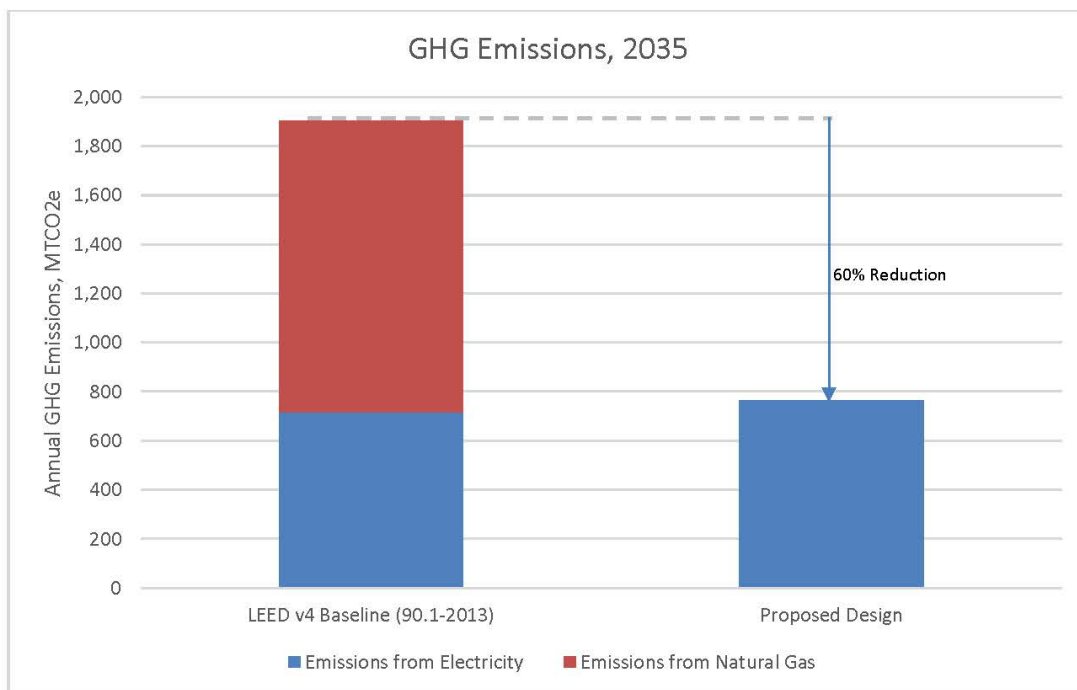
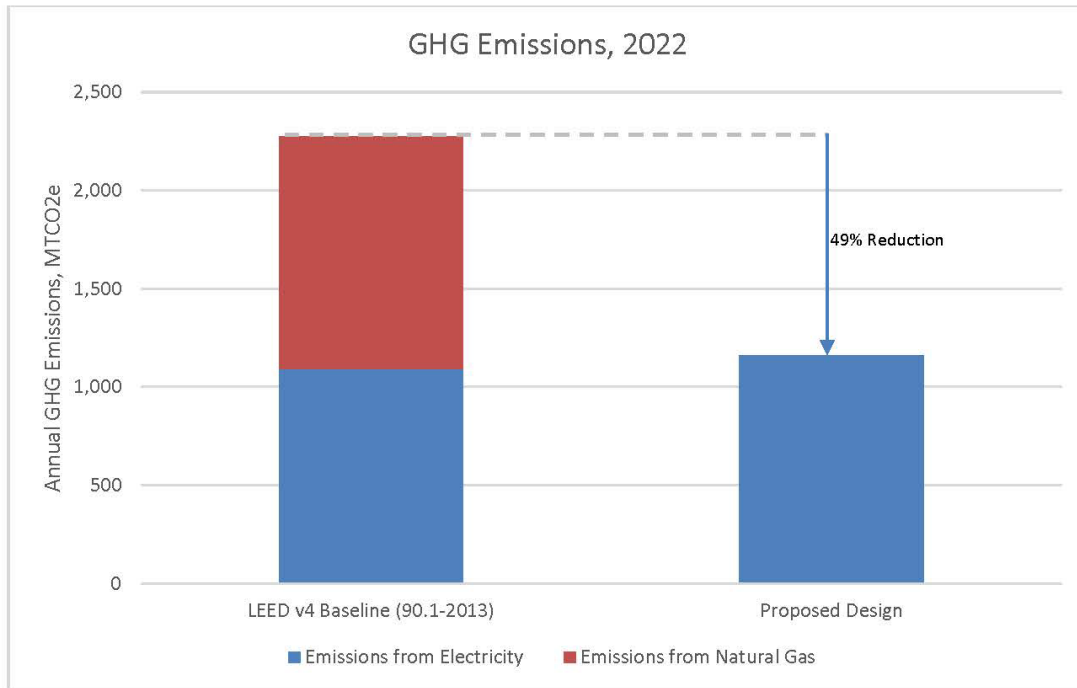
The proposed model reduces service hot water energy usage by 73%. In this case, hot water demand is identical between the two models. However the baseline model produces service hot water using an 80% efficient gas water heater. The proposed design uses high-efficiency CO₂ refrigerant heat pumps with a rated performance of 3.65 COP.

Ventilation Fans

Fan energy is reduced by 36%. This is reflective of the average reduction in laboratory ventilation airflow due to the contaminant sensing variable volume system. The proposed model operates at 6 air changes per hour during occupied hours and 3 air changes per hour during unoccupied hours. The Baseline model operates at 9 air changes per hour during occupied hours and 4.5 air changes per hour during unoccupied hours per 90.1-2013 G3.1.3.13.

Greenhouse Gas Emissions Summary

The annual greenhouse gas emissions for present and future electricity GHG emissions rates are shown in the charts below. EIA estimates the social cost of carbon to be \$51 per metric ton. This equates to \$116,000/year annual social cost for the baseline model and \$59,000/year annual social cost for the proposed design at current GHG emissions factors. The proposed design is an all-electric building, so these emissions will reduce proportionally as the electricity grid improves. The baseline building relies on natural gas, which has a fixed minimum GHG emissions factor per unit of energy and is unlikely to significantly change in the future.



Net-Zero Building Assessment

The current design puts this project in a strong position to achieve net-zero emissions in the future. All functions in the building are 100% electric and the building is not reliant on natural gas. Due to the service-intensive nature of a high rise laboratory building, there is minimal space for renewable energy generation on site. However, the project includes state-of-the-art all-electric lab design, including contaminant-sensing variable laboratory airflow, exhaust air energy recovery, and 100% heat pump space heating and service hot water heating. These efficiency measures significantly reduce electricity usage compared to a typical laboratory building, and the project will benefit from ongoing improvements to the carbon intensity of the New England electricity supply.

This combination of an all-electric design and package of energy efficiency measures positions the project to achieve net-zero emissions with the help of off-site renewable energy or carbon offsets.