Commercial East

250 Binney Street Cambridge, MA 02142

Design Review Filing

Article 14.74: 'Sustainability'
&
Article 22.20: 'Green Building Requirements'

Table of Contents:

Project Description

Commercial East (250 Binney Street), part of the MXD Infill Development Concept Plan (the "Concept Plan") within the Kendall Square Urban Renewal Plan (KSURP), is meeting the Article 22.20 requirement with a minimum of LEED Gold certification under the LEEDv4 Core and Shell rating system. The project scorecard for Commercial East will develop over the course of design, possible points may be achieved, and any updates to this report will be included in subsequent submissions or applications.

Commercial East at 250 Binney Street is proposed as part of Phase 4 of the Concept Plan. The redevelopment of Commercial East consists of a new, up to 16 story (±250') commercial building of up to approximately 431,288 GFA.

The team has committed to pursue formal LEED certification for the development. Additionally, because all portions of the project will be built as a campus with combined site and infrastructure elements the team will is looking into pursuing certification under a LEED Master Site. This will allow the project to show compliance with various LEED elements from a "campus approach".

General Project Information (Commercial East – 250 Binney Street)

SITE AND BUILDING AREA	
Total Site Area within the LEED Project Boundary (LPB)	TBD
Total Gross Floor Area	438,555 Gross Floor Area (GFA)
Retail Square Feet	7,267 GFA
Commercial Square Feet	431,288 GFA
Building Footprint	30,476 SF
TRANSPORTATION	
Parking Spaces	736
Long-Term Bike Storage	LEED requirement: 68 spaces
Short-Term Bike Storage	LEED requirement: 4 spaces

Affidavit Form for Green Building Professional
Special Permit

Green Building
Project Location: 250 Binney Street, Cambridge, MA

Green Building Professional

Name: CHRISTOPHER R. SCHAFFNER

☐ Architect
☒ Engineer

License Number: MASSACHUSETTS 37211 MECHANICAL
Company: THE GREEN ENGINEER, INC.
Address: 23 BRADFORD ST CONCORD MA 01742
Contact Information
Email Address: CHRIS@GREENENGINEER.COM
Telephone Number: 978-369-8978

I, CHRISTOPHER R. SCHAFFNER, as the Green Building Professional for this Green Building Project, have reviewed all relevant documents for this project and confirm to the best of my knowledge that those documents indicate that the project is being designed to achieve the requirements of Section 22.24 under Article 22.20 of the Cambridge Zoning Ordinance.

(Signature) 5/6/21 (Date)

Attach either:

☒ Credential from the applicable Green Building Rating Program indicating advanced knowledge and experience in environmentally sustainable development in general as well as the applicable Green Building Rating System for this Green Building Project.

☐ If the Green Building Rating Program does not offer such a credential, evidence of experience as a project architect or engineer, or as a consultant providing third-party review, on at least three (3) projects that have been certified using the applicable Green Building Rating Program.

Greenhouse Gas Emissions

250 Binney Street

Energy Consumption	*Area Light (kWh)*	*Misc. Equipment (kWh)*	*Space Heating (kWh)*	*Space Heating (Therm)*	*Space Cooling (kWh)*	*Pump & Aux (kWh)*	*Heat Rejection (kWh)*	*Ventilation Fans (kWh)*	*DHW (kWh)*	*Exterior Usage (kWh)*		*Total Electricity (kWh)*	*Total Natural Gas (Therm)*	*Total Energy (MBTU)*
MA Energy Code Baseline	1,693,770	3,701,970	0	820,940	1,276,331	1,600,316	27,907	6,254,196	135,283	12,076		14,701,849	820,940	132,271
Proposed Design	1,693,770	3,701,970	5,062,478	88,212	1,554,913	1,312,301	25,632	6,078,515	95,016	12,076		19,536,671	88,212	75,500
Savings	0	0	-5,062,478	732,728	-278,582	288,015	2,275	175,681	40,267	0		-4,834,822	732,728	**56,772**
% Savings												-33%	89%	**43%**

Greenhouse Gas Emissions	*Area Light (tons of CO2)*	*Electric Misc. Equipment (tons of CO2)*	*Electric Space Heating (tons of CO2)*	*Gas Space Heating (tons of CO2)*	*Space Cooling (tons of CO2)*	*Pump & Aux (tons of CO2)*	*Heat Rejection (tons of CO2)*	*Ventilation Fans (tons of CO2)*	*DHW (tons of CO2)*	*Exterior Usage (tons of CO2)*		*Electricity GHG Emission (tons)*	*Natural Gas GHG Emission (tons)*	*Total GHG Emissions (tons)*
MA Energy Code Baseline	557	1,218	0	4,802	420	527	9	2,058	45	4		4,837	4,802	9,639
Proposed Design	557	1,218	1,666	516	512	432	8	2,000	31	4		6,428	516	6,944
Savings	0	0	-1,666	4,286	-92	95	1	58	13	0		-1,591	4,286	**2,696**
% Savings														**28%**

Conversion:

MWH to Lbs of CO2 (Electricity)	658 ISO New England CO2 Emission factor: 658 lb of CO2 per MWH reduction in electricity use
MBTU to Lbs of CO2 (Natural Gas)	117 Direct GHG Emissions Factor for the US from EPA
Lbs to Short Tons	0.0005

2,696 tons of GHG Emissions Savings is equivalent to GHG Emissions from:

6,775,581

Miles driven by an average passenger vehicle

OR

325

homes' energy use for one year

OR

2,979,844

Pounds of coal burned

enviENERGY

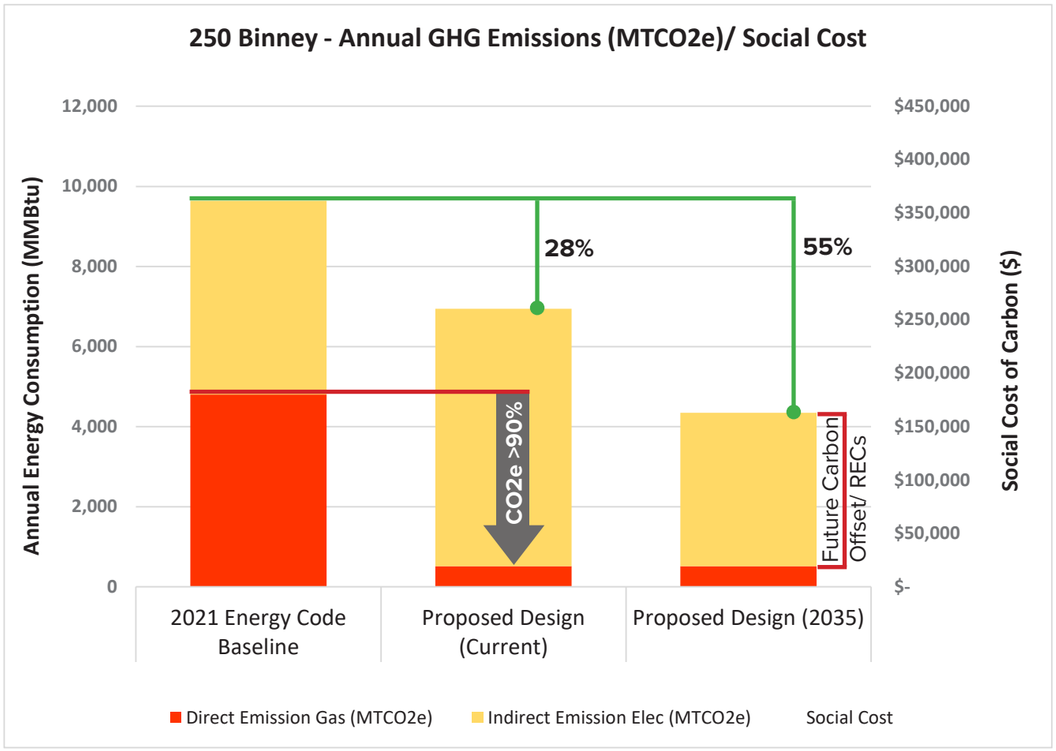
Transition to Carbon Neutrality

Annual GHG Emissions

The Basis of Design HVAC system was selected in alignment with the State of Massachusetts's and City of Cambridge's carbon neutrality goals. The proposed design consists of 100% Outside Air AHUs with Konvekta heat recovery system, all air-VAV with reheat in the lab spaces and 4-pipe Fan Coil Units/ Heat Pumps in the future office spaces. The water-side HVAC consists of high-efficiency water-cooled centrifugal chillers plus a heat recovery chiller as well as a hybrid hot water heating system, including high-efficiency gas-fired condensing boilers and air-to-water heat pump system, which is sized for approximately 20% of the boiler plant capacity.

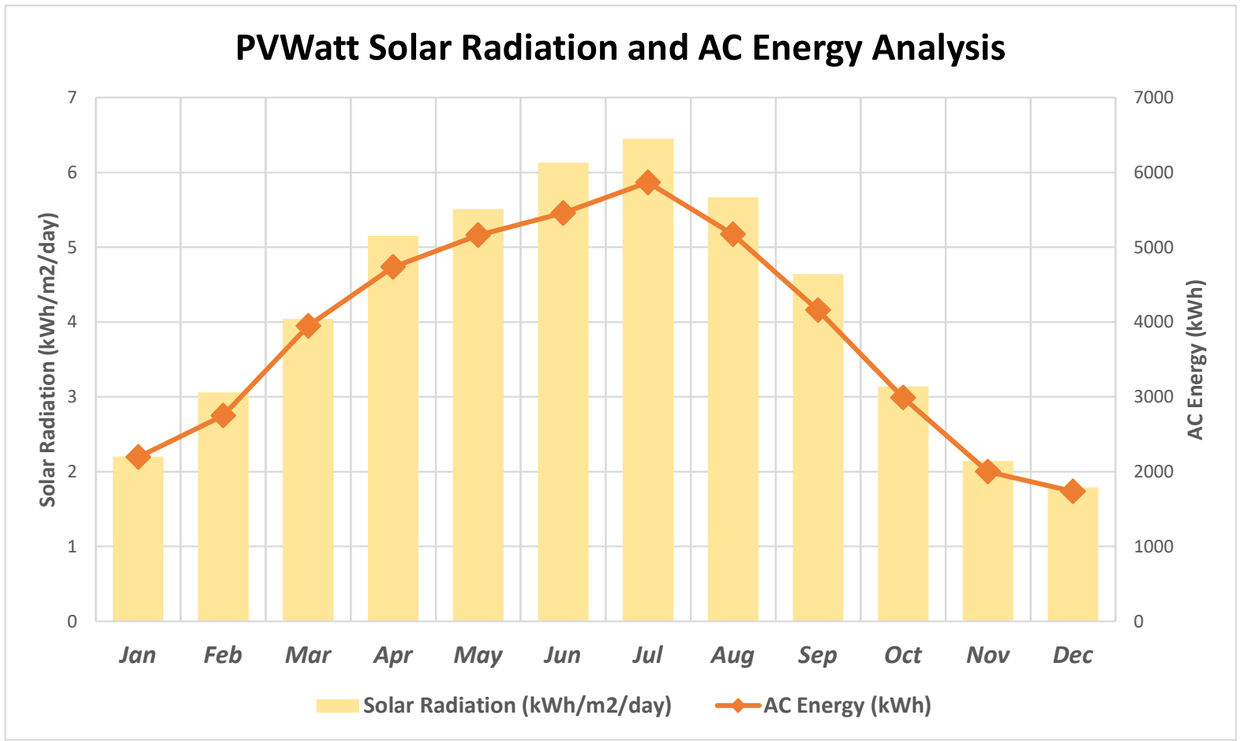
The hybrid heating system was implemented to reduce the project dependence on the fossil fuel heating. With the current available technologies and the site condition, these laboratory buildings will not be able to be 100% electric and the boiler plant needs to be included; however, utilizing the Konvekta heat recovery system and Air-to-water heat pump for supplemental heating reduces the project's carbon footprint significantly and helps with transitioning to an all-electric system in the future. As the grid gets cleaner, the carbon footprint of the project reduces; as shown in the following graphs, the estimated GHG emissions of the proposed design in year 2035 (assuming a GHG rate of 392 lbs CO2e per MWh of electricity) would be more than 50% less that the Energy Code Baseline.

The hybrid system cannot be modeled in eQuest; therefore, a 8,760-hour spreadsheet calculation was performed: the capacity and efficiency of the air to water heat pump was calculated at each hour and the boiler consumption was adjusted accordingly. The electricity for the heat pumps was added to the total energy consumption. The preliminary analysis showed that the annual fossil fuel consumption and its associated GHG emissions will be reduced by 85-90%.



Social Cost of Carbon: "EPA and other federal agencies use estimates of the social cost of carbon (SC-CO2) to value the climate impacts of rule-makings. The SC-CO2 is meant to be a comprehensive estimate of climate change damages and includes changes in net agricultural productivity, human health, property damages from increased flood risk, and changes in energy system costs, such as reduced costs for heating and increased costs for air conditioning."
In this analysis, GHG savings are based on regional rates, and the environmental impact of the building was calculated for one year of operation. In order to evaluate the impact of climate change at a social level, the "Social Cost" of carbon was used as an additional metric. The EPA values this cost at $42/ton CO2e for year 2021 with a 3% average discount rate.

Renewable Energy | Solar PV



RESULTS

Print Results

46,162 kWh/Year*

System output may range from 44,306 to 47,842 kWh per year near this location.
*Click **HERE** for more information.*

Month	Solar Radiation (kWh / m^2 / day)	AC Energy (kWh)	Value ($)
January	2.20	2,195	415
February	3.06	2,750	520
March	4.04	3,948	746
April	5.15	4,735	895
May	5.51	5,161	975
June	6.13	5,456	1,031
July	6.45	5,865	1,109
August	5.67	5,170	977
September	4.64	4,158	786
October	3.14	2,989	565
November	2.14	2,000	378
December	1.79	1,736	328

(PVWatts Calculation) - 250 Binney St

System Data:

Building Location	Cambridge, MA
Roof Area Available	2,500 SF
System DC Power(kW)	40
Array Tilt Angle	3
Array Azimuth Angle	180
Inverter Efficiency	96%

Annual Energy Savings:

Generated Electricity from PV Array
46,162 kWh

Annual Electricity Consumption
14,499,481 kWh

% Generation/ Consumption
0.32%

Water Management

Pursuant to Article 14.74 (b) of the Cambridge Zoning ordinance, the Project will reduce overall potable water use and reduce wastewater generation compared to a conventional development through installation of low-flow plumbing fixtures and high-efficiency irrigation systems. The Project is currently targeting a minimum 30% water use reduction compared to conventional plumbing fixtures (per Energy Policy Act of 1992 fixture performance requirements). Additionally, all water-consuming appliances will be ENERGY STAR certified at the most current version of the applicable standard.

The landscape design will incorporate native and adaptive vegetation and the design of the irrigation system will target, at minimum, a 50% reduction in potable water use when compared to a mid-summer baseline using high-efficiency irrigation systems with controllers and moisture sensors. Non-potable water use strategies, such as rainwater reuse will be considered for irrigation. In addition, the landscape design will consist mostly of local, drought resistant species to minimize or eliminate the need for irrigation over the lifetime of the Project. Landscape areas will be designed to hold as much rainwater as practicable. The Applicant is also considering the use of rainwater capture for irrigation and the incorporation of green roofs and a rainwater harvesting tank for the building.

The Project will largely maintain the existing site drainage, replacing existing impervious rooftop and hardscape in kind on-site. The Project will be required to mitigate stormwater runoff to comply with City and MassDEP standards. Stormwater infrastructure will be designed and installed for the Project to reduce the runoff discharge rate and improve the quality of the runoff to the City's stormwater system and the Charles River basin.

As the design progresses, the design team will continue to analyze the potential to further increase the Project's potable water consumption, both indoors and outdoors.

Cool Roofs

Pursuant to Article 14.74 (c) of the Cambridge Zoning ordinance, the Project is taking several steps to include building-specific strategies to help reduce the Project's impact on the local urban heat island effect. The project aims to achieve this using a light-colored roofing membrane with a minimum initial solar reflective index (SRI) of 82 (or three-year aged SRI of 64), hardscape materials with an initial solar reflectance (SR) of 0.33 or greater (or three-year aged SR of 0.28), and a below-grade parking structure that greatly reduces the uncovered and impervious surface area needed for the Project's required parking.

The Applicant is also exploring the use of green roof cover, where feasible. Vegetation and shading structures will also be employed to shade the building and outdoor spaces, where possible. The roof membrane on all Project Components will be a high albedo roof product, excluding any green roof areas. All vehicle parking supporting the Project will

The Applicant understands the City Council approved a zoning petition on May 3, 2021 that would require installation of green roofs, or bio-solar roofs on future construction and significant rehab of buildings that are 20,000 square feet and larger. The Applicant is taking this requirement into account as the design advances for the remaining phases of the Project.

Monitoring

Pursuant to Article 14.74 (d) of the Cambridge Zoning Ordinance, the Applicant has a robust internal program for tracking building energy use over time, using Energy Star Portfolio Manager and other tools. The Project will include an energy management system to monitor operation of equipment or systems that are not already directly metered for electric or gas use. There will also be a centrally monitored electronic metering network in the base building design that is capable of being expanded to accommodate and document the future tenant sub-metering.

In compliance with the Cambridge Building Energy Use Disclosure Ordinance, Chapter 8.67 of the Municipal Code, the Applicant will report energy use.

Lastly, as mentioned in the 'Commissioning' section of this report, the Project will be implementing monitoring-based commissioning plan which will allow the building operators to track energy consumption, detect faulty equipment operations, and identify / address unusual energy consumption trends as they occur.

Rooftop Equipment Noise Mitigation

Pursuant to Article 14.74 (e) of the Cambridge Zoning Ordinance, the MEPFP system located near, discharging at, or on the roof shall be selected to be low sound models to reduce their sound emissions, where such selections are possible during the design process. In general, equipment will have variable speed drives to reduce equipment capacity and lower sound emissions when the equipment needs to operate at a lower capacity. Furthermore, equipment shall include sound attenuators, equipment enclosures, and noise barriers to mitigate sound emissions to adjacent buildings and the surrounding community to comply with the City of Cambridge Noise Ordinance at full capacity operations and produce even lower sound levels when the demands from the building and equipment capacity are reduced.

Commissioning

Pursuant to Article 22.24.2 of the Cambridge Zoning Ordinance, the Applicant will pursue commissioning in line with LEED v4 Fundamental and Enhanced Commissioning requirements. The commissioning agent will perform the scope of work required to comply with the prerequisite 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. Enhanced commissioning scope will include reviewing the Owner's Project Requirements, and the Basis of Design, creating, distributing and implementing a commissioning plan, performing a design review of the project documents, reviewing contractor submittals, witnessing on-site installations and testing and performing commissioning of installed HVAC, lighting, lighting controls and domestic hot water systems. Monitoring-based commissioning in line with LEED v4 Enhanced Commissioning Option 1 Path 2: Enhanced and Monitoring-Based Commissioning will also be pursued. Monitoring-based commissioning allows the building operators to track energy consumption, detect faulty equipment operations, and identify / address unusual energy consumption trends as they occur.

The Applicant will also be pursuing envelope commissioning in line with LEED v4 Enhanced Commissioning Option 2: Envelope Commissioning. The building envelope commissioning agent will perform the scope of work required to comply with the credit in accordance with ASHRAE Guideline 0–2005 and the National Institute of Building Sciences (NIBS) Guideline 3–2012, Exterior Enclosure Technical Requirements for the Commissioning Process, as they relate to energy, water, indoor environmental quality, and durability.

Resiliency

The Applicant has studied the vulnerability of the infill development sites for the potential of precipitation-based inland flooding events. Potential building design resiliency measures being considered include limiting basement areas, and other improvements that may mitigate potential flooding. Additionally, ground floor finish elevations for the Project will be raised to the greatest extent possible to reduce the risk of internal flooding. Flood-resilient materials will be specified for first floor uses, where practicable.

Flood prevention techniques could include: sealed wall penetrations for cable and electrical lines; watertight door barriers; septic line backflow prevention valves, sump pumps, and discharge pumps—all of which could be connected to auxiliary external generator connections or resilient backup power. In addition, the Project is anticipated to include green roofs/roof gardens where feasible, and roofing membranes with high SRI to reduce the volume of storm water runoff and reduce solar heat gain/minimize air conditioning loads, respectively. Additionally, high-performance curtain wall is being considered to maximize views and daylighting of interior spaces, thus reducing overall lighting loads and associated internal heat gains, which has a direct impact on the space cooling load. As climate change analysis shows, the rising temperature increases the space cooling demand in the Cambridge climate; therefore, any strategy that can reduce the space cooling demand is considered an adaptive strategy for climate change.

On-site renewable energy, and a district energy network also provide opportunities for added resiliency during periods of power loss during storms. While the KSURP area is served by underground utility power lines and gas mains, and as such, is not normally effected by storms that disrupt power or gas transmissions, according to Massachusetts Department of Energy Resources (DOER), the Kendall Square Cogeneration Station (the “Cogeneration Station)”) has been registered by the ISO-NE as a black start generation asset that can operate in island mode to provide both electricity to the Cambridge grid and thermal energy to the KSURP area in the event of a grid outage.

On-site combined heat and power (CHP), or solar PV, generally will operate in phase with the incoming utility power and needs incoming power to synchronize phase delivery. In “island mode”, generators and CHP systems can be made to operate independently of the grid and self-synchronize power phasing with on-site solar. However, this approach is normally used in large-scale shelter locations only, when long-term operation may be needed to protect a group of people.

In most cases, the proposed commercial building will shut down and send occupants home in storm-related power failure scenarios. Any generators provided will most likely be optional standby generators that are sized to maintain server room or process operations only. The capacity provided by solar PV, even if the available space is maximized, will not provide all power needed for normal operations. A CHP system could be used to provide limited ongoing operation, but the economics of such a system when compared to the likelihood of repeated power outages in the Kendall Square area would not be favorable. Storm response actions and resiliency measures will be incorporated into tenant guidelines, including guidance related to tenant fit out of commercial space, particularly those located on the lower floors.

Health and Wellness

Human health and wellness are addressed in the Project through design, operations, and occupant behavior. Within the Project, special attention will be given to address human health and comfort during construction and once the building is occupied. This will be accomplished by implementing pollutant reduction strategies, using non-toxic materials, providing fresh air to occupants, installing individual lighting and heating controls, and by providing natural daylight and views to outdoor green spaces. Tenant Design and Construction Guidelines will include comfort related requirements such as installing CO2 sensors in all regularly occupied spaces.

The Applicant is also exploring the use of principles of the WELL and/or Fitwel Building Standards, which place human health and wellness at the center of design and can encourage and educate future tenants on healthy living practices. Active design principles, encouraging physical and social activity, will be employed where possible. The Project site will include vibrant spaces where people can safely walk, bike, use transit, and access open spaces. Ground level outdoor spaces will be easily accessible to both building occupants and visitors alike.

Embodied Carbon

The Applicant understands that, while CO_2 emissions are a major concern related to a building's operation, many of the prominent building materials commonly used in the built environment include a carbon-intensive life cycle that needs to be considered if the Project is to accurately assess the carbon impact of the building.

To quantify the embodied carbon impact of the Project, the design team will be performing a whole-building life cycle analysis (LCA) using tools like Athena, Tally, or One Click LCA. Additionally, the design team will ensure that the specifications call for materials and products with high-recycled content and have no or very minimal carbon impact by using the Embodied Carbon Calculator in Construction (EC3) Tool. The team will also use environmental product declarations (EPDs) to assess individual product's embodied carbon impact.

Lastly, products that sequester carbon (i.e. wood) will be used, where practicable.

LEED Scorecard

Commercial East at 250 Binney Street (the “Project”) was reviewed for compliance using the USGBC’s LEED for Core & Shell (LEED-CS), version 4 rating system. The Project is targeting **66** out of a possible 110 credit points with an additional **32** credit points still undergoing evaluation to determine feasibility of achievement. By targeting **66** credit points, the Project anticipates meeting the City of Cambridge requirement to be LEED v4 Gold ‘certifiable’. In addition to the City of Cambridge requirements, the Project will be registered under the LEED-CS v4 rating system and will be pursuing formal certification with the USGBC.

The team will continue to evaluate design options against LEED requirements with the goal to design and construct a building that minimizes its impact on the environment, creates an engaging and healthy space for occupants and reduces operating costs. Several credits remain designated as ‘Maybe’ due to the uncertainty of future design decisions, which is common at this phase of the Project. The team will continue to evaluate LEED credits to pursue to ensure enough of a "point cushion" to ensure the LEED Gold requirement is met.

The USGBC recently released the beta version of the LEEDv4.1 rating system which is intended to serve as an update to (and improvement upon) LEEDv4. Recent guidance issued by the USGBC allows LEEDv4 projects to substitute any prerequisite or targeted credit for the LEEDv4.1 equivalent. Credits these buildings intend to pursue using the LEED v4.1 criteria have been denoted with (LEEDv4.1) adjacent to the credit name within the scorecard below and ensuing credit narratives.

Y	M	N			
1	**0**	**0**	**Integrative Process**		**1**
1			Credit 1	Integrative Process	1

19	**1**	**0**	**Location and Transportation**		**20**
		N	Credit 1	LEED for Neighborhood Development Location	
2			Credit 2	Sensitive Land Protection	2
3			Credit 3	High Priority Site	3
6			Credit 4	Surrounding Density and Diverse Uses	6
6			Credit 5 (LEEDv4.1)	Access to Quality Transit	6
	1		Credit 6 (LEEDv4.1)	Bicycle Facilities	1
1			Credit 7 (LEEDv4.1)	Reduced Parking Footprint	1
1			Credit 8 (LEEDv4.1)	Electric Vehicles	1

5	**5**	**1**	**Sustainable Sites**		**11**
Y			Prereq 1	Construction Activity Pollution Prevention	Required
1			Credit 1	Site Assessment	1
	1	1	Credit 2	Site Development - Protect or Restore Habitat	2
	1		Credit 3	Open Space	1
	3		Credit 4 (LEEDv4.1)	Rainwater Management	3
2			Credit 5	Heat Island Reduction	2
1			Credit 6	Light Pollution Reduction	1
1			Credit 7	Tenant Design and Construction Guidelines	1

5	**6**	**0**	**Water Efficiency**		**11**
Y			Prereq 1	Outdoor Water Use Reduction	Required
Y			Prereq 2	Indoor Water Use Reduction	Required
Y			Prereq 3	Building-Level Water Metering	Required
1	2		Credit 1	Outdoor Water Use Reduction	3

2	3		Credit 2	Indoor Water Use Reduction	5
1	1		Credit 3	Cooling Tower Water Use	2
1			Credit 4	Water Metering	1

18	11	4	**Energy and Atmosphere**		33
Y			Prereq 1	Fundamental Commissioning and Verification	Required
Y			Prereq 2	Minimum Energy Performance	Required
Y			Prereq 3	Building-Level Energy Metering	Required
Y			Prereq 4	Fundamental Refrigerant Management	Required
6			Credit 1	Enhanced Commissioning	6
10	8		Credit 2	Optimize Energy Performance	18
	1		Credit 3	Advanced Energy Metering	1
		2	Credit 4	Demand Response	2
	1	2	Credit 5	Renewable Energy Production	3
	1		Credit 6	Enhanced Refrigerant Management	1
2			Credit 7	Green Power and Carbon Offsets	2

3	7	4	**Materials and Resources**		14
Y			Prereq 1	Storage and Collection of Recyclables	Required
Y			Prereq 2	Construction and Demolition Waste Management Planning	Required
	4	2	Credit 1 (LEEDv4.1)	Building Life-Cycle Impact Reduction	6
1		1	Credit 2 (LEEDv4.1)	BPDO – EPD	2
	1	1	Credit 3 (LEEDv4.1)	BPDO - Sourcing of Raw Materials	2
1	1		Credit 4 (LEEDv4.1)	BPDO – Material Ingredients	2
1	1		Credit 5 (LEEDv4.1)	Construction and Demolition Waste Management	2

7	0	3	**Indoor Environmental Quality**		10
Y			Prereq 1	Minimum Indoor Air Quality Performance	Required
Y			Prereq 2 (LEEDv4.1)	Environmental Tobacco Smoke Control	Required
Y			Prereq 3	Minimum Acoustic Performance	Required
2			Credit 1	Enhanced Indoor Air Quality Strategies	2
3			Credit 2 (LEEDv4.1)	Low-Emitting Materials	3
1			Credit 3	Construction Indoor Air Quality Management Plan	1
		3	Credit 4	Daylight	3
1			Credit 5	Quality Views	1

6	0	0	**Innovation**		6
1			Credit 1	Innovation: Purchasing - Lamps	1
1			Credit 2	Innovation: O&M Starter Kit	1
1			Credit 3	Exemplary Performance: Heat Island Effect	1
1			Credit 4	Exemplary Performance: EPDs / Material Ingredients	1
1			Credit 5	Pilot Credit: Integrative Analysis of Building Materials	1
1			Credit 6	LEED Accredited Professional	1

2	2	0	**Regional Priority (earn up to 4 points)**	4

1			Credit 1	Regional Priority Credit: LTc3 High Priority Site (2 points)	1
	1		Credit 2	Regional Priority Credit: SSc4 Rainwater Management (2 points)	1
	1		Credit 3	Regional Priority Credit: WEc2 Indoor Water Use Reduction (4 points)	1
1			Credit 4	Regional Priority Credit: EAc2 Optimize Energy Performance - 17% (8 points)	1

66	32	12	TOTALS	Possible Points: 110

LEED Narrative

Pursuant to Article 22.25.1 (b) of the Cambridge Zoning Ordinance, the Project meets the LEEDv4 Core & Shell Minimum Program Requirements, required, Prerequisites, and targeted Credits through the following strategies:

Integrative Process (IP)

IP Credit 1 Integrative Process — 1 credit point

The Project will meet the intent of this credit through identification of cross discipline opportunities to design a sustainable building project. Sustainable design focused meetings will be conducted in early design to assist the team in establishing shared sustainable design and energy / water efficiency goals for the project. Early design phase energy modeling is being conducted to review systems synergies and assess areas where energy loads may be significantly reduced. A water use analysis will be conducted to aid in establishing water use reduction targets.

The Project will continue to conduct interdisciplinary early meetings focusing on sustainability. These meetings will include the ownership group, architect, MEP engineer, energy analyst, and sustainability expert. An initial workshop was conducted in March 2021.

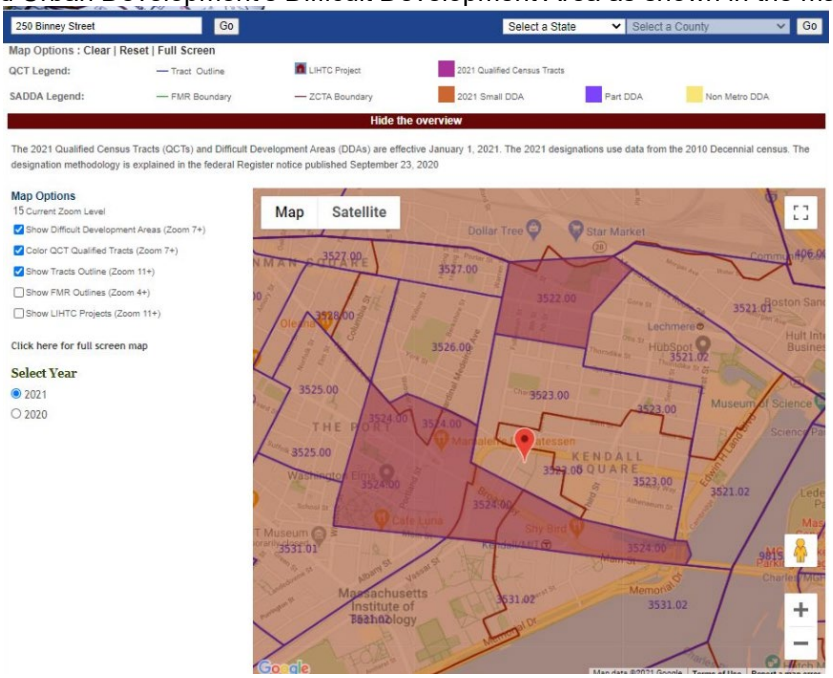
Location and Transportation (LT)

LT Credit 2 Sensitive Land Protection — 2 credit points

The Project will meet the credit requirements by locating the building on land that has been previously developed.

LT Credit 3 High Priority Site — 3 credit points

The Project will meet Option 2 requirements by being located on a site in a U.S. Department of Housing and Urban Development's Difficult Development Area as shown in the map below.



Additionally, the Project site soils are contaminated and will require remediation.

LT Credit 4 Surrounding Density and Diverse Uses (LEEDv4.1) 6 credit points

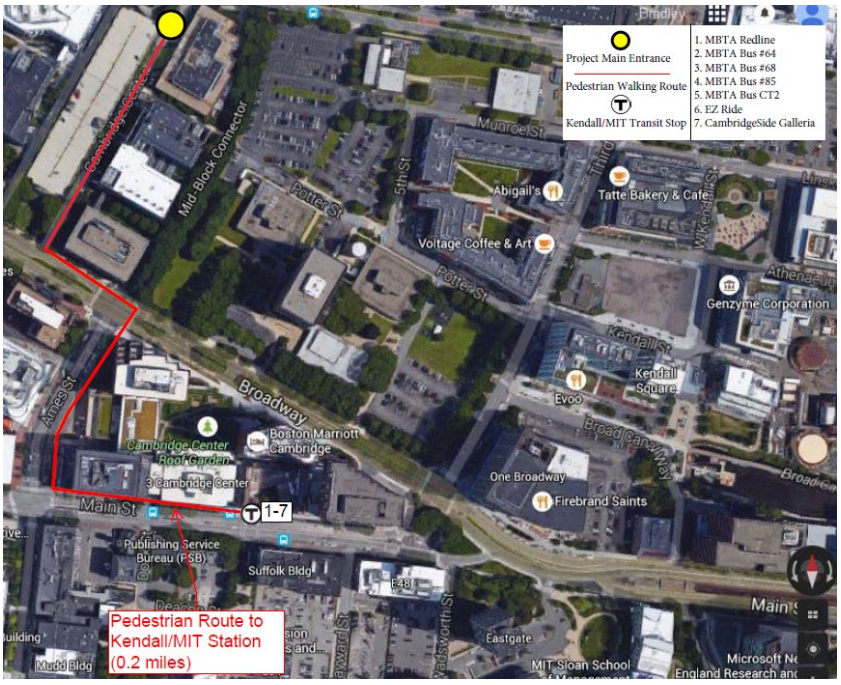
The Project meets Option 1 for Surrounding Density by being located in an area with an average density greater than 35,000 sf/acre. The Project meets Option 2 for Diverse Uses by being located within ½ mile walking distance of at least 9 publicly available diverse uses in at least three separate use categories.

The Project is located within ½ mile of the following 9 diverse uses:

Category	Use Type	# of Diverse uses	Business Name	Distance (mi.)
Food Retail	Grocery Store	1	Brothers Marketplace	0.4 mi.
Community Serving Retail	Convenience Store	2	Fresh Mart	0.5 mi.
	Hardware Store	3	Fran-Dan Corporation	0.4 mi.
	Other Retail	4	MIT COOP @Kendal Sq.	0.3 mi.
Services	Restaurant	5	B.GOOD	0.3 mi.
	Health Club	6	Cambridge Athletic Club	0.4 mi.
	Bank	7	Bank of America Financial Center	0.3 mi.
Civic and Community Facilities	Police or Fire station	8	Cambridge Police Dept.	0.3 mi.
	Public Park	9	Danny Lewin Park	0.3 mi.

LT Credit 5 Access to Quality Transit (LEEDv4.1) 4 credit points

The Project is located within ½ mile walking distance of the Kendall/MIT MBTA station. This transit station provides occupants with access to 445 weekday rides and 264 weekend rides via the MBTA Redline, and MBTA bus lines 64, 68, 85 and CT2 which is greater than the 360 weekday and 216 weekend trips required for 6 points.



LT Credit 6 Bicycle Facilities (LEEDv4.1) *1 maybe point*

Short term and long-term bike storage will be provided for the building occupants and visitors. The quantity of short-term and long-term bike parking will meet the minimum LEED requirements as Cambridge bike parking requirements are more stringent. The Owner is evaluating the possibility of providing shower facilities accessible by building occupants (including any future retail employees). To achieve the point, a minimum of 4 total exterior short-term and 68 total covered long-term bicycle

storage spaces are needed for visitors and regular occupants of the Project. Additionally, 10 total shower and changing facilities will need to be provided for use by building occupants. The immediate neighborhood provides a direct connection to a local bicycle network that links to a variety of services with pedestrian and cyclist access.

The Project will meet City of Cambridge requirements for bike storage.

LT Credit 7 Reduced Parking Footprint (LEEDv4.1) 1 credit point
A new, underground parking garage is proposed to provide on-site parking for employees and visitors. The new parking garage will provide up to 736 parking spaces for the Project which results in a >41% reduction to the baseline number of parking spaces calculated from the ratios set forth in the LEED reference guide.

LT Credit 8 Green Vehicles (LEEDv4.1) 1 credit point
The Owner has committed to provide EV charging stations to satisfy the LEED credit by providing EV charging stations for 5% of the total parking capacity. There are 736 parking spaces that will be provided. For those spaces, the Owner will outfit 5% as electric vehicle charging stations (37), 10% with electric vehicle charging station infrastructure (74), or a combination of both electric vehicle charging stations and electric vehicle-ready spaces to meet the credit requirements.

Sustainable Sites (SS)

SS Prerequisite 1: Construction Activity Pollution Prevention Required
The construction manager will be required to submit and implement an appropriate SWPPP/Erosion and Sedimentation Control (ESC) Plan for construction activities related to the construction of the Project. The ESC Plan will conform to the erosion and sedimentation requirements of the applicable NPDES regulations and specific municipal requirements for the City of Cambridge. Additionally, the ESC Plan will address management and containment of dust and particulate matter generated by on site demolition and construction activities.

SS Credit 1: Site Assessment 1 credit point
A comprehensive site assessment was completed as part of the MXD Infill Development Concept Plan. The design team will continue to study topography, hydrology, climate, vegetation, soils, human use, and human health effects specific to the Project to inform the design.

SS Credit 2: Site Development – Protect or Restore Habitat *1 maybe point*
The Owner is considering making a donation to a qualified Land Trust equivalent to $0.20 per square foot of project site area. A decision on whether this credit will be pursued will likely not occur until the Construction Phase.

SS Credit 3: Open Space *1 maybe point*
The project design will prioritize providing as much physically accessible outdoor space as possible. Once the landscape design progresses further, calculations will be performed to determine if the open space provided is equal to at least 30% of the total site area.

SS Credit 4: Site Development – Rainwater Management *3 maybe points*
The Project will implement a stormwater management plan that decreases the volume of stormwater runoff and the peak runoff rate by capturing and treating runoff using acceptable best management practices (BMP's). Some of the BMP's being considered are as follows:

- *Subsurface infiltration systems*
- *Rainwater harvesting and reuse*
- *Stormwater detention tanks*
- *Pervious landscaped areas*

- *Deep sump, hooded catch basins*

The Project must comply with the Mass DEP Stormwater Management Policy, as well as reduce the peak rate for the 25-year design storm in the post-development condition to meet the two-year predevelopment condition, as required by Cambridge Department of Public Works (CDPW). Therefore, the Project will greatly improve stormwater contributions to the CDPW stormwater infrastructure by meeting the required mitigation thresholds.

SS Credit 5 Heat Island Reduction 2 credit points
The roof and non-roof hardscape materials will include light-colored surfaces to reduce the overall heat island effect impact on the project site. The roof membranes will be high albedo roof products with an initial SRI value of 82 minimum. The inclusion of a green roof will be further studied as the design progresses. Paving materials will target an initial SR value of 0.28 minimum. All parking associated with the Project will be located undercover.

SS Credit 6 Light Pollution Reduction 1 credit point
The Project will meet uplight and light trespass requirements by complying with the LEED v4 BUG Rating method. To meet credit requirements, the site lighting will not exceed the LEEDv4 allowable luminaire backlight, uplight and glare ratings for Lighting Zone 3.

SS Credit 7 Tenant Design and Construction Guidelines 1 credit point
Tenant Design and Construction Guidelines will be developed outlining the sustainable design and energy efficiency measures in the core and shell phases and providing detailed guidance for the future tenants to design and build in alignment with the project sustainability goals. Information will also be included to assist tenants in pursuing LEED certification for their spaces. The team will encourage tenants to pursue LEED and/or WELL certification as part of their build out.

Water Efficiency (WE)

WE Prerequisite 1 Outdoor Water Use Reduction, 30% Required
The Project will meet the minimum requirement of a 30% reduction in potable water use for irrigation. The Project is still evaluating if permanent irrigation will be included as part of the Project. If permanent irrigation is included for the Project, it will use efficient technology such that water use will show a minimum 50% reduction against a LEED baseline.

WE Prerequisite 2 Indoor Water Use Reduction, 20% Reduction Required
Through the specification of low flush and flow and high efficiency plumbing fixtures, the Project will reduce potable water consumption by at least 20% over the baseline calculated for the building (not including irrigation) after meeting Energy Policy Act of 1992 fixture performance requirements.

WE Prerequisite 3 Building Level Water Metering Required
The Project will meet the requirements of this prerequisite by installing permanent water meters that measure the total potable water use of the building and associated grounds. In addition to installing the meters, The Owner will commit to sharing water usage data with the USGBC for a five-year period beginning on the date the Project accepts LEED certification or typical occupancy, whichever comes first.

WE Credit 1 Outdoor Water Use Reduction (LEEDv4.1) 1 credit point, *2 maybe points*
The landscape design will incorporate native and adaptive plantings and the design of the irrigation system (if included in Project scope) will target at least a 50% reduction (1 point) in potable water use when compared to a mid-summer baseline using high controller efficiency and moisture sensors.

As the design progresses, the team will continue to analyze approaches to potentially achieve 75% (2 points) or 100% (3 points) reductions in potable water use for irrigation.

WE Credit 2 Indoor Water Use Reduction 2 credit points, *3 maybe points*
Through the specification of low flow and high efficiency plumbing fixtures, the Project will implement water use reduction strategies that at a minimum result in a 30% reduction in potable water use annually when compared to EPA baseline fixtures for the building (not including irrigation) after meeting Energy Policy Act of 1992 fixture performance requirements.

Additional analysis will be performed will more aggressive water-saving fixtures to determine if the higher thresholds can be achieved.

WE Credit 3 Cooling Tower Water Use (LEEDv4.1) 1 credit point, *1 maybe point*
The Project will conduct a one-time potable water analysis for the cooling tower water and calculate the cycles of concentration. Through increasing the level of treatment in the make-up and/or condenser water, the Project will achieve the calculated maximum number of cycles before any of the parameters analyzed exceed their maximum allowable levels of concentration. The control parameters that are required to be assessed are: Ca, total alkalinity, SiO_2, Ci, and conductivity.

The team will analyze the potential for using non-potable water for cooling tower makeup and/or increasing the treatment of the cooling tower makeup water to achieve 25% more cycles.

WE Credit 4 Water Metering 1 credit point
To support water management and identify opportunities for additional water savings, the Project will include permanent water meters for a minimum of two water subsystems.

Energy and Atmosphere (EA)

EA Prerequisite 1 Fundamental Commissioning and Verification Required
A commissioning agent will be engaged by the Owner for purposes of providing fundamental commissioning services for the building energy-related systems by the end of Design Development. The commissioning agent will perform the scope of work required to comply with the prerequisite in accordance with ASHRAE Guideline 0-2005 and ASHRAE Guideline 1.1-2007 for HVAC & R systems.

The commissioning agent (CxA) will be independent of the project's design and construction management teams. The commissioning agent will report findings to the Owner. The Owner's Project Requirements and the Basis of Design documents will be provided to the CxA for review.

The following systems will be included in the Commissioning scope of work:

- Heating, ventilating, air conditioning and refrigeration (HVAC&R) systems
- HVAC controls
- Lighting controls
- Electrical systems
- Domestic hot water systems
- Plumbing and pumps
- Building Automation System
- PV (if applicable)

EA Prerequisite 2 Minimum Energy Performance Required
To meet the prerequisite, the Project's building performance will demonstrate a minimum of 2% improvement in energy use by cost when compared to a baseline building's performance as calculated using the rating method in Appendix G of ANSI/ASHRAE/IESNA Standard 90.1-2010. The Project is also required to meet the MA Energy Code and MA Stretch Energy Code requirements. Comprehensive, iterative energy modeling will be used to explore design options to meet all Code

requirements and to provide substantiation for the LEED application. Energy performance goals have been established and will be monitored throughout the design phase.

EA Prerequisite 3 Building Level Energy Metering Required

To meet the requirements of this prerequisite, the Project will install whole building energy meters for gas and electricity. In addition to installing the meters, the Project will commit to sharing energy usage data with the USGBC for a five-year period beginning on the date it accepts LEED certification or typical occupancy, whichever comes first.

EA Prerequisite 4 Fundamental Refrigerant Management Required

CFC based refrigerants will not be used in the Project's HVAC & R systems.

EA Credit 1 Enhanced Commissioning 6 credit points

In addition to EApr1 Fundamental Commissioning and Verification requirements, Option 1 Path 2 Enhanced and Monitoring-Based Commissioning and Option 2 Building Envelope Commissioning will be pursued by the Project. The Owner will engage a commissioning agent to review the proposed design and verify the building systems meet the Owner's expectations and requirements.

The following commissioning process activities in addition to those required under EA Prerequisite Fundamental Commissioning and Verification will be completed by the commissioning agent, 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:

- 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.

Requirements for enhanced and monitoring-based commissioning will be included in the OPR and BOD.

EA Credit 2 Optimize Energy Performance 10 credit points, *8 maybe points*

For this submission, the Project is carrying an estimate that the building will perform 21% better on an annual energy cost basis than the ANSI/ASHRAE/IESNA Standard 90.1-2010 baseline building. We anticipate these percentages to increase as a result of the team's commitment to energy efficiency to meet the MA State Stretch Energy Code. Please see the Net Zero Narrative report for more information.

The team recognizes the importance of energy efficiency and will continue to evaluate opportunities reduce energy use and increase points within the Energy & Atmosphere category, specifically within the Optimize Energy Performance credit.

EA Credit 3: Advanced Energy Metering *1 maybe point*

Advanced energy meters will be considered for installation as part of the base building. If this credit is pursued, tenants would be capable of independently measuring energy consumption for all systems dedicated to their space (electricity, chilled and or condenser water for cooling, hot water for heating, etc.) on a floor-by-floor basis.

EA Credit 5: Renewable Energy Production *1 maybe point*

On-site renewable energy systems (i.e. PV) are being considered to potentially offset 1% (1pt) of the predicted annual energy costs for the Project. Additional analysis is required to determine if the installation of PV is cost-effective.

EA Credit 6 Enhanced Refrigerant Management *1 maybe point*
The HVAC equipment installed in the base building uses low-impact refrigerants that have low global warming and ozone depletion potential. Calculations will be run to determine compliance once equipment selections have been made.

EA Credit 7: Green Power and Carbon Offsets 2 credit points
The Owner will purchase green power and carbon offsets through a 5-year contract to offset a minimum of 100% of the Project's energy use with renewable sources.

Materials and Resources (MR)

MR Prerequisite 1 Storage and Collection of Recyclables Required
Storage of collected recyclables will be accommodated in a designated recycling area within the Project. Recyclable materials collected will include mixed paper, corrugated cardboard, glass, plastics, and metals, and the safe disposal of at least two of the following: batteries mercury-containing lamps, and/or electronic waste.

MR Prerequisite 2 Construction and Demolition Waste Management Planning Required
The Project will meet the requirements of this prerequisite by including a Construction Waste Management section in Division 1 of the project manuals. The specifications will include direction for the construction manager to submit and implement a compliant waste management plan for the duration of construction. Waste diversion goals for the Project will include at least five materials targeted for diversion.

MR Credit 1 Building Life-Cycle Impact Reduction (LEEDv4.1) *4 maybe points*
The Owner is considering engaging the architect to conduct a whole-building life-cycle assessment for the Project. If the analysis is performed, it would be used to refine the design accordingly such that it demonstrates that the structures and enclosures achieve at least a 5% reduction in a minimum of three of the six impact categories when compared to a baseline building. One of the impact categories must be global warming potential. The remaining impact categories that would be assessed are depletion of the stratospheric ozone layer, acidification, eutrophication, formation of tropospheric ozone and depletion of nonrenewable energy resources.

MR Credit 2 BPDO: Environmental Product Declarations (LEEDv4.1) 1 credit point
The Project will achieve this credit via Option 1. The technical specifications will include direction for the construction manager and their sub-contractors to provide and submit materials and products Environmental Product Declarations that conform to ISO 14025, 14040, 14044, and EN 15804 or ISO 21930 and have at least a cradle to gate scope. The team will work to provide documentation for 10 different permanently installed products sourced from at least 3 different manufacturers.

MR Credit 3 BPDO: Sourcing of Raw Materials (LEEDv4.1) *1 maybe point*
The technical specifications will include information for applicable products and materials to meet one of the following extraction criteria (as applicable): Extended producer responsibility, Bio-Based materials, FSC wood, Materials reuse, Recycled Content, and/or regionally extracted and manufactured (within 100 miles of the project site). The Project will attempt this credit, but compliance cannot be assured until well into construction of the building.

MR Credit 4 BPDO: Material Ingredients (LEEDv4.1) 1 credit point, *1 maybe point*
The Project will pursue Option 1 and Option 2 for product and material disclosure, and by selecting products and materials with third party confirmation of reduced hazardous substances. The project manuals will include the information and direction for the construction manager and their sub-contractors to provide and submit materials and products documentation identifying the chemical

make-up. The documentation may be Health Product Declarations, Cradle-to-Cradle or Declare certification. The team will provide documentation for 10 different permanently installed products sourced from at least 3 different manufacturers.

MR Credit 5 C&D Waste Management (LEEDv4.1) 1 credit point, *1 maybe point*
The Project will meet the requirements of this credit by including a Construction Waste Management section in Division 1 of the project manuals. The specifications will include direction for the construction manager to attempt to divert a minimum of 50% of the demolition and construction waste generated on site from area landfills. On-site separation of waste will be prioritized as part of the strategy to meet this credit.

To achieve an additional point, the Project will need to generate less than 10 lbs/sf of total waste (construction and demolition).

Indoor Environmental Quality (IEQ)

IEQ Prerequisite 1 Minimum IAQ Performance Required
The Project's mechanical systems are being designed to exceed the requirements of ASHRAE Standard 62.1-2010 sections 4 through 7. The mechanical engineer will complete a ventilation rate procedure (VRP) calculator to verify compliance for the Project. Outdoor airflow monitors will be included in the Project.

IEQ Prerequisite 2 Environmental Tobacco Smoke Control (LEEDv4.1) Required
Smoking will be prohibited in the Project and within 25' of the building. Signage will be posted within 10' of all building entrances to indicate the interior and exterior no-smoking policy.

IEQ Credit 1 Enhanced Indoor Air Quality Strategies 2 credit points
The Project is being designed to incorporate permanent entryway systems, properly enclosed and ventilated chemical use/storage areas, and compliant filtration media (MERV 13+).

Additionally, the Project anticipates providing ventilation rates that are at least 30% above the minimum requirements of ASHRAE 62.1-2010.

IEQ Credit 2 Low Emitting Materials 3 credit points
The Project will achieve this credit through meeting the compliance criteria for the following compliant categories: interior paints and coatings, adhesives and sealants, flooring, ceilings, insulation, and composite wood. Intending to achieve at least 4 categories for 3 points.

IEQ Credit 3 Construction Indoor Air Quality Management Plan 1 credit point
The project manuals will include direction for the Construction Manager to develop and implement an Indoor Air Quality Management plan in compliance with applicable control measures as stated in the SMACNA IAQ Guidelines for Occupied Buildings under construction 2nd Edition, 2007 ANSI/SMACNA 008-2008 Chapter 3. Additional measures will be implemented to ensure absorptive materials will be protected from moisture damage.

IEQ Credit 8 Quality Views 1 credit point
A direct line of sight to the outdoors and/or atrium will be provided for 75% of the regularly occupied floor area of the Project. 75% of the regularly occupied floor area will also have quality views to the outdoors which will include multiple lines of sight; unobstructed views; views to landscaped areas, sky, pedestrian walkways, and streetscapes.

Innovation (IN)

Inc1 Innovation: Purchasing - Lamps 1 credit point

The Project will achieve one innovation point by complying with LEED Innovation Credit: Purchasing – Lamps, which requires that the calculated average mercury content for the Project be below 35 picograms of Hg per lumen hour. The Project will be 100% LED.

Inc2 Innovation, O & M Starter Kit 1 credit point
The Owner will develop and implement compliant Green Cleaning and Integrated Pest Management policies that will ensure reduce the use of chemical inputs and provide increased human health and wellbeing during operation.

INc3 Exemplary Performance: SSc5 Heat Island Reduction 1 credit point
The Project will achieve Exemplary Performance for Heat Island Reduction by meeting both Option 1: Roof and Nonroof and Option 2: Parking Under Cover.

INc4 Innovation, TBD 1 credit point
The Project is exploring several options to achieve this Innovation credit and are confident that a path will be found to earn all innovation credits. Options include, but are not limited to, exemplary performance in MRc2/3 BPDO: Environmental Product Declarations/Material Ingredients, Green Building Education, Occupant Comfort Survey, Social Equity within the Project team, Safety First policies, or Beauty and Design WELL feature compliance.

INc5 Pilot: Integrative Analysis of Building Materials 1 credit point
The Project will specify, purchase, and install three different permanently installed products that have a documented qualitative analysis of potential health, safety, and environmental impacts of the product over its life cycle.

INc6 LEED Accredited Professional 1 credit point
Many members of the team are LEED Accredited Professionals (APs).

Regional Priority (RP)

Regional Priority Credits (RPCs) are established by the USGBC to have priority for a particular area of the country. When a project team achieves one of the designated RPCs, an additional credit is awarded to the project. LEEDv4 RPCs applicable to the Cambridge area include: LTc3 High Priority Site (2 points), SSc4 Rainwater Management (2 points), WEc2 Indoor Water Use Reduction (4 points), EAc2 Optimize Energy Performance (17%/8 points), EAc5 Renewable Energy Production (3%/2 points), and MRc1 Building Life-Cycle Impact Reduction (2 points).

The Project is currently tracking the following RPCs:

EAc2 Optimize Energy Performance	1 credit point
LTc3 High Priority Site	1 credit point
SSc4 Rainwater Management	*1 maybe point*
WEc2 Indoor Water Use Reduction	*1 maybe point*

ATTACHMENT A
Energy Model Report

Environmental Performance Analysis

Blue Garage Commercial

250 Binney Street, Cambridge, MA

July 2, 2021

Prepared for: Boston Properties

Prepared by: enviENERGY Studio

enviENERGY
Sustainable Design Consulting

Executive Summary

The purpose of this energy study is to investigate the project compliance with the Massachusetts Energy Code requirements and to evaluate the impacts of several architectural and mechanical systems on the project overall energy use and cost. The minimum requirements of ASHRAE 90.1-2013 (Energy Code Baseline) and the proposed design assumptions for each building, are listed in the Energy Modeling Assumptions tables. As demonstrated in the report, in order to reduce the annual energy consumption of each building, the design team will implement a series of integrated strategies. The studies and analyses presented here focus on aspects of energy efficiency, thermal comfort, water conservation and GHG reduction that are most applicable to the early stages of design.

This energy analysis shows that all Proposed Design buildings meet and exceed the LEED v4 Minimum Energy Performance and MA Energy Code requirements.

	Electricity (kWh)	Natural Gas (Therms)	Total Site Energy (MBTU)	Total Source Energy (MBTU)	Total Site Energy Cost ($)	Performance Savings	
						Site Energy	Source Energy
B250- Energy Code Baseline	14,701,849	820,940	132,267	226,695	$ 3,620,932		
B250- Proposed Design	19,536,671	88,212	75,500	195,963	$ 3,639,436	42.9%	13.6%

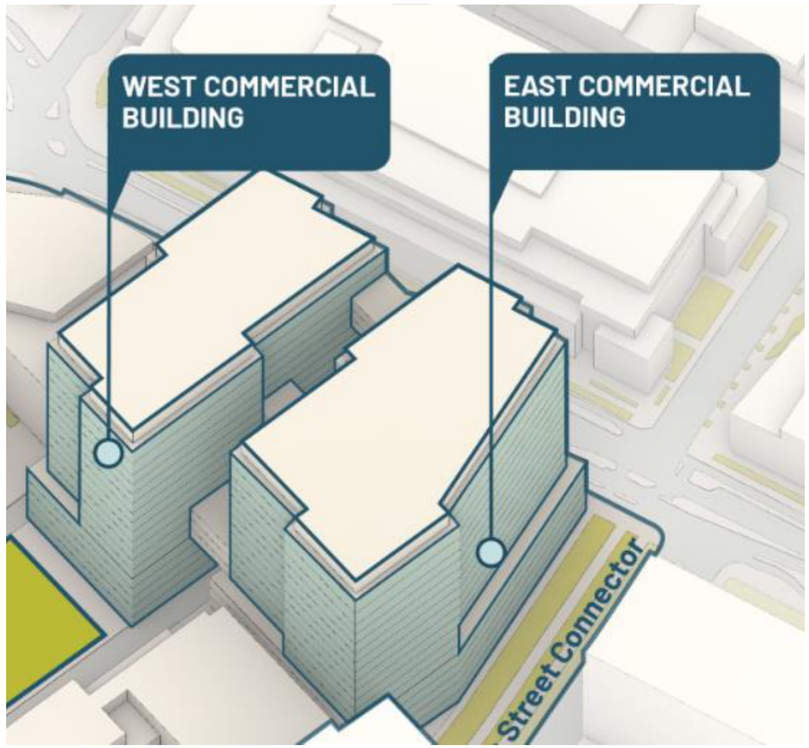
Methodology

The DOE2.3 based energy simulation program, eQuest 3.65, has been used in this analysis to generate the estimated annual energy savings associated with each proposed option. The building geometries are based on the preliminary massing, and the window-to-wall ratios are estimated based on the current design.

Please note that the proposed estimated energy performance and cost are not predictions of actual energy consumption or costs for the proposed design after construction. The actual energy use will differ from these estimates due to the variations in occupancy patterns and schedules, weather conditions, and building operation and maintenance, but the energy modeling results should serve as an accurate comparison tool.

The following energy models were generated:

- **Massachusetts Stretch Energy Code Baseline:** Following the Appendix G – Performance Rating Method and Mass Amendments to IECC 2018, the envelope, HVAC, lighting, and service water heating systems are modified to meet the minimum requirements of ASHRAE 90.1-2013 Standard. This model is used as the baseline for MA Energy Code analysis. Per C406.1 Requirements, both baseline and proposed models include three additional efficiency measures: (1) 10% reduction in lighting power density; (2) 10% increase in the HVAC system efficiencies; (3) Reduced air infiltration.
- **LEED v4 Baseline:** Per USGBC guidelines, LEED projects that are subject to alternative energy codes stringent than ASHRAE 90.1-2010 are allowed to demonstrate additional energy performance improvements. In this analysis, ASHRAE 90.1-2013 model was used as the baseline case for LEED. An additional 2-3% savings can be applied to the estimated LEED performance savings.
- **Proposed Options:** The proposed design represents the actual design.



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Energy Performance Analysis

Introduction

The project consists of two (2) core and shell lab/office buildings; It is assumed that 60% of the gross floor area in each commercial building is allocated to laboratory spaces and the rest will be office, common and back-of-house areas. The design team has divided the building elements into passive, building envelope, and active, MEP systems, and implemented measures so that the overall building envelope meets and exceeds the IECC 2018 envelope performance recommendations before introducing any active energy efficiency measures.

The proposed design incorporates the following energy conservation measures:

- High-performance window system; U-0.24 and SHGC-0.25
- High-efficiency LED light fixtures
- High-efficiency water-cooled centrifugal chillers with VSD
- High-efficiency cooling towers
- Konvekta Heat Recovery system
- Variable speed pumping systems
- Hybrid heating system: High-efficiency gas-fired condensing boilers plus air-to-water heat pump
- Low-flow plumbing fixtures

Setpoints

Setpoints were entered identically in both the baseline and proposed models. See below for the temperature setpoints used.

<u>Office and Laboratory:</u>

Heating set point:	70˚ F	Heating setback:	66˚ F
Cooling set point:	75˚ F	Cooling setback:	80˚ F

<u>Storage and Mechanical:</u>

Heating set point:	60˚ F	Heating setback:	60˚ F

Internal Gains

The interior lighting power densities in the commercial energy models has been modeled based on the building-area-method, following Table C405.3.2 of Massachusetts Amendments and a 10% reduction in the interior lighting power densities was applied as one of the C406 ECMs.
Automatic lighting controls for daylight utilization and for occupancy are accounted for in the analysis. In both the proposed and the baseline models, daylight controls are input per the minimum requirements of Section 9.4. As the occupancy sensors are assumed to match the code minimum, no additional credit has been taken.
End uses such as computers and receptacles and laboratory equipment are included as process gains. These are inputs to reflect the design team's understanding of the anticipated equipment usage and are identical between the baseline and the proposed models.
The occupancy reflects the design team's understanding of the typical number of people that will be in the building and is identical in the baseline and proposed models.

Building Envelope

The vertical elements of the envelope primarily consist of curtainwall system. In this preliminary analysis, the overall window area is approximately 41% of the building exterior wall area. High performance insulated glazing throughout with the overall window assembly U-value of 0.24 and SHGC of 0.25. The opaque area consists of insulated spandrel panels with an overall U-value of 0.10.

Mechanical Systems

The commercial building HVAC system will consist of 100% OA AHUs with Konvekta Energy Recovery Ventilators (modeled with 60% effectiveness) and Fan Coil Units which will be designed to provide heating, cooling, and ventilation for the building, meeting the requirements of ASHRAE 55, ASHRAE 62.1 and ASHRAE 90.1. Ventilation air will be provided by variable volume Energy Recovery Air Handling Units and future tenants will have the flexibility of installing 4-pipe Fan Coil Units or other terminal units. High-efficiency water-cooled centrifugal chillers will provide chilled water to the AHUs and FCUs. The hot water will be heated by a hybrid system including air-to-water heat pump system and high efficiency condensing gas boilers.

Energy Modeling Assumptions | 250 Binney Street

	Laboratory/ Office 60%/40%	Stretch Energy Code Baseline ASHRAE 90.1-2013 + MA Amendments		Proposed Design (BOD)
Envelope	**Windows**	Metal framing (fixed): U-value of 0.42; SHGC-0.40		BOD: 100% Curtainwall Upper levels(Triple-pane Glass): U-0.28 or lower; SHGC-0.30
	Window-To-Wall Ratio	40%		41%
	Roof	Insulation entirely above deck; R-30 c.i.; U-value of 0.032		R-30 c.i.; U-value of 0.032
	Slab-on-grade	Unheated: R-15 for 24 inch		Meets ASHRAE 90.1-2013 requirements
	Infiltration (Mandatory)	**C406 ECM #1:** Reduced air infiltration in accordance with C406.9 - 0.25 CFM/SF of building envelope		**C406 ECM #1:** Reduced air infiltration in accordance with C406.9 - 0.25 CFM/SF of building envelope and commitment to pressurization testing
	Exterior Walls	Steel-framed: R-13 + R-10 c.i.; U-0.055		Curtainwall system with continuous insulation behind mullion and spandrel; U-0.10
Interior Loads	**Occupancy**	Office: 250 SF/ Person Lab: 400 SF/ Person		Office: 250 SF/ Person Lab: 400 SF/ Person
	Interior Lighting	**C406 ECM#2:** 10% reduction per C406.3 0.64 W/SF Office **(0.576 W/SF)** 1.33 W/SF Laboratory **(1.197 W/SF)** 0.84 W/SF Lobby **(0.756 W/SF)**		**10% reduction per C406.3 (with lease agreement)** 0.576 W/SF Office 1.197 W/SF Laboratory 0.756 W/SF Lobby
	Plug Load	Office: 0.90 -1.1 W/SF (50% turndown) Lab: 4 W/SF (Including Fume Hoods)		Office: 0.90 -1.1 W/SF (50% turndown) Lab: 4 W/SF (Including Fume Hoods)
	Elevator Load	Each car at 11 kW		Each car at 11 kW
DHW	**Low-Flow Hot Water Fixtures**	LEED v4 Baseline		Target at least 30% reduction
	Water Heater type & Efficiency	Electric resistance		Electric Heaters

Energy Modeling Assumptions | 250 Binney Street

	Laboratory/ Office 60%/40%	Stretch Energy Code Baseline ASHRAE 90.1-2013 + MA Amendments	Proposed Design (BOD)
Primary HVAC System	**System Type**	System #7: VAV with reheat; Chilled water; Hot water	Ventilation: 100% OA AHUs + Konvekta Heat Recovery Lab: All-air VAV with reheat Office: FCUs/ Heat Pump
	Cooling Type & Efficiency	Water-cooled Centrifugal; ≥600 tons: 0.560 FL, 0.500 IPLV **C406 ECM#3:** 10% increase in minimum efficiencies per C406.2: 0.513 FL; 0.4851 IPLV	Variable Speed Centrifugal Chillers Full Load Efficiency = 0.560 kW/Ton; 0.355 NPLV ARI Condition: FL 0.520 kW/Ton; 0.340 NPLV **C406.2: 10% improvements to be targeted**
	Heating Type & Efficiency	Gas-fired Boiler; 82% efficiency **C406 ECM#3:** 10% increase in minimum efficiencies per C406.2: 90%	Condensing Boilers, 92% EFF, plus an air-to-water heat pump (sized at 20-25% of the heating capacity) **C406.2: 10% improvements in thermal efficiency is achieved**
	HW Supply Temperature & Control	180˚ F; OA Temperature Control	140 ˚ F; OA Temperature Control
	Hot Water ΔT	50˚ F	40˚ F
	HW Pumps	Primary only; variable speed	Primary and Secondary; variable speed pumps
	CHW Supply Temperature & Control	44˚ F; OA Temperature Control	42˚ F; OA Temperature Control
	Chilled Water ΔT	12˚ F	16˚ F
	CHW Pumps	variable speed on secondary pump	Primary; Variable speed pumps
	Cooling Towers	Variable speed fans	Variable speed fan
	CW Design Supply Temperature	Boston: 7.5˚ F approach = 78.5 ˚ F with 10˚ F rise	Design WB: 78˚ F; 85˚ F with 10˚ F rise
Air-Side HVAC	**Ventilation**	8 ACH (occupied)/ 4 ACH (unoccupied) in lab Energy Recovery was not modeled for the lab system, following section 6.5.7.2. Office meets ASHRAE 62.1 requirements and is equipped with energy recovery (50% Effectiveness)	8 ACH (occupied)/ 4 ACH (unoccupied) in lab 20 CFM/person in office Konvekta heat recovery system
	Supply Fan Control and Sizing	Primary System: Variable Volume Supply-air-to-room-air temp of 17F in lab and 20F in office	Variable Volume; Cycling fans on FCUs

Energy Modeling Assumptions | C406 Energy Conservation Measures

Per the Massachusetts Amendments to IECC 2018, buildings following ASHRAE 90.1 or IECC shall comply with at least three Energy Conservation Measures listed under Section C406.1. The following ECMs are proposed for and were implemented in both the Baseline and Proposed case models.

The Commercial Buildings 250 and 290 incorporate the following energy conservation measures:

- ECM#1: Reduced air infiltration in accordance with Section C406.9: Per IECC 2018, the tested air leakage rate of the building thermal envelope should not be greater than 0.40 CFM/SF of building envelope, at a pressure differential of 0.3 inch water gauge (75 pa). Per Section 406.9, this tested infiltration rate should not be greater than 0.25 CFM/ SF of the building envelope. Following the ASHRAE 90.1-2016 Appendix G Guidelines, this rate was converted to an appropriate units for the simulation program, which are 0.0538 CFM/SF in the baseline models and 0.0336 CFM/SF in the proposed design models.
- ECM#2: More efficient HVAC performance in accordance with Section C406.2: The Baseline energy model utilizes centrifugal chillers and natural gas-fired boilers, following the ASHRAE 90.1-2016 Appendix G, requirements. The cooling efficiency of chillers and the thermal efficiency of HW Boilers were increased by 10% in the Baseline Case models. The Proposed Design utilizes centrifugal chillers and condensing gas-fired boilers. The cooling and heating efficiency of the proposed systems exceed the IECC 2018 requirements by at least 10%.
- ECM#3: Reduced lighting power in accordance with Section C406.3: The interior lighting power densities were modeled following the requirements of the Massachusetts Amendments along with an additional 10% reduction in both Baseline and Proposed case models.

C402.1.5 Envelope Calculation

250 Binney Street

	Area or Perimeter		IECC 2018	Proposed	
Envelope Component (Vertical)	Baseline	Design	U-or F- value	U-or F- value	
Framed Insulated Wall	171543	0	0.064		
% Framed Insulated Wall	70%	0%			
Curtainwall - Opaque	0	144,587	0.064	0.100	
% Curtainwall - Opaque	0%	59%			
Windows	73,519	100,475	0.38	0.240	
% Windows	30%	41%			
Total Vertical Area/Normalized Area	245,062	245,062	38,916	38,573	
Vertical UA			**0.159**	**0.157**	**0.88%**
Roof		44,690	0.032	0.032	
Whole Building UA (vertical + horizontal)			40,346	40,003	
Whole Building U-value			**0.139**	**0.138**	**0.85%**

Energy Simulation Results | 250 Binney Street

Energy Modeling Run Options	Interior Lighting	Misc. Equipment	Space Heating	Space Cooling	Heat Rejection	Pumps & Aux.	Ventilation Fans	Exterior Lighting	Domestic HW		Space Heating		MA Stretch Energy Code: Total Site Energy	MA Stretch Energy Code: Energy Savings Compared to Baseline	LEED v4 Alternative Path: Total Energy Cost	LEED v4 Alternative Path: Energy Cost Savings Compared to Baseline
	kWh	*kWh*	*kWh*	*kWh*	*kWh*	*kWh*	*kWh*	*kWh*	*kWh*		*Therms*		*MBTU*	*Compared to ASHRAE 2013+ three ECMs required by Mass. Amendments*	*$*	*Compared to ASHRAE-90.1-2013*
ASHRAE 90.1-2013 (LEED v4)	1,863,048	3,701,970	0	1,422,470	28,214	1,617,832	6,254,442	12,076	135,283		900,848		141,395		$ 3,774,628	
MA Stretch Energy Code	1,693,770	3,701,970	0	1,276,331	27,907	1,600,316	6,254,196	12,076	135,283		820,940		132,267		$ 3,620,932	***(a)***
Proposed Design (BOD)	1,693,770	3,701,970	5,062,478	1,554,913	25,632	1,312,301	6,078,515	12,076	95,016		88,212		75,500	**42.9%**	$ 3,639,436	**3.6%**

Energy Modeling Run Options	LEED v4 Alternative Energy Performance Metric Path (EApc95): Total Source Energy	Source Energy Savings	Direct Emission	Indirect Emission	Total Emission	Total CO2 Emission Savings	Alternative Metric Savings	EUI (kBTU/SF): Site	EUI (kBTU/SF): Source
	MBTU	*Compared to ASHRAE-90.1-2013*	Gas (kg CO2e)	Elec (kg CO2e)	kg of CO2e	*Compared to ASHRAE-90.1-2013*	*Compared to 2013*		
ASHRAE 90.1-2013 (LEED v4)	238,273		4,784,404	3,598,763	8,383,167		***Average (2 highest of a,b,c)***	***268***	***451***
MA Stretch Energy Code	226,695	***(b)***	4,360,012	3,518,942	7,878,954	***(c)***		***250***	***429***
Proposed Design (BOD)	195,963	**17.8%**	468,496	4,676,174	5,144,671	**38.6%**	**28.2%**	***143***	***371***

Energy Modeling Runs:

- Baseline: ASHRAE 90.1-2013, Appendix G plus Massachusetts Amendments to IECC 2018
- Proposed Design (BOD): 41% WWR; High-performance glazing (overall assembly: U-0.24, SHGC-0.25); Insulated spandrel panels with U-value of 0.10; High-efficiency Chillers and Boilers; Konvekta Heat Recovery; Air-to-Water heat pump

LEED v4 Alternative Compliance Path

The Alternative Compliance Path (ACP), which was introduced as a Pilot credit (EApc95) under LEED v4 rating system, let the high-performance buildings utilize performance metrics other than the energy cost to comply with LEED v4 minimum and optimize energy performance criteria. This approach is beneficial to those projects that are in States with higher utility rates such as Massachusetts. Per ACP requirements, four (4) metrics should be calculated for the Baseline and Proposed cases: Energy Cost, Energy Source, Greenhouse Gas Emissions, and (if available) Time Dependent Valuation (TDV) – TDVs are only available in California. The percent savings will be the average of the two highest-performing metrics using equal weighting, and LEED points are awarded according to Table 1 under EA credit Optimize Energy Performance.

As shown above, the estimated annual energy cost savings is significantly lower than the annual energy cost savings because the proposed design utilizes an air-to-water heat pump system which can provide the heating hot water for off peak season, and therefore, the annual electricity consumption of the proposed case is higher than the baseline case while its gas consumption is significantly lower; that results in a significant GHG emissions savings but decrease the estimated energy cost savings.

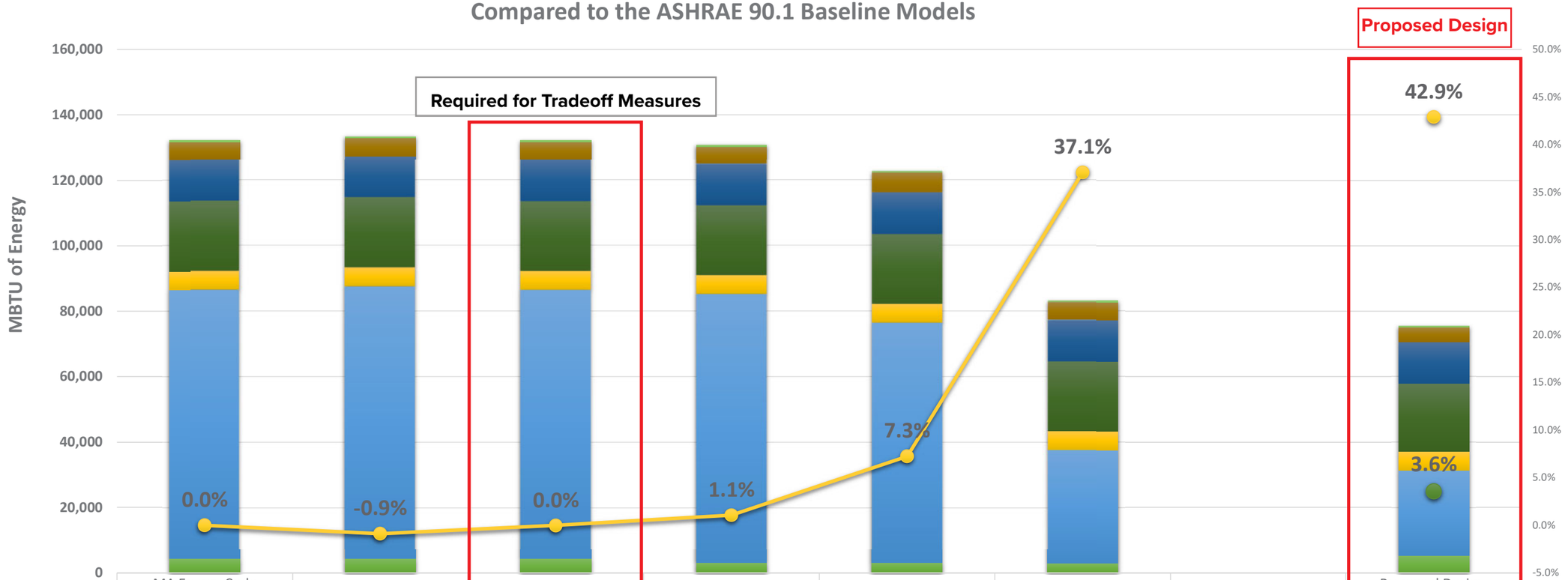
Utility Rates
Electricity: *$0.1809/kWh (2019 Eversource's G3 rates)*
Gas: *$1.1684/ therm (Eversource's G53 rate structure)*

Site to Source Energy Factors (Mass. Amendments to IECC 2018)
Electricity: *2.80*
Gas: *1.05*

Greenhouse Gas Emission Factors (EPA- Used only for LEED):
Electricity (New England): *70.13 kg/MMBTU*
Gas (US Average): *53.11 kg/MMBTU*

Energy Simulation Results | 250 Binney Street

Annual Site Energy Consumption and Energy Cost Savings Compared to the ASHRAE 90.1 Baseline Models



	MA Energy Code Baseline	Design Wall	Design Windows	Design Chillers	Design Boilers	Lab Heat Recovery		Proposed Design (BOD)
Domestic HW	462	462	462	462	462	462		324
Pumps & Aux.	5,462	5,571	5,619	5,450	6,001	5,368		4,479
Heat Rejection	95	96	98	93	93	83		88
Misc. Equipment	12,630	12,630	12,630	12,630	12,630	12,630		12,630
Ventilation Fans	21,350	21,340	21,250	21,250	21,250	21,250		20,750
Interior Lighting	5,781	5,781	5,781	5,781	5,781	5,781		5,781
Space Heating	82,090	83,130	81,940	81,940	73,209	34,629		26,100
Space Cooling	4,356	4,375	4,463	3,197	3,197	2,961		5,307
Energy Use Savings (Compared to Stretch Code)	0.0%	-0.9%	0.0%	1.1%	7.3%	37.1%		42.9%
Energy Cost Savings (Compared to 2013)								3.6%

ATTACHMENT B
Net Zero Narrative

Green Building Requirements
Net Zero Narrative

Last Updated – 2/23/2021

Introduction

The "Net Zero Narrative" is required for projects subject to Green Building Requirements, Section 22.20 of the Cambridge Zoning Ordinance. The requirement is based on the recommendations of the City's Net Zero Action Plan (adopted in 2015), which seeks to neutralize greenhouse gas emissions in Cambridge by 2050. This plan sets a timeframe of 2025 for most new construction to be designed to a "net zero" standard, meaning that on an annual basis, all greenhouse gas emissions resulting from building operations are offset by carbon-free energy production. In the meantime, the goal is to reduce greenhouse gas emissions to the maximum extent possible, and to design and develop buildings to adapt to net zero emissions in the future.

This Net Zero Narrative is provided for advisory review only. It is intended to inform City staff and officials on how the Net Zero Action Plan has influenced the design of the project, and to begin a dialogue so that all parties can better understand what building improvements are possible and what the major barriers are to achieving net zero emissions. As research, design, and development of the project continues to unfold, this narrative must be updated and included in the submission for the Building Permit and Certificate of Occupancy.

Example Narrative Template

This document provides an example format for the Net Zero Narrative as a guide for developers and designers. Variations are appropriate to account for the unique conditions of a case. However, any Net Zero Narrative must include the components set forth in Paragraph (c), Section 22.25.1 of the Zoning Ordinance:

(1) anticipated building envelope performance, including roof, foundation, walls and window assemblies, and window-to-wall ratio;

(2) anticipated energy loads, baseline energy simulation tool assumptions, and proposed energy targets, expressed in terms of site energy use intensity ("EUI"), source EUI, and total greenhouse gas emissions;

(3) description of ways in which building energy performance has been integrated into aspects of the Green Building Project 's planning, design, and engineering, including building use(s), orientation, massing, envelope systems, building mechanical systems, on-site and off-site renewable energy systems, and district- wide energy systems;

(4) description of the technical framework by which the Green Building Project can be transitioned to net zero emissions in the future (acknowledging that such a transition might not be economically feasible at first), including future net zero emissions options for building envelope, HVAC systems, domestic hot water, interior lighting, and on- and off-site renewable energy sources;

(5) description of programs provided by local utility companies, government agencies, and other organizations that provide technical assistance, rebates, grants, and incentives that can assist in achieving higher levels of building performance, summarizing which entities have been contacted and which programs could be utilized in the Green Building Project; and

(6) assessment of the technical and financial feasibility to meet the projected HVAC and domestic hot water demands of the building as noted above in (2) using energy systems that do not consume carbon-based fuels on-site compared to code-compliant energy systems that consume carbon-based fuels on-site, which shall include the cost of installation, maintenance and upkeep of the energy system and its components (incorporating programs and incentives as noted above in (5).

Project Profile

Development Characteristics

Lot Area (sq.ft.):	TBD
Existing Land Use(s) and Gross Floor Area (sq.ft.), by Use:	Commercial Building D: Manufacturing/lab building.
Proposed Land Use(s) and Gross Floor Area (sq.ft.), by Use:	Commercial Building D: Commercial office/lab and ground floor retail.
Proposed Building Height(s) (ft. and stories):	Commercial Building D: Up to 17 stories (±250')
Proposed Dwelling Units:	N/A
Proposed Open Space (sq.ft.):	Between Commercial Buildings C and D the Project will construct the approximately 56,000 square feet of new open space known as the "Center Plaza".
Proposed Parking Spaces:	The Project will construct two, below-grade connected parking garages beneath Commercial Building C and Commercial Building D that will accommodate 1,584 total parking space.
Proposed Bicycle Parking Spaces (Long-Term and Short-Term):	Commercial Building D: 96 Long-term spaces / 26 Short-term spaces

Green Building Rating System

Choose the Rating System selected for this project:

LEED-Leadership in Energy & Environmental Design (U.S. Green Building Council)					
Rating System & Version:	LEED v4 BD+C: Core and Shell	***Seeking Certification?****	**Yes**	No	TBD
Rating Level:	LEED Gold	***64***			

Enterprise Green Communities					
Rating System & Version:	N/A	***Seeking Certification?****	Yes	**No**	TBD
Rating Level:	N/A	***# of Points:***	N/A		

Passive House Institute US (PHIUS) or Passivhaus Institut (PHI)					
Rating System & Version:	N/A	***Seeking Certification?****	Yes	**No**	TBD

**NOTE: Certification is not required through the Green Building Requirements. However, you may choose to indicate if the Project Team intends to pursue formal certification through these Green Building Rating Programs (or their affiliates).*

Proposed Project Design Characteristics

Building Envelope

Assembly Descriptions:

Roof:	R-30 Insulation entirely above deck ; U-0.032
Foundation:	Meets Energy Code
Exterior Walls:	Curtainwall system with continuous insulation behind mullion and spandrel; U-0.10
Windows:	Triple-pane windows; U-0.24
Window-to-Wall Ratio:	41%
Other Components:	Targeted building infiltration rate of 0.25 CFM/sf (at 75 pa)

Envelope Performance:

Provide estimates of the thermal transmittance (U-value) for the building envelope compared to "Baseline" standards required by the Massachusetts Stretch Energy Code, latest adopted edition.

	Proposed		***Baseline***	
	Area (sf)	*U-value*	*Area (sf)*	*U-Value*
Window	100,475	0.24	73,519	0.38
Wall	144,587	0.10	171,543	0.064
Roof	44,690	0.032	44,690	0.032

Envelope Commissioning Process:

The Applicant will pursue envelope commissioning in line with LEED v4 Enhanced Commissioning Option 2: Envelope Commissioning.

Building Mechanical Systems

Systems Descriptions:

Space Heating:	100% OA air handling units with HW heating coils will provide ventilation to the office spaces and ventilation, heating and cooling to the laboratory spaces. Future office spaces will be conditioned by 4-pipe FCUs or similar systems. HW will be supplied by gas-fired boilers
Space Cooling:	Centrifugal water-cooled chillers will provide CHW to AHUs and FCUs
Heat Rejection:	High-efficiency heat rejection plant with variable speed fans on cooling towers.
Pumps & Auxiliary:	All variable speed pumping systems
Ventilation:	100% OA Air Handling Units equipped with energy recovery system
Domestic Hot Water:	Gas-fired condensing heater with >90% efficiency
Interior Lighting:	LED fixtures in core spaces C406.3 measure: a 10% reduction in LPD values listed in MA Amendments is targeted
Exterior Lighting:	LED fixtures
Other Equipment:	Office: 0.9-1.1 W/SF process load associated with office equipment Lab: 4 W/SF associated with laboratory equipment

Systems Commissioning Process:

The Applicant will pursue commissioning in line with LEED v4 Fundamental and Enhanced Commissioning requirements. The commissioning agent will perform the scope of work required to comply with the prerequisite in accordance with ASHRAE Guideline 0-2005 and ASHRAE Guideline 1.1-2007 for HVAC & R systems. Enhanced commissioning scope will include reviewing the owner's project requirements, and the basis of design, creating, distributing and implementing a commissioning plan, performing a design review of the project documents, witnessing on-site installations and testing and performing commissioning of installed HVAC, lighting, lighting controls and domestic hot water systems.

Building Energy Performance Measures

Overview

Broadly describe the ways in which building energy performance has been integrated into the following aspects of the project's planning, design, engineering, and commissioning. More detail on specific measures can be provided in appendices.

Land Uses:	The site has been previously developed and it is classified as a Difficult Development Area by the US Department of Housing and Urban Development. The selected site will provide access to the public transportation, bicycle network and facilities.
Building Orientation and Massing:	The building massing is developed and optimized based on the orientation that is dictated by the existing site and will provide access to view and daylight for majority of the future occupied spaces. Fenestration area is optimized for the Project to minimize thermal losses and to bring in sufficient daylight into the spaces.
Envelope Systems:	High performing envelope which meets and exceeds the IECC 2018 – C402.1.5 requirements. It includes continuous insulation on walls and roofs, high performing glazing assemblies and decreased infiltration rates.
Mechanical Systems:	Variable Volume 100% OA Air-Handling Units with HW and CHW coils; High-efficiency water-cooled centrifugal chillers; High-efficiency gas-fired boilers; energy recovery system.
Renewable Energy Systems:	The Project's roofs are being designed as solar ready and the team is continuing to evaluate economics for solar. Due to the nature of the Project, part of the roof will be occupied by large mechanical systems. On areas of the roof free of mechanical systems and with good solar availability, the potential of installing photovoltaic panels is under evaluation.
District-Wide Energy Systems:	The project will not be connected to the district steam because the emission data is not readily available and per the team's experience with evaluating Vicinity Steam and its environmental impacts for other similar projects, the overall GHG emissions for a building connected to the district steam will not be significantly better than a stand-alone building due to the fact that steam is generated via a non-renewable fuel source; therefore, it will not help the project to meet the City's Net Zero goals in the future.
Other Systems:	EV charging stations will be provided for 5% of the total parking capacity.

Integrative Design Process

Describe how different parties in the development process (owners, developers, architects, engineers, contractors, commissioning agents) have collaborated in the design. Include the Basis of Design and Owner's Project Requirements and describe how they have been informed by planning activities such as meetings or design charettes. Describe how continuing collaborative processes will inform Schematic/Design and Construction Documents.

The project team is pursuing the LEED Integrative Process credit for this project, and therefore, energy models were developed during the conceptual design phase. The project team for the overall master site development, including the ownership group, architects, Civil and MEP engineers, as well as the sustainability consultants and energy modelers met several times in the early stages of planning and design to discuss the project overall energy, sustainability, and environmental goals.
The preliminary and conceptual energy models were developed early on to investigate the project's compliance with the LEED v4 Minimum and Optimize Energy Performance criteria and the Massachusetts Stretch Energy Code requirements and to estimate the project site and source energy use and cost as well as the GHG emissions. As a result of these analyses, the design team proposed and evaluated additional energy conservation measures to improve the building overall performance and decided to improve the overall performance of the building envelope.

Green Building Incentive Program Assistance

Describe any programs applicable to this project that would support improved energy performance or reduced greenhouse gas emissions, and which of those programs have been contacted and may be pursued. Programs may be offered by utility companies, government agencies, and other organizations, and might include rebates, grants, financing, technical assistance, and other incentives.

The Project has had multiple engagements with local utility representatives and is planning to participate in all relevant energy-efficiency incentive programs. An initial MassSave kickoff/energy charrette will be conducted in Spring 2021. The project will be participating in the Mass Save Integrated Design Path for Large Buildings as well as the EV make-ready program.

Net Zero Scenario Transition

Describe the technical framework by which the project can be transitioned to net zero greenhouse gas emissions in the future, acknowledging that such a transition might not be economically feasible at first. This description should explain the future condition and the process of transitioning from the proposed design to the future condition.

	Net Zero Condition:	***Transition Process:***
Building Envelope:	Additional insulation can be added behind the spandrel panels if necessary but potentially upgrades to the building envelope will be insignificant.	N/A
HVAC Systems:	Replacing the fossil-fuel heating systems with all-electric equipment. It may not be feasible to develop these laboratory buildings as 100% electric at the moment but with new technologies, the transition to an all-electric system is feasible.	Utilizing energy recovery systems with higher effectiveness Heat-recovery chillers Air-source heat pumps in office spaces Air-to-water heat pump
Domestic Hot Water:	The Domestic Hot Water system can be replaced with electric Heat Pump heaters	
Lighting:	All LED light fixtures with advanced lighting control systems	The base building will utilize LED fixtures and the future tenants will be required to meet the targeted LPDs which can be achieved by utilizing all/ mostly LED fixtures. At the end of life of fixtures, with potential new technologies, lighting upgrades may result in additional savings.
Renewable Energy Systems:	Due to the limited roof area, an on-site renewable system may not be feasible for laboratory projects.	When the building is all-electrified and the Grid is clean, the project can achieve carbon neutrality.
Other Strategies:	Plug loads and other process equipment: in a laboratory building, receptacle loads represent a significant percentage of the building annual energy consumption. Utilizing high-efficiency equipment and implementing advanced control strategies to reduce these loads will have a significant impact on the building overall energy performance and environmental footprint.	As new technologies emerge, the office and lab equipment might be replaced with new and low-energy ones and the plug-load control strategies may improve. Additionally, implementing control strategies for the lab fume hoods (i.e. controlled by occupancy or Indoor Air Quality sensors) will help the project with achieving NZE goals.

Energy Systems Comparison

Overview

This section should describe the results of an analysis comparing the technical and financial feasibility to meet the projected HVAC and domestic hot water demands of the building using energy systems that do not consume carbon-based fuels on-site compared to code-compliant energy systems that consume carbon-based fuels on-site.

As design progresses, the project team will investigate implementation of strategies to reduce the project dependence on the fossil fuel heating. With the current available technologies and the site condition, these laboratory buildings will not be able to be 100% electric and the boiler plant needs to be included; however, utilizing the following technologies can help the project to reduce its carbon footprint significantly and transition to an all-electric system in the future. These technologies will be evaluated as design progresses:

- Konvekta or other energy recovery systems with similar performance
- Air-to-water heat pump for supplemental heating
- Electric heat pump in office spaces (during tenant design)
- Heat recovery chillers

Assumptions

Describe what building energy systems were included and excluded in your analysis and why.

	Included in analysis?		***Describe the systems for which this was analyzed or explain why it was not included in the analysis:***
	Yes	***No***	
Solar Photovoltaics:	x		Majority of the roof area will be covered by laboratory mechanical equipment and therefore, limited area will be available. As design progresses, the feasibility of roof-mounted solar array will be investigated.
Solar Hot Water:		x	It is not feasible for this size and type building.
Ground-Source Heat Pumps (Geothermal):		x	These buildings will be located over a parking garage and over/ adjacent to the Eversource Electrical Substation and therefore, locating geothermal boreholes under and adjacent to these structures will not be feasible.

Water-Source Heat Pumps:		x	It will be investigated as design progresses.
Air-Source Heat Pumps:	x		It is feasible for the office portion of the building.
Non-Carbon-Fuel District Energy:		x	Not Analyzed.
Other Non-Carbon-Fuel Systems:	x		Partial electrification of laboratory buildings is feasible and it will be analyzed as design progresses.

Non-Carbon-Fuel Scenario

The Net Zero Energy (NZE) Scenario includes upgrades to the building HVAC systems so that no fossil fuel is used. It is assumed that the office portion will be all electric heating. 100% electric laboratory may not be a feasible option at the moment but a partial electrification with a help of heat-recovery chillers and air-to-water heat pumps is achievable. In the NZE option, it is assumed that technologies will be available in the future for a 100% electric heating in a laboratory building. It was also assumed that there will be increases in the efficiencies for lighting and equipment loads and that the service hot water will be provided by heat pump heaters.

Solar-Ready Roof Assessment

The purpose of this assessment is to determine the technical feasibility of solar energy system installation, either as part of the proposed project or in the future. It is helpful to supplement this narrative with a plan depicting the information provided.

Total Roof Area (sq. ft.):	***44,690***
Unshaded Roof Area (sq. ft.):	Majority of the roof will be covered by the mechanical equipment which will shade the uncovered areas. Per our preliminary analysis, approximately 2,500 SF might be unshaded and available for solar PV array.
Structural Support:	The roofs will be PV/Solar ready for the areas identified with good solar access. The team is continuing to evaluate economics for solar/PV.
Electrical Infrastructure:	The design team will take electrical infrastructure into account while evaluating the economics for solar/PV on the roofs.
Other Roof Appurtenances:	Majority of mechanical equipment for a lab building will occupy the roof area. As the design of the roof progresses, the design team will locate HVAC equipment strategically to provide an unshaded area for potentially future solar PV arrays or green roof. Preliminary estimates show that approximately 5-10% of the roof area can be used in the initial PV analysis.
Solar-Ready Roof Area (sq. ft.):	Per the initial analysis, the area is approximately 2,500-3,000 SF. The final area provided as solar-ready may change as the building design progresses.
Capacity of Solar Array:	37-40 kW DC. The annual generated electricity is 0.24% of the building annual electricity consumption.
Financial Incentives:	There are federal and state (SMART) incentives available for eligible PV generation systems. These incentives programs are continuously changing. Therefore, this analysis will be performed at the time of PV system design.
Cost Feasibility:	Installed cost: $3.0/Watt Total cost of PV and installation is estimated to be at $120,000 for the 40 kW array. Without any incentives this will provide a simple payback of 14 years based on an annual generation of 46,200 kWh renewable energy.

Results

Briefly summarize the results of the analysis and how it has informed the design of the project. Also include figures for the "Non-Carbon-Fuel Scenario" in the concluding Summary Table at the end of the Net Zero Narrative. Attachments can be provided with more specific figures and metrics regarding installation, maintenance, and upkeep costs (exclusive *of operating fuel expenses), but a full report is not necessary.*

TBD	***Proposed Design***		***Non-Carbon-Fuel Scenario***	
	Installation Cost	*Maintenance Cost*	*Installation Cost*	*Maintenance Cost*
Space Heating				
Space Cooling				
Heat Rejection				
Pumps & Aux.				
Ventilation				
Domestic Hot Water				
(Financial Incentives)				
Total Building Energy System Cost				

The project team utilized energy benchmarking tools and database such as Lab21 and Cambridge Building Energy Use Disclosure Ordinance (BEUDO) to establish an energy performance benchmark and a predicted Energy Use Intensity (pEUI) for the commercial buildings. After narrowing down the building parameters in the Lab21 benchmarking tool to reflect the current design, the outcomes are three peer buildings with an average source EUI of 414 kBtu/SF. This comparison shows that the current design with a predicted source EUI of approximately 330 kBTU/SF is low energy when compared to the benchmarking data. The site pEUI for the 250 Binney laboratory is estimated at 150 kBtu/SF which is significantly lower than the BEUDO average EUI of 250 kBTU/SF.
This energy analysis shows that this building will have a significantly better energy performance as compared to the MA Stretch Energy Code baseline case. Throughout the design process, the design team will use three performance metrics in their decision making around energy use in the design process: site energy use, source energy use, and greenhouse gas emissions.

Anticipated Energy Loads and Greenhouse Gas Emissions

Assumptions

Describe the assumptions and methodology used to conduct preliminary energy modeling and set energy targets for the project. Specifically describe what components of the building were included and excluded.

Energy models were developed for 250 Binney Street project to investigate its compliance with the Massachusetts Energy Code and to evaluate the impact of several energy conservation measures on the building overall energy use, cost, and GHG emissions in the early stage of design.

250 Binney Street will be a new Core and Shell, Laboratory/ Office building, in Cambridge, MA. The building program includes 60% laboratory and 40% office spaces. Using the guidelines outlined in Appendix G of ASHRAE 90.1-2013 and Massachusetts Amendments, the Stretch Energy Code baseline and proposed building design were modeled following Tables G3.1 in terms of the space use classification, schedules, building envelope, lighting, thermal blocks, HVAC systems, service hot water system, and receptacle and other loads.

The building geometry is based on the preliminary massing. The vertical elements of the envelope primarily consist of a curtainwall system. The overall window area is estimated at 42% of the building exterior wall area but may change as design progresses, considering compliance with the requirements of the new Massachusetts Amendments to Energy Code. High performance insulated glazing is expected to be installed throughout.

The building is expected to be occupied during extended office hours throughout the year, with some partial occupancy during weekends. The peak occupancy density is estimated to be 250 GSF/person in the office and 400 GSF/person in Lab spaces. The HVAC system will operate 24/7.

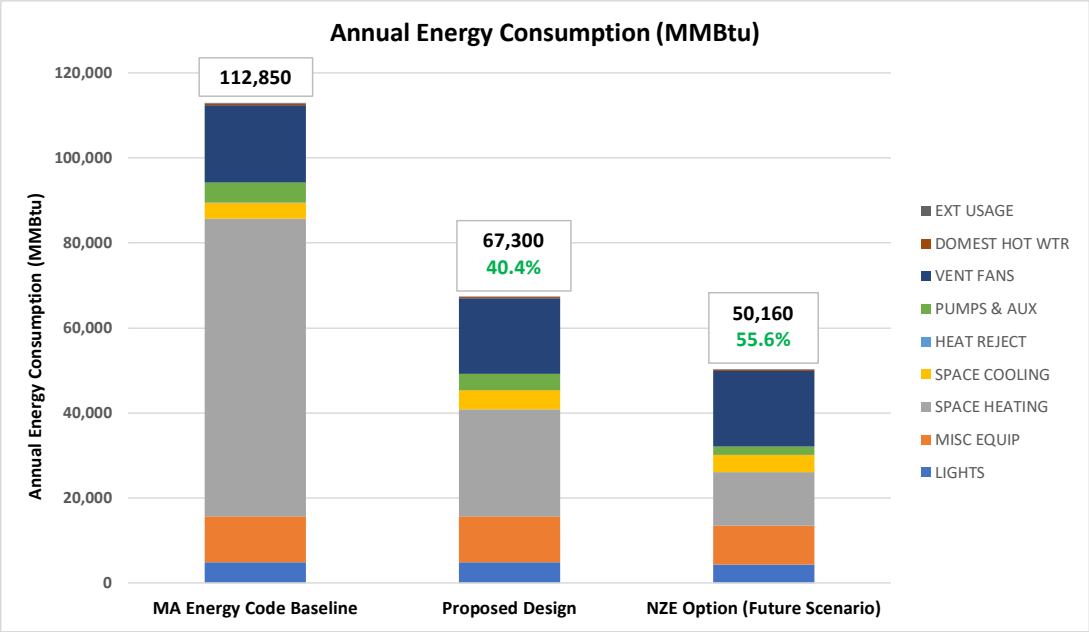
The interior lighting power densities in both the baseline and proposed case models follow the building-area-method approach and are consistent with the new Massachusetts amendments. End uses such as computers, receptacles, and lab equipment are included as equipment gains. These are inputs to reflect the design team's understanding of the anticipated equipment usage and are identical between the baseline and the proposed models.

Annual Projected Energy Consumption and Greenhouse Gas (GHG) Emissions

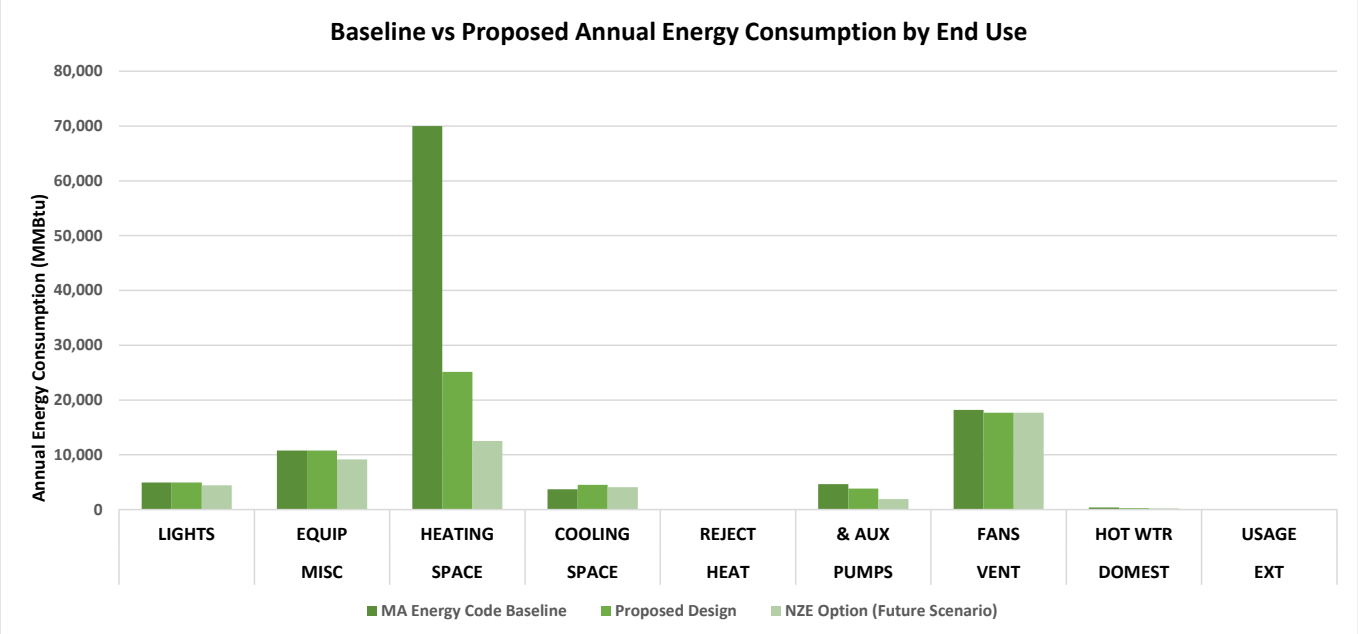
The preliminary energy modeling results should be shown in a concluding table format similar to what is shown at the end of this document. It should compare the "baseline building" (Massachusetts Stretch Energy Code) to the proposed design, as well as the future "net zero" scenario described later in this narrative.

	Baseline Building		***Proposed Design***		***Future Net Zero Scenario***	
	MMBTU	*% of Total*	*MMBTU*	*% of Total*	*MMBTU*	*% of Total*
Space Heating	70,017	62%	25,093	37.3%	12,547	25%
Space Cooling	3,715	3.3%	4,527	6.7%	4,047	8.1%
Heat Rejection	81	0.1%	75	0.1%	71	0.1%
Pumps & Aux.	4,659	4.1%	3,820	5.7%	1,910	3.8%
Ventilation	18,210	16.1%	17,698	26.3%	17,698	35.3%
Domestic Hot Water	394	0.3%	277	0.4%	221	0.4%
Interior Lighting	4,931	4.4%	4,931	7.3%	4,438	8.8%
Exterior Lighting	42	<1%	42	<1%	42	<1%
Misc. Equipment	10,773	9.5%	10,773	16%	9,157	18.3%
	$US, kBTU, kBTU/SF		*$US, kBTU, kBTU/SF*	*% Reduction from Baseline*	*$US, kBTU, kBTU/SF*	*% Reduction from Baseline*
Site EUI (kBTU/SF)	250		149	40.4%	112	55.6%
Source EUI (kBTU/SF)	429		321	25.3%	312	27.4%
Total Electricity (kWh)	12,549,977		12,367,076	1.5%	14,696,028	-17.1%
Total Gas Use (Therms)	700,207		250,945	64.2%	0	100%
Total Energy Use (MMbru)	112,853		67,302	40.4%	50,158	55.6%
Total Energy Cost ($US)	$3,088,413		$2,530,408	18.1%	$2,658,511	
	kWh or Therms	*% Total Energy*	*kWh or Therms*	*% Total Energy*	*kWh or Therms*	*% Total Energy*
On-Site Renewable Energy Generation	-	-	-	-		
Off-Site Renewable Energy Generation	-	-	-	-		
	MTons CO_2 [/SF]		*MTons CO_2 [/SF]*	*% Reduction from Baseline*	*MTons CO_2[/SF]*	*% Reduction from Baseline*
GHG Emissions	8,225		5,537	32.7%	4,835	41.2%
GHG Emissions per SF	0.0182		0.0123	32.7%	0.011	41.2%

Example Chart 1:



Example Chart 2:



ATTACHMENT C
Green Building Requirements Checklist

Green Building Project Checklist

Green Building Project Location: 250 Binney Street, Cambridge, MA

Applicant

Name: Boston Properties Limited Partnership

Address: 800 Boylston Street, STE 1900

Contact Information

Email Address: ihatch@bxp.com

Telephone #: 617.236.3602

Project Information (select all that apply):

- ☐ New Construction – GFA: 438,555
- ☐ Addition – GFA of Addition: 0
- ☐ Rehabilitation of Existing Building – GFA of Rehabilitated Area: 0
  - ☐ Existing Use(s) of Rehabilitated Area: _____
  - ☐ Proposed Use(s) of Rehabilitated Area: _____
- ☒ Requires Planning Board Special Permit approval
- ☐ Subject to Section 19.50 Building and Site Plan Requirements
- ☐ Site was previously subject to Green Building Requirements

Green Building Rating Program/System:

- ☒ Leadership in Energy and Environmental Design (LEED) – Version: LEED version 4
  - ☒ Building Design + Construction (BD+C) – Subcategory: Core and Shell Development
  - ☐ Residential BD+C – Subcategory: _____
  - ☐ Interior Design + Construction (ID+C) – Subcategory: _____
  - ☐ Other: _____
- ☐ Passive House – Version: _____
  - ☐ PHIUS+
  - ☐ Passivhaus Institut (PHI)
  - ☐ Other: _____
- ☐ Enterprise Green Communities – Version: _____

Project Phase

☒ **SPECIAL PERMIT**

Before applying for a building permit, submit this documentation to CDD for review and approval.

Required Submissions

All rating programs:

- ☒ Rating system checklist
- ☒ Rating system narrative
- ☒ Net zero narrative (see example template for guidance)
- ☒ Affidavit signed by Green Building Professional with attached credentials – use City form provided (Special Permit)