



# 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)).*

**Net Zero Narrative – EXAMPLE TEMPLATE**

Project Name/Address:

Submitted By:

Date of Submission:

**Project Profile**

**Development Characteristics**

<b>Lot Area (sq.ft.):</b>	
<b>Existing Land Use(s) and Gross Floor Area (sq.ft.), by Use:</b>	
<b>Proposed Land Use(s) and Gross Floor Area (sq.ft.), by Use:</b>	
<b>Proposed Building Height(s) (ft. and stories):</b>	
<b>Proposed Dwelling Units:</b>	
<b>Proposed Open Space (sq.ft.):</b>	
<b>Proposed Parking Spaces:</b>	
<b>Proposed Bicycle Parking Spaces (Long-Term and Short-Term):</b>	

**Green Building Rating System**

Choose the Rating System selected for this project:

<b>LEED-Leadership in Energy &amp; Environmental Design (U.S. Green Building Council)</b>					
<b>Rating System &amp; Version:</b>		<b>Seeking Certification?*</b>	Yes	No	TBD
<b>Rating Level:</b>		<b># of Points:</b>			

<b>Enterprise Green Communities</b>					
<b>Rating System &amp; Version:</b>		<b>Seeking Certification?*</b>	Yes	No	TBD
<b>Rating Level:</b>		<b># of Points:</b>			

<b>Passive House Institute US (PHIUS) or Passivhaus Institut (PHI)</b>					
<b>Rating System &amp; Version:</b>		<b>Seeking Certification?*</b>	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).

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### Proposed Project Design Characteristics

#### Building Envelope

Assembly Descriptions:

<b>Roof:</b>	<i>[Describe assembly/assemblies ...]</i>
<b>Foundation:</b>	<i>[Describe assembly/assemblies ...]</i>
<b>Exterior Walls:</b>	<i>[Describe assembly/assemblies ...]</i>
<b>Windows:</b>	<i>[Describe assembly/assemblies ...]</i>
<b>Window-to-Wall Ratio:</b>	<i>[Calculate approximate % of window glazing to total façade area]</i>
<b>Other Components:</b>	<i>[Describe any additional envelope components ...]</i>

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.

	<b>Proposed</b>		<b>Baseline</b>	
	<i>Area (sf)</i>	<i>U-value</i>	<i>Area (sf)</i>	<i>U-Value</i>
Window				
Wall				
Roof				

Envelope Commissioning Process:

*[Describe anticipated commissioning process for building envelope components ...]*

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### Building Mechanical Systems

Systems Descriptions:

<b>Space Heating:</b>	<i>[Describe systems ...]</i>
<b>Space Cooling:</b>	<i>[Describe systems ...]</i>
<b>Heat Rejection:</b>	<i>[Describe systems ...]</i>
<b>Pumps &amp; Auxiliary:</b>	<i>[Describe systems ...]</i>
<b>Ventilation:</b>	<i>[Describe systems ...]</i>
<b>Domestic Hot Water:</b>	<i>[Describe systems ...]</i>
<b>Interior Lighting:</b>	<i>[Describe systems ...]</i>
<b>Exterior Lighting:</b>	<i>[Describe systems ...]</i>
<b>Other Equipment:</b>	<i>[Describe any other building mechanicals/utilities]</i>

Systems Commissioning Process:

*[Describe anticipated commissioning process for building systems ...]*

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### 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.

<b>Land Uses:</b>	<i>[Examples: Mixed-use development promoting walking and bicycling, efficient arrangement of uses within a site ...]</i>
<b>Building Orientation and Massing:</b>	<i>[Examples: Solar orientation (for daylighting, reduced heat gain, solar energy capacity, &amp;c.), passive ventilation ...]</i>
<b>Envelope Systems:</b>	<i>[Examples: Continuous insulation, high performance glazing, sun screening, green roofs ...]</i>
<b>Mechanical Systems:</b>	<i>[Examples: Heat pumps, energy/heat recovery equipment, high-efficiency equipment ...]</i>
<b>Renewable Energy Systems:</b>	<i>[Examples: Solar energy, geothermal energy, wind energy ...]</i>
<b>District-Wide Energy Systems:</b>	<i>[Examples: District cogeneration, waste steam from power plants, microgrids ...]</i>
<b>Other Systems:</b>	<i>[Examples: Electric vehicle charging ...]</i>

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### 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 charrettes. Describe how continuing collaborative processes will inform Schematic/Design and Construction Documents.*

### 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.*

*[Example programs: MassSave (Eversource), Massachusetts Clean Energy Center, MA Department of Energy Resources.]*

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**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.*

	<b>Net Zero Condition:</b>	<b>Transition Process:</b>
<b>Building Envelope:</b>	<i>[Describe measures that could be implemented to meet future “net zero” performance.]</i>	<i>[Describe process for adapting from the current proposal to a future “Net Zero Condition.”]</i>
<b>HVAC Systems:</b>	<i>[Describe measures that could be implemented to meet future “net zero” performance.]</i>	<i>[Describe process for adapting from the current proposal to a future “Net Zero Condition.”]</i>
<b>Domestic Hot Water:</b>	<i>[Describe measures that could be implemented to meet future “net zero” performance.]</i>	<i>[Describe process for adapting from the current proposal to a future “Net Zero Condition.”]</i>
<b>Lighting:</b>	<i>[Describe measures that could be implemented to meet future “net zero” performance.]</i>	<i>[Describe process for adapting from the current proposal to a future “Net Zero Condition.”]</i>
<b>Renewable Energy Systems:</b>	<i>[Describe measures that could be implemented to meet future “net zero” performance.]</i>	<i>[Describe process for adapting from the current proposal to a future “Net Zero Condition.”]</i>
<b>Other Strategies:</b>	<i>[Describe measures that could be implemented to meet future “net zero” performance.]</i>	<i>[Describe process for adapting from the current proposal to a future “Net Zero Condition.”]</i>

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### 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.*

#### Assumptions

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

	<i>Included in analysis?</i>		<i>Describe the systems for which this was analyzed or explain why it was not included in the analysis:</i>
	<i>Yes</i>	<i>No</i>	
<b>Solar Photovoltaics:</b>			
<b>Solar Hot Water:</b>			
<b>Ground-Source Heat Pumps (Geothermal):</b>			



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<b>Water-Source Heat Pumps:</b>			
<b>Air-Source Heat Pumps:</b>			
<b>Non-Carbon-Fuel District Energy:</b>			
<b>Other Non-Carbon-Fuel Systems:</b>			

**Non-Carbon-Fuel Scenario**

*Describe the final scenario used in this analysis.*

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**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.*

<b>Total Roof Area (sq. ft.):</b>	<i>[Calculate roof area of all buildings in the project.]</i>
<b>Unshaded Roof Area (sq. ft.):</b>	<i>[Determine amount of roof area with adequate solar access for solar photovoltaic (PV) or hot water panels.]</i>
<b>Structural Support:</b>	<i>[Identify roof sections that will be designed to physically support solar PV or hot water panels, including a manual roof access point from the uppermost floor and a roof hoist mounting point/plate. Identify the solar panels' sun exposure angle.]</i>
<b>Electrical Infrastructure:</b>	<i>[Describe capacity of electrical panel to accommodate potential solar array capacity, pathway from solar-ready roof area to electrical panel, and location reserved for future inverters and other electrical equipment.]</i>
<b>Other Roof Appurtenances:</b>	<i>[Describe any other objects that will occupy roof area, such as mechanical equipment or headhouses, the extent to which those objects would preclude the installation of solar PV or hot water panels, and measures taken to minimize such interference.]</i>
<b>Solar-Ready Roof Area (sq. ft.):</b>	<i>[Based on information above, estimate the total roof area on which the installation of solar PV or hot water panels would be technically feasible either immediately or in the future.]</i>
<b>Capacity of Solar Array:</b>	<i>[Based on the solar-ready area, estimate the total energy capacity of a solar PV or hot water system, if installed.]</i>
<b>Financial Incentives:</b>	<i>[Describe programs that are available to mitigate the up-front costs of solar PV or hot water system installation, including the potential for third-party ownership.]</i>
<b>Cost Feasibility:</b>	<i>[Determine whether it is cost-feasible to install a solar PV or hot water system as a component of the project. This may be supplemented with a detailed third-party analysis.]</i>

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### 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.

	<i>Proposed Design</i>		<i>Non-Carbon-Fuel Scenario</i>	
	<i>Installation Cost</i>	<i>Maintenance Cost</i>	<i>Installation Cost</i>	<i>Maintenance Cost</i>
<b>Space Heating</b>				
<b>Space Cooling</b>				
<b>Heat Rejection</b>				
<b>Pumps &amp; Aux.</b>				
<b>Ventilation</b>				
<b>Domestic Hot Water</b>				
<b>(Financial Incentives)</b>				
<b>Total Building Energy System Cost</b>				

*Describe results and conclusions from the analysis.*

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**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.

**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		Non-Carbon-Fuel Scenario	
	kWh or Therms	% of Total	kWh or Therms	% of Total	kWh or Therms	% of Total	kWh or Therms	% of Total
Space Heating								
Space Cooling								
Heat Rejection								
Pumps & Aux.								
Ventilation								
Domestic Hot Water								
Interior Lighting								
Exterior Lighting								
Misc. Equipment								
	\$US, kBTU, kBTU/SF		\$US, kBTU, kBTU/SF	% Reduction from Baseline	\$US, kBTU, kBTU/SF	% Reduction from Baseline	\$US, kBTU, kBTU/SF	% Reduction from Baseline
Site EUI								
Source EUI								
Total Energy Use								
Total Energy Cost								
	kWh or Therms	% Total Energy	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								
	Tons CO <sub>2</sub> [/SF]		Tons CO <sub>2</sub> [/SF]	% Reduction from Baseline				
GHG Emissions								
GHG Emissions per SF								

It may be helpful to present this information in a chart or graph. The following page provides examples.

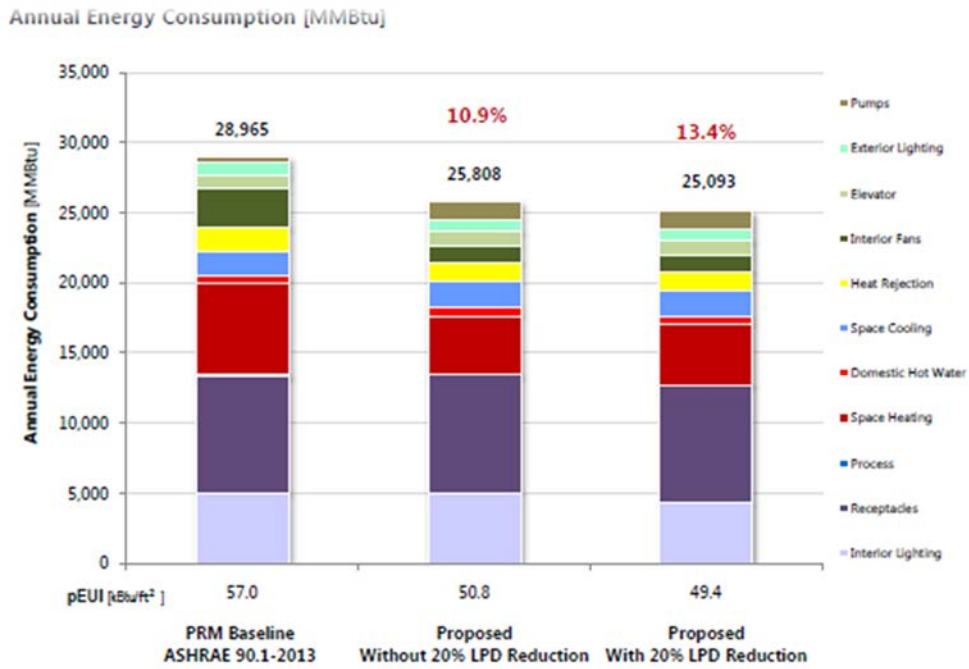
# Net Zero Narrative – EXAMPLE TEMPLATE

Project Name/Address:

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**Example Chart 1:**



**Example Chart 2:**

