Commonwealth of Massachusetts
Division of Professional Licensure
Office of Public Safety and Inspections

1000 Washington Street, Suite 710
Boston, Massachusetts 02118

MASSACHUSETTS STATE BUILDING CODE – CODE CHANGE PROPOSAL FORM

Impacted code:	■ **Base Code** ☐ **Residential Code**	**State Use Only**	
Date Submitted:	May 6, 2020	**Date Received:**	
Code Section:	Chapter 115 -Appendix AA	**Code Change Number:**	
Name of proponent:	Darren Port		
Company / Organization represented, if any:	Northeast Energy Efficiency Partnerships (NEEP)	**Check** ☐ if representing self	
Address (number, street, city, state, ZIP):	81 Hartwell Ave. Lexington, MA 02421		
Telephone number:	781-860-9177 ext 132		
Email address:	dport@neep.org		

PLEASE CHECK √ THE TYPE OF AMENDMENT PROPOSED

☐ **Change existing section language** ☐ **Add new section** ■ **Delete existing section and substitute**

☐ **Delete existing section, no substitute** ☐ **Other, Explain:** _____

PLEASE TYPE THE PROPOSED AMENDMENT BELOW. If you propose to change a section, please copy the original text from either the relevant model code and/or MA amendment and indicate the code edition. Indicate, with a ~~strikethrough~~, the text that you propose to delete. Please also indicate any new text in both *italic* and red font. Finally, for each proposal submitted, please provide the justification items requested below. Completed code amendment forms may be emailed to Dan Walsh, Director of Code Development and Manufactured Buildings at Dan.P.Walsh@mass.gov . **Please attach additional pages as necessary.**

Existing language: None

Proposed changes: See attached

Background and rationale: See attached

Pros of the proposed change: See attached

Cons of the proposed change: See attached

Estimated impact on life safety: See attached

Estimated impact on cost: See attached

Existing Language:
None

Proposes Language:
See Attached

Background and Rationale:
The MA E-Z Code offers an alternative compliance path for building energy efficiency and an update to the existing stretch code. The alternative compliance path is a prescriptive path, which may be selected for new buildings, instead of the performance (energy model) path. The prescriptive path has been named the "Energy Zero (E-Z)" path because it enhances building energy efficiency, is simpler to apply, and supports a more streamlined regulatory review for compliance.

In addition to offering a prescriptive compliance path, the MA E-Z Code addresses the electrification of buildings, a critical strategy for the Commonwealth to reach carbon neutrality. The MA E-Z Code modifies the IECC 2021 Zero Code Renewable Energy Appendix (ZCREA) to limit renewable energy sources to those that meet 'additionality,' ensuring that the renewable energy will have a net positive effect on Massachusetts greenhouse gas (GHG) emissions. The MA E-Z Code additionally addresses demand response, resilience, and several other topics that minimize a new building's life cycle impact on GHG emissions.

The MA E-Z Code includes the following:

1. A prescriptive compliance path, offering a straightforward approach to building energy performance. This path does not require whole building energy modeling to demonstrate compliance.
2. A performance (energy model) compliance path, matching the IECC 2021 ZCREA.
3. A prescriptive backstop for projects using the performance (energy model) path. The backstop avoids the variability that can come from relying solely on energy modeling for compliance.
4. Requirements that preclude on-site combustion (with exceptions) to ensure that buildings can rely on renewable energy and improve public health, safety, and climate-related outcomes.
5. A pass/fail criteria for renewable energy sources with no weighting factors. The requirements provide a straightforward path while ensuring that the source of renewable energy is additional, creating a new tangible net reduction in GHG emissions that otherwise would not have occurred.
6. Requirements to address the critical issues of resilience and demand management.

	MA E-Z Stretch Code
Energy Efficiency	Prescriptive Path IECC 2021 + Massachusetts Amendments Incorporating Passive House Principles -OR- Performance Path ASHRAE 90.1-2016 Appendix G (matches IECC Zero Energy Appendix / AIA Zero Code) (building performance factors, using site energy or 2030 projected source fossil fuel) WITH Prescriptive Backstop (same as the prescriptive path, but with less strict requirements)

Electrification	No Combustion, with exceptions (examples of exceptions: labs, healthcare, commercial kitchens, domestic hot water) Electric Vehicle requirements Demand Response requirements
Renewable Energy	Requires renewable energy systems of adequate capacity to achieve zero energy and carbon Only Renewable Energy Demonstrating Additionality Allowed No Weighting Factors On-site Solar requirements
Jurisdictional Compliance Requirements	Addresses several additional topics, including embodied carbon, refrigerants, commissioning, and energy use disclosure.

See the Attached Background and Rationale section of the MA E-Z Code for further information.

Pros of Proposed Changes:

MA E-Z Code offers a prescriptive zero energy compliance path that focuses on measures that are straightforward and high-impact. MA E-Z Code prescriptive compliance path enhances building energy efficiency, is simpler to apply, and supports a more streamlined regulatory review for compliance. The MA E-Z Code prioritizes building energy efficiency before leveraging renewable energy to meet the building's remaining energy needs. The major advantages of this proposal are that energy-efficient zero energy buildings lower the operations and maintenance costs for building owners by prioritizing electrification. A tight building envelope with high-performance windows and low thermal bridging enhances building resiliency. The proposal also improves the health and comfort of building occupants and mitigates environmental impact by cutting carbon emissions through electrification, renewable energy, and combustion-free energy sourcing.

Overall, the prescriptive measures of the MA E-Z Code reduce demand on building systems and utility infrastructure. Thereby, the MA E-Z Code promotes cost-effective zero energy buildings for various commercial building typologies that can be scaled from individual buildings to the entire Commonwealth.

The MA E-Z Code is intended to be updated with each successive version of the national model energy codes to reflect new developments in the market adoption of building technology and practices.

Cons of the Proposed Changes:
None

Estimated Impact on Life Safety:
The enhanced energy efficiency of the MA E-Z Code will have a measurably positive impact on life safety. For example:

1. Improved thermal distribution benefits occupant comfort.
2. A focus on air exchange and tight building construction prevents harmful airborne contaminants from spreading throughout the building.
3. Well-insulated buildings with high-efficiency windows enhance passive survivability by maintaining comfortable indoor temperatures in the event of power loss.

Other life safety benefits of an energy efficient code are outlined in *Energy Codes are Life Safety Codes* published by Northeast Energy Efficiency Partnerships (NEEP).

Estimated Impact on Cost:
Many factors impact construction and operations costs, such as building type, location, siting, size, and building owner specifications. However, the MA E-Z code provides a prescriptive pathway that has minimal impacts on design cost by deprioritizing energy modeling in exchange for a prescriptive design path. Overall, operations and maintenance costs will also decrease. Boston's Department of Neighborhood Development recently published a zero emissions buildings report titled Guidebook for Zero Emissions Buildings (ZEBs). The guidebook provides a cost analysis of ZEBs compared to current stretch code buildings and demonstrates minimal cost increases for ZEBs by building size. A 2019 report published by Built Environment Plus (Formerly USGBC MA) titled *Zero Energy Buildings in Massachusetts: Saving Money from the Start* made five key findings:

1. ZE buildings are being built in Massachusetts today with virtually no upfront costs.
2. Return on investment for ZE in Existing and New Office Buildings can begin in as little as one year for ZE ready buildings.
3. Of the six building types studied, all can be Zero Energy Ready (ZER) for upfront costs of 0-7 percent and all types breakeven in eight years or less when there are no additional upfront costs.
4. Existing office buildings retrofitted to zero energy, with renewables, can produce a return on their investment in as little as five to six years in comparison to a code compliant renovation.
5. Building energy demand can be reduced 44 – 54 percent across all building types with technology that's readily available today.

Additional Background and Rational

2021 Massachusetts Energy-Zero Code (MA E-Z Code)

Introduction

In the Commonwealth of Massachusetts, commercial and residential building operations result in nearly half of the Commonwealth's total annual greenhouse gas (GHG) emissions. Most buildings constructed today will still be in service long after we reach the Massachusetts Global Warming Solutions Act 2050 requirement to reduce GHG emissions by 80 percent. Therefore, we must take action now to reach our GHG emissions reduction goals.

New buildings can and should be designed to zero energy specifications now if we expect to have a carbon-neutral building stock in the future. Zero energy buildings offer many advantages, including better health and comfort, lower total cost of ownership, and greater resilience.

Zero energy buildings have been built at many scales and budgets, including a broad range of building uses and architectural styles. Homeowners, businesses, institutions, and developers are now taking advantage of the benefits of zero energy buildings at all scales. The benefits have led to exponential growth in the number and size of zero energy buildings in recent years.

While the energy efficiency of a building's design and operations itself is critical and therefore is the focus of this code, the source of a building's energy (e.g., electric grid) and its corresponding carbon footprint is equally essential to addressing GHG emissions reduction goals. As Massachusetts works toward deep carbon reductions in its electricity grid, this code seeks to align with the opportunity of a lower carbon energy footprint via electrification.

Massachusetts was the first state to adopt a statewide stretch code and now is poised to be among the first to adopt a zero energy stretch code. Massachusetts is not alone in the pursuit of zero energy buildings. California is implementing similar codes. Mayors of New York City, Portland, Seattle, and Washington DC have also committed to requiring zero energy operation for all new buildings by 2030. Additionally, states such as Vermont and New York have committed to having all new construction be zero energy, and all grid electricity be renewably generated.

The MA E-Z Code aligns ardently with the goals and requirements of the Commonwealth's Global Warming Solutions Act, Green Communities Act, Executive Order 569, and the Massachusetts Comprehensive Energy Plan. The proposed requirements of the MA E-Z Code is backed up by successful built examples, demonstrating that these targets are achievable and cost-effective today.

Development

The creation of the MA E-Z Code was a consensus-based process, drawing from professionals with extensive experience with zero and high-performance buildings in Massachusetts and the surrounding region, review of precedent zero energy codes and standards, and feedback from municipal and regulatory representatives. The development management of this code was organized by Northeast Energy Efficiency Partnerships (NEEP), www.neep.org.

MA E-Z Code Proposal Context

The currently adopted 9th Edition Massachusetts base energy code is based on the model 2018 International Energy Conservation Code (IECC), with Massachusetts amendments that increase specific energy efficiency requirements. The 9th Edition incorporates ASHRAE 90.1-2016 Appendix G, with Massachusetts Amendments, for the performance compliance path.

The currently adopted Massachusetts stretch code builds off of the Massachusetts base energy code, relying on ASHRAE 90.1-2013 Appendix G, with Massachusetts amendments incorporated into the baseline. The currently adopted stretch code requires a ten percent reduction in energy consumption for large new commercial buildings compared to the Massachusetts base code-reference design.

In 2022, the Massachusetts base energy code will be updated. At that time, it will be based on the model IECC 2021. Based on past precedents, the state may amend IECC 2021 to increase specific efficiency requirements. In 2022, the Massachusetts stretch code will also be updated to the 10th Edition.

AIA Massachusetts has submitted a code change proposal to the Massachusetts Board of Building Regulations and Standards (BBRS)[1] for inclusion in the 10th Edition of the Massachusetts stretch code (2022). The MA AIA proposal amends the current Appendix 115 AA (the stretch energy code). The AIA Massachusetts proposal is to adopt the IECC 2021 Zero Code Renewable Energy Appendix (ZCREA).

The MA E-Z Code proposal generally supports the IECC 2021 ZCREA proposal. But, the IECC 2021 ZCREA proposal does not sufficiently address the need for a flexible and comprehensive framework to rapidly pursue the Commonwealth's GHG emission reduction goals for new commercial buildings. The MA E-Z Code incorporates and enhances the AIA Massachusetts proposal.

Regardless of the differences between the two proposals, both the AIA proposal and the MA E-Z Code proposal recognize the express desire of numerous municipalities, energy advocates, and state elected officials that have requested that the BBRS provide a zero energy code compliance option within the state's next building code.

[1] The BBRS oversees Massachusetts building codes adoption and construction supervisor licensing.

AIA Zero Code

The 2021 IECC Zero Code Renewable Energy Appendix (ZCREA), known nationally as the "ZERO Code," provides code-adaptable language defining the energy efficiency and renewable energy requirements (on-site generation and/or off-site procurement) for zero-net-carbon new buildings.

Complying with the ZERO Code entails first meeting the minimum prescriptive or performance requirements for building energy efficiency defined by ASHRAE Standard 90.1-2016.

As part of a standardized and predictable process to continue to advance energy efficiency, new standards that exceed ASHRAE Standard 90.1-2016 have been incorporated into the ZERO Code, such as the 2018 International Green Construction Code (IgCC) and ASHRAE Standard 189.1-2017. Once the minimum requirements of the standard are met, then the on-site and/or off-site renewable energy is calculated to achieve a zero-net-carbon building design. https://zero-code.org/

MA E-Z Code Overview

The MA E-Z Code defines a zero building as an ultra-low-energy, combustion-free building that sources 100% of its annual energy from additional renewable energy. The MA E-Z Code offers an alternative compliance path to design and build zero buildings. The alternative compliance path is a prescriptive path, which may be selected for new buildings, instead of the performance (energy model) path. The prescriptive path has been named the "E-Z" path because it enhances building energy efficiency, is simpler to apply, and supports a more streamlined regulatory review for compliance.

In addition to offering a prescriptive compliance path, the MA E-Z Code addresses the electrification of buildings, a critical strategy for the Commonwealth to reach carbon neutrality. The MA E-Z Code modifies the IECC 2021 ZCREA to limit renewable energy sources to those that meet 'additionality,' ensuring that the renewable energy will have a net positive effect on Massachusetts GHG emissions. The MA E-Z Code also addresses demand response, resilience, and several other topics that minimize a new building's life cycle impact on GHG emissions.

The MA E-Z Code includes the following:

1. A prescriptive compliance path, offering a straightforward approach to building energy performance. This path does not require whole building energy modeling to demonstrate compliance.
2. A performance (energy model) compliance path, matching the IECC 2021 ZCREA.
3. A prescriptive backstop for projects using the performance (energy model) path. The backstop avoids the variability that can come from relying solely on energy modeling for compliance.
4. Requirements that preclude on-site combustion (with exceptions) to ensure that buildings can rely on renewable energy.

5. A pass/fail criteria for renewable energy sources with no weighting factors. The requirements provide a straightforward path while ensuring that the source of renewable energy is additional, creating a new tangible net reduction in GHG emissions that otherwise would not have occurred.
6. Adds requirements to address the critical issues of resilience and demand management.

The table below provides a summary of these enhancements and how they incorporate and enhance the IECC 2021 ZCREA / AIA Zero Code:

	IECC 2021 ZCREA / AIA Zero Code	**MA E-Z Stretch Code**
Energy Efficiency	ASHRAE 90.1-2016 Appendix G (building performance factors, using site energy)	Prescriptive Path IECC 2021 + Massachusetts Amendments Incorporating Passive House Principles[2] -OR- Performance Path ASHRAE 90.1-2016 Appendix G (matches IECC Zero Energy Appendix / AIA Zero Code) (building performance factors, using site energy or 2030 projected source fossil fuel)[3] WITH Prescriptive Backstop (same as the prescriptive path, but with less strict requirements)
Electrification	n/a	No Combustion, with exceptions (examples of exceptions: labs, healthcare, commercial kitchens, domestic hot water) Electric Vehicle requirements Demand Response requirements

[2] 1) highly insulated envelope, 2) airtight construction, 3) high-performance glazing, 4) thermal-bridge-free detailing, and 5) high performance heat recovery ventilation.

[3] By 2030, New England's fuel mix is 27 percent fossil fuel, a 13 percentage point reduction relative to 2018. By 2030, the fuel mix of wind, solar, hydro, and other renewables is 35 percent, a 19 percentage point increase relative to 2018. Source: Massachusetts Comprehensive Energy Plan Commonwealth and Regional Demand Analysis Massachusetts Department of Energy Resources December 12, 2018 https://www.mass.gov/files/documents/2019/01/10/CEP%20Report-%20Final%2001102019.pdf

Renewable Energy	Many Renewable Energy Options With Weighting Factors	Only Renewable Energy Demonstrating Additionality Allowed No Weighting Factors (MA Class I or long-term PPA from any continental US grid with greater than or equal emissions factor to that of ISO-NE) On-site Solar requirements
Other	n/a	Addresses several additional topics, including embodied carbon, refrigerants, commissioning, and energy use disclosure.

"E-Z" Prescriptive Path

MA E-Z Code offers a prescriptive zero energy compliance path that focuses on measures that are straightforward and high-impact. MA E-Z Code prescriptive compliance path enhances building energy efficiency, is simpler to apply, and supports a more streamlined regulatory review for compliance. The MA E-Z Code prioritizes building energy efficiency before leveraging renewable energy to meet the building's remaining energy needs.

Overall, the prescriptive measures reduce demand on building systems and utility infrastructure. Thereby, the MA E-Z Code promotes cost-effective zero energy buildings for various commercial building typologies that can be scaled from individual buildings to the entire Commonwealth.

The MA E-Z Code is intended to be updated with each successive version of the national model energy codes to reflect new developments in the market adoption of building technology and practices.

The "E-Z" Prescriptive measures address the following categories:

1. Building Thermal Envelope (AA104.3.1)
2. Energy Recovery Ventilation Systems (AA104.3.2)
3. Allowable Fan Horsepower (AA104.3.3)
4. Heat Pump Capacity (AA104.3.4)
5. Service Water-heating Equipment Performance Efficiency (AA104.3.5)
6. Internal Lighting Power Allowance (AA104.3.6)

Proposed Adoption Pathway for the MA E-Z Code

The MA E-Z Code proposal provides the Massachusetts Board of Building Regulations and Standards (BBRS) with a pathway to create a Massachusetts zero energy stretch code.

Proposed Adoption Pathway:

1. Adoption of the MA E-Z Code as an appendix to 780 CMR 13.00 creating a revised Appendix 115 AA stretch code[4].

Arrangement and Format of the 2021 Massachusetts Energy - Zero Code

AA101. Scope and Intent

AA102. Definitions

AA103 Administration and Enforcement

AA104 Load Reduction + Energy Efficiency

AA105 Electrification

AA106 Renewable Energy

AA107 Jurisdictional Compliance Requirements

AA108 Referenced Standards

[4] Although the intent is for full adoption of the MA E-Z Code, the proposal has been separated into sections, such that the BBRS may adopt the E-Z Code in part. The BBRS may also select portions to adopt as part of the base energy code.

Replace current Chapter 115 - Appendix AA as follows:

780 CMR: STATE BOARD OF BUILDING REGULATIONS AND STANDARDS

780 CMR: MASSACHUSETTS AMENDMENTS TO THE INTERNATIONAL BUILDING CODE 2015

~~**Appendix AA STRETCH ENERGY CODE**~~

~~**AA101 Purpose and Adoption.** The purpose of the stretch energy code is to provide a more energy efficient code alternative for new buildings. The stretch energy code may be adopted or rescinded by any municipality in the Commonwealth in the manner prescribed by law.~~

~~**AA102 Applicability.** Municipalities that have adopted the stretch energy code shall use the energy efficiency requirements of this appendix as provided in AA103 and AA104. These requirements replace all previous stretch energy code requirements.~~

~~**AA103 New Buildings.**~~

~~**AA103.1 R-use Buildings.** In all R-use buildings, of four stories or less above grade plane with one or more dwelling units, each dwelling unit shall comply with IECC 2018 section R406 of 780 CMR 51.00 and all mandatory requirements of 780 CMR 13.00: Energy Efficiency and 51.00, as applicable.~~

~~**AA103.2 Large Area and High Energy Use Buildings.** All buildings over 100,000 ft2, and new supermarkets, laboratories and conditioned warehouses over 40,000 ft2 shall comply with 780 CMR 13.00: Energy Efficiency and shall demonstrate energy use per ft2 at least 10% below the energy requirements of ANSI/ASHRAE/IESNA 90.1 Appendix G Performance Rating Method on either a site or source energy basis. The additional efficiency package options selected in accordance with C406.1 shall be included in calculating the baseline building performance value.~~

~~**Exception:** Exclusively R-use buildings complying with AA103.1 dwelling unit Requirements.~~

~~**AA103.3 Other New Buildings.** New buildings not covered in AA103.1 and AA103.2 shall comply with 780 CMR 13.00: Energy Efficiency or Chapter 11 of 780 CMR 51.00 as applicable based on the use and occupancy of the building.~~

~~**AA104 Existing Buildings.** For alterations, renovations, additions or repairs of existing buildings in these municipalities, the energy efficiency requirements of 780 CMR 13.00: Energy Efficiency or Chapter 11 of 780 CMR 51.00 shall be used as applicable based on the use and occupancy of the building.~~

APPENDIX AA: Massachusetts Energy - Zero Code (MA E-Z Code)

AA101. SCOPE AND APPLICATION

AA101.1 Title. *APPENDIX AA shall be known as the* ***Massachusetts Energy - Zero Code (MA E-Z Code)*** *and shall be cited as such. It is referred to herein as "this/the code" or "the MA E-Z Code."*

AA101.2 Scope. *This code applies to commercial buildings and the buildings' sites and associated systems and equipment.*

AA101.3 Intent. *The intent of the MA E-Z Code is to provide a zero energy code to require the design and construction of buildings to achieve zero energy.*

AA101.4 Applicability. *Municipalities that have adopted the Massachusetts Stretch Code or others wishing to comply with MA E-Z Code shall use the requirements of this appendix as provided below. These requirements replace all previous stretch energy code requirements.*

AA101.4.1 New Buildings

AA101.4.1.1 Commercial Buildings. *All buildings over 5,000 sq ft shall comply with 780 CMR Chapter 13.00: Energy Efficiency and shall comply with the MA E-Z Code.*

Exceptions:

1. Exclusively R-use buildings, of four stories or less above grade plane[5].

2. Structures that do not use electricity or fuels to produce heat or power.

AA101.4.1.2 Other New Buildings. *New buildings not covered in AA101.4.1.1 shall comply with 780 CMR 13.00: Energy Efficiency or Chapter 11 of 780 CMR 51.00: Massachusetts Residential Code as applicable based on the use and occupancy of the building.*

AA101.4.2 Existing Buildings*. For alterations, renovations, additions, or repairs to existing buildings in these municipalities, the energy efficiency requirements of 780 CMR 13.00: Energy Efficiency or Chapter 11 of 780 CMR 51.00: Massachusetts Residential Code shall be used as applicable based on the use and occupancy of the building.*

[5] The MA E-Z Code does not address R-use buildings of four stories or less above grade.

AA102 DEFINITIONS, ABBREVIATIONS AND ACRONYMS

AA102.1 General. *Specific terms, abbreviations, and acronyms are defined in this section for the purpose of the MA E-Z Code. These terms are applicable to all sections of the MA E-Z Code. The definitions supplement or modify the definitions in the International Energy Conservation Code and 780 CMR 13.00.*[6]

AA102.2 Definitions

ADDITIONALITY. *Additionality means sourcing renewable energy that creates a new tangible net reduction in GHG emissions that otherwise would not have occurred.*

AIR SUPPLY. *(1) Air delivered by mechanical or natural ventilation to a space composed of any combination of outdoor air, recirculated air, or transfer air. (2) Air entering a space from an air-conditioning, heating, or ventilating apparatus for the purpose of comfort conditioning. Supply air is generally filtered, fan forced, and either heated, cooled, humidified, or dehumidified as necessary to maintain specified conditions. Only the quantity of outdoor air within the supply airflow may be used as replacement air.*

AIR-SOURCE HEATING CAPACITY. *Installed equipment heating capacity, based on published manufacturer data, using ambient air as the heating source, at winter design condition.*

BACK-UP SYSTEM. *Systems intended to operate only in case of failure of a primary system.*

COEFFICIENT OF PERFORMANCE. *The ratio of the rate of heat removal to the rate of energy input, in consistent units, for a complete refrigeration system or some specific portion of that system under designated operating conditions.*

COMMERCIAL BUILDING. *For this code, all buildings that are not included in the definition of "Residential Building."*

DEMAND MANAGEMENT. *Implementing methodologies to bring the electricity demand and supply closer to a perceived optimum, so that electricity end-users benefit by reducing their demand.*

DEMAND RESPONSIVE CONTROL. *A control that is capable of receiving and automatically responding to a demand response signal.*

DEMAND RESPONSE. *Short-term changes in electricity usage by end-use customers from their normal consumption patterns.*

DEMAND RESPONSE SIGNAL. *A signal sent by the local utility, Independent System Operator (ISO), or designated curtailment service provider or aggregator, to a customer, indicating a price or a request to modify electricity consumption, for a limited time period.*

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[6] Where possible the definitions where taken from approved ICC 2021 IECC proposals

DISTRICT ENERGY SYSTEM. *District Energy Systems are networks of hot and cold water pipes, or steam distribution systems, typically buried underground, that are used to efficiently heat and cool buildings using less energy than if the individual buildings were to each have their own boilers and chillers.*

ELECTRIFICATION. *Substituting electric technologies for combustion-fueled technologies*

ELECTRIC VEHICLE SUPPLY EQUIPMENT (EVSE). *The conductors, including the ungrounded, grounded, and equipment grounding conductors, and the Electric Vehicle connectors, attachment plugs, and all other fittings, devices, power outlets, or apparatus installed specifically for the purpose of transferring energy between the premises wiring and the Electric Vehicle.*

EV CAPABLE SPACE. *Electrical panel capacity and space to support a minimum 40-ampere, 208/240-volt branch circuit for at least that parking space, and the installation of raceways, both underground and surface mounted, to support a future dedicated EVSE servicing Electric Vehicles*

FLOOR AREA, GROSS*. The total floor area, including occupied areas and unoccupied accessory areas such as corridors, stairways, toilet rooms, mechanical rooms, and closets. Utilize BOMA 2018 Gross Areas: Standard Methods of Measurement (ANSI/BOMA Z65.3—2018).*

GROUND-SOURCE HEATING CAPACITY*. Geo-exchange bore field heating capacity, based on design engineering calculations, at winter design condition.*

HEALTHCARE SPACE. *A space or portion of a building regulated by the Massachusetts Department of Public Health as a health care facility.*

HEALTHCARE BUILDING. *A building regulated by the Massachusetts Department of Public Health as a health care facility.*

MULTI FAMILY HOUSING. *High-rise buildings. (10 or more stories), mid-rise buildings. (5 to 9 stories),*

LABORATORY SPACE. *A space or portion of a building specifically intended for scientific purposes where the installed infrastructure includes provisions for more than 10% of the exhaust from the space as Class 4 air. Class 4 air is as defined by ASHRAE 62.1-2019: "air with highly objectionable fumes or gases or with potentially dangerous particles, bioaerosols, or gases, at concentrations high enough to be considered as harmful."*

LABORATORY BUILDING. *A building where more than 25% of the BOMA Usable Square Feet is intended for Laboratory use.*

LABORATORY EXHAUST. *Exhaust from a laboratory space.*

POWER PURCHASE AGREEMENT. *A long-term contract to procure RECs and underlying electrons from a specific project. The project can be an on-site or off-site renewable energy system.*

RESIDENTIAL BUILDING. *Detached one and two-family dwellings and multiple single-family dwellings (townhouses) as well as Group R-2, R-3, and R-4 buildings three stories or less in height above grade plane.*

RENEWABLE ENERGY CREDIT. *The environmental "attributes" of electricity generated from renewable resources (1 REC = 1 MWh). Attributes are based on the generation technology type and age, geographic location, and time of generation.*

RENEWABLE ENERGY SYSTEM. *A generator powered by renewable energy, defined as Photovoltaic solar array, Solar thermal, Wind energy, Small hydropower, Marine or hydrokinetic energy, Geothermal energy (without vapor compression cycle).*

RESILIENCE*. The ability to maintain critical life-support conditions in the event of extended loss of power, heating fuel, or water.*

SENSIBLE ENERGY RECOVERY RATIO. *The change in the dry-bulb temperature of the outdoor air supply divided by the difference between the outdoor air and entering exhaust air dry-bulb temperatures expressed as a percentage.*[7]

SITE ENERGY. *Site Energy is the combination of primary and secondary energy that you buy directly for use at your building.*

SOLAR ENERGY SYSTEM*. A device or structural design feature, a substantial purpose of which is to provide for the collection, storage, and distribution of solar energy for space heating or cooling, electricity generation, or water heating.*

SOURCE ENERGY. *Source Energy is your total primary energy consumption (Site Energy) plus all the delivery and production losses. To get the delivery and production losses, each fuel is multiplied by a "Site-to-Source" conversion factor. Source energy is the sum of the: primary energy you buy directly. If source energy is used as a metric, it should be based on source fossil fuel energy.*

THERMAL ENERGY: *Includes all systems that provide heating or domestic hot water, including, for example, boilers, furnaces, water heaters, and cogeneration systems.*

UA CALCULATION. *U-factor X area; Comcheck performs a simple UA calculation for each building assembly to determine the overall UA of your building. The UA that would result from a building conforming to the code requirements is compared against the UA for your building. If the total heat loss (represented as a UA) through the envelope of your building does not exceed the total heat loss from the same building conforming to the code, then the software declares that the building passes.*

[7] Matches the definition in ASHRAE 90.1-2019.

U-FACTOR/U-VALUE. *A measure (Btu/h ft^2 °F) of how well a material or series of materials conducts heat. U-factors for window and door assemblies are the reciprocal of the assembly R-value. The smaller the number, the less the heat flow.*

VIRTUAL POWER PURCHASE AGREEMENT. *A financially-settled arrangement between a renewable energy project and buyer, where the renewable energy project and buyer do not need to be in the same grid region. This arrangement may be appealing to buyers that have multiple load centers.*

5.3 ABBREVIATIONS AND ACRONYMS

Btu	*British thermal Unit*
Btu/h-sf	*Btu per hour per square foot*
cfm	*Cubic feet per minute*
cfm/sf	*Cfm per square foot*
COP	*Coefficient of Performance (See 5.2 Definitions)*
degF	*Degrees Fahrenheit*
EV	*Electric vehicle*
EVSE	*Electric vehicle system equipment*
HVAC	*Heating, ventilating, and air conditioning*
pa	*Pascal*
PPA	*Power Purchase Agreement*
VPPA	*Virtual Power Purchase Agreement*

AA103 ADMINISTRATION AND ENFORCEMENT

AA103.1 Administration and Enforcement*. Administration and enforcement of MA E-Z Code shall be governed by 780 CMR, (Chapter 1 - Scope and Administration), and enforced by the building official, in accordance with M.G.L. c. 143, §§ 3, 3A, 3Y, and 3Z and M.G.L. c. 22, the building official shall include the building commissioner or inspector of buildings, local inspector, and state building inspector.*

AA103.2 Compliance. *Buildings regulated by the MA E-Z Code shall comply with all of the following:*

1. *The requirements of 780 CMR Chapter 13.00 Energy Efficiency.*
2. *The requirements of Section AA104 Energy Efficiency.*
3. *The requirements of Section AA105 Electrification.*
4. *The requirements of Section AA106 Renewable Energy.*
5. *The requirements of Section AA107 Additional Measures.*

AA103.2.1 Conflicts. *Where, in any specific case, different sections of this code and 780 CMR Chapter 13.00: Energy Efficiency specify different requirements, the most restrictive shall govern. Where there is a conflict between a general requirement and a specific requirement, the specific requirement shall govern.*

AA103.3 Referenced Codes and Standards. *The codes, standards, and certification protocols referenced in this code shall be those listed in Section AA108, and such codes and standards shall be considered as part of the requirements of this code to the prescribed extent of each such reference and such reference as further regulated in Section AA103.3.1.*

> ***AA103.3.1 Conflicts.*** *Where conflicts occur between provisions of the MA E-Z Code and referenced codes and standards within the MA E-Z Code, the provisions of this code shall apply.*

AA104 ENERGY EFFICIENCY

AA104.1 Scope. *The provisions of this section address building energy efficiency requirements.*

AA104.2 Application. *Buildings regulated by the MA E-Z Code shall comply with the energy efficiency requirements with one of the following:*

1. *The requirements of Section AA104.3 Prescriptive Compliance Path.*
2. *The requirements of Section AA104.4 Performance Compliance Path.*

AA104.3 Prescriptive Compliance Path. *Buildings shall comply with the requirements of sections AA104.3.1 (Building Thermal Envelope) through AA104.3.6 (Lighting Power Density).*

> ***AA104.3.1 Building Thermal Envelope.*** *Building thermal envelopes shall comply with the requirements of sections AA104.3.1.1 (Envelope Heating Load Limit) through AA104.3.1.3 (Envelope Airtightness).*

Exception: *Buildings exempt from Building Envelope Requirements per IECC (2021).*

AA104.3.1.1 Envelope Heating Load Limit. *Building heating load shall not exceed 5 Btu/h-sf, in accordance with Equation AA4-1[8]. IP or SI units shall be used consistently in the calculation.*

(Equation AA4-1)

UA x ΔT / SF ≤ 5 Btu/h-sf (8.8 W/sm-K)
where:

UA = Sum of the Proposed U-value x Area values for each distinct assembly type of the building thermal envelope, other than slabs on grade and below-grade walls, as defined by IECC 2021.

ΔT = Temperature difference of 70°F (38.9°C) between indoor conditioned space and winter ambient..

SF = Building gross floor area, not including areas exempt from Building Envelope Requirements.

AA104.3.1.2 Area-Weighted Average Building Envelope U-value. *Building envelope values and fenestration areas shall comply with Equation 4-2 of IECC 2021*. In addition, for purposes of this calculation, the following modifications shall be made:*

AA104.3.1.2.1 Fenestration U-value. *For purposes of demonstrating compliance with Equation 4-2, the U-factors in Table C402.4 of IECC 2021 shall be modified as follows:*

Table C402.4 Building Envelope Fenestration Maximum U-Factor Requirements

Fenestration Type	***U-factor (Climate Zone 5)***
Fixed fenestration	***0.28***
Operable fenestration	***0.35***

AA104.3.2.2 Fenestration Area. *For purposes of demonstrating compliance with Equation 4-2, the baseline vertical fenestration area shall be equal to the lesser value of the following:*

1. The value defined by IECC 2021 C402.4.1.

[8] The E-Z Code utilizes a single consistent value that approximately aligns with PHI and MA climate PHIUS allowable values. Note that PHIUS values vary based on building and climate parameters, so the E-Z Code does not match the PHIUS values.
* References to specific sections of the 2021 IECC subject to change upon publication of the 2021 IECC.

2. The values listed in Table AA1.04.3.2.2-1 Baseline Building Gross Above-Grade -Wall Area.

Table AA104.3.2.2-1[9] Baseline Building Gross Above-Grade -Wall Area

Building Area Types	***Baseline Building Gross Above-Grade -Wall Area***
Grocery store	*7%*
Healthcare (outpatient)	*21%*
Hospital	*27%*
Hotel/motel (≤75 rooms)	*24%*
Hotel/motel (>75 rooms)	*34%*
Office/Laboratory Building (≤5000 ft2)	*19%*
Office/Laboratory Building (5000 to 50,000 ft2)	*31%*
Office/Laboratory Building (>50,000 ft2)	*40%*
Restaurant (quick service)	*34%*
Restaurant (full service)	*24%*
Retail (stand alone)	*11%*
Retail (strip mall)	*20%*
School (primary)	*22%*
School (secondary and university)	*22%*
Warehouse (non-refrigerated)	*6%*
Multifamily	*24%*

[9] Based on ASHRAE 90.1-2019 Appendix G baseline. Includes the MA Amendment to the 780 CMR Ninth Edition, which adds Multifamily.

AA104.3.1.3 Air Leakage-thermal Envelope[10]. *The thermal envelope of buildings shall comply with C402.5 of IECC 2021. In addition, the thermal envelope airtightness shall only be deemed to comply when tested air leakage of the total area of the building thermal envelope is no greater than 0.10 cfm/ft^2 envelope at a pressure differential of 0.3-inch water gauge (75 Pa).*

AA104.3.2 Energy Recovery Ventilation Systems. *Energy recovery ventilation systems shall comply with C403.7.4 of IECC 2021. In addition, energy recovery ventilation systems shall comply with the following:*

AA104.3.2.1 Application. *All mechanical ventilation systems shall include an energy recovery system, regardless of the minimum fan system supply airflow rate and percent outdoor air. Exceptions listed in IECC 2021 shall be eliminated and replaced with the exceptions listed below.*

AA104.3.2.2 Energy Recovery Effectiveness. *The weighted average sensible energy recovery ratio of the building ventilation systems shall not be less than 1.0, in accordance with Equation AA4-2. The sensible energy recovery ratios used in the equation shall be the values listed in Table AA104.3.2.2-1. All values and calculations shall be based on the winter design condition. IP or SI units shall be used consistently.*

Exempt Exhaust *is defined as exhaust where energy recovery systems are prohibited by 780 CMR or the International Mechanical Code. This includes exhaust from commercial kitchen hoods used for collecting and removing grease vapors and smoke.*

Class 4 Exhaust *is defined as exhaust meeting the definition of Class 4 air in ASHRAE/ASHE Standard 62.1-2019, including laboratory fume hood exhaust, exhaust where energy recovery is not allowed by ASHRAE/ASHE Standard 170 for use in energy recovery systems with leakage potential, and systems exhausting toxic, flammable, paint or corrosive fumes or dust. The Class 4 Exhaust system must be capable of reducing exhaust and makeup airflow rates to 50% of the zone design values or the minimum required to maintain pressurization relationship requirements. Excludes exempt exhaust.*

Other Exhaust *is defined as any exhaust that does not fall under the categories of Exempt Exhaust or Class 4 Exhaust.*

Sensible Energy Recovery Ratio *is defined as the change in the dry-bulb temperature of the outdoor air supply divided by the difference between the outdoor air and entering exhaust air dry-bulb temperatures, expressed as a percentage.[11]*

[10] Approximately equivalent to PHIUS

[11] Matches the definition in ASHRAE 90.1-2019.

Table AA104.3.2.2-1 Sensible Energy Recovery Ratio

Exhaust Type	***Sensible Energy Recovery Ratio***
$EXH.EF_{OTHER}$	*80%*
$EXH.EF_{CLASS\text{-}4}$	*50%*
$EXH.EF_{EXEMPT}$	*0%*

$SENSIBLE.RATIO_{PROPOSED} \ / \ SENSIBLE.RATIO_{REQUIRED} \geq 1.0$

where:

$SENSIBLE.RATIO_{PROPOSED} = [(VENT.\Delta T_1 \times VENT.CFM_1) + (VENT.\Delta T_2 \times VENT.CFM_2) + (VENT.\Delta T_3 \times VENT.CFM_3) + \ldots) / VENT.CFM_{TOTAL}]$

and:

$SENSIBLE.RATIO_{REQUIRED} = [((EXH.\Delta T_{OTHER} \times EXH.CFM_{OTHER} \times EXH.EF_{OTHER}) + (EXH.\Delta T_{CLASS\text{-}4} \times EXH.CFM_{CLASS\text{-}4} \times EXH.EF_{CLASS\text{-}4}) + (EXH.\Delta T_{EXEMPT} \times EXH.CFM_{EXEMPT} \times EXH.EF_{EXEMPT})) / EXH.CFM_{TOTAL}]$

and:

(Equation AA4-2)

where:

$SENSIBLE.RATIO_{PROPOSED}$ = *Weighted average sensible energy recovery ratio of all mechanical ventilation systems.*

$SENSIBLE.RATIO_{REQUIRED}$ = *Minimum average sensible energy recovery ratio required by code.*

$VENT.\Delta T_X$ = *Change in the dry-bulb temperature of each individual mechanical ventilation system, calculated by subtracting the outdoor air dry-bulb temperature from the ventilation air temperature leaving the heat recovery device. This value shall be based on the change in dry-bulb temperature achieved by the heat recovery system alone, not including heat input from return air, fans, heat pumps, or active heating systems.*

$VENT.CFM_X$ = *Ventilation rate in cubic feet per minute of each individual mechanical ventilation system.*

$VENT.CFM_{TOTAL}$ = *Total volume of mechanical ventilation in cubic feet per minute.*

$EXH.CFM_{TOTAL}$ = *Total volume of mechanical exhaust in cubic feet per minute.*

$EXH.\Delta T_{OTHER}$ = *Dry-bulb temperature difference between the exhaust air and the ambient outdoor air, calculated by subtracting the ambient outdoor air temperature from the exhaust air temperature. The exhaust air*

temperature shall be based on the weighted average exhaust air temperature of all exhaust sources other than exempt exhaust and Class 4 exhaust. The value shall be based on the exhaust air temperature prior to exhaust heat recovery.

$EXH.\Delta T_{CLASS\text{-}4}$ = Similar definition as $EXH.\Delta T_{OTHER}$ except limited to Class 4 exhaust.

$EXH.\Delta T_{EXEMPT}$ = Similar definition as $EXH.\Delta T_{OTHER}$ except limited to exempt exhaust.

$EXH.CFM_{OTHER}$ = Exhaust rate in total cubic feet per minute of all exhaust sources other than exempt exhaust and Class 4 exhaust.

$EXH.CFM_{CLASS\text{-}4}$ = Exhaust rate in total cubic feet per minute of all Class 4 exhaust sources.

$EXH.CFM_{EXEMPT}$ = Exhaust rate in total cubic feet per minute of all exempt exhaust sources.

$EXH.EF_{OTHER}$ = Sensible energy recovery ratio requirement for ventilation air associated with all exhaust sources other than exempt exhaust and Class 4 exhaust. See Table AA104.3.2.2-1.

$EXH.EF_{CLASS\text{-}4}$ = Sensible energy recovery ratio requirement for ventilation air associated with all Class 4 exhaust sources. See Table AA104.3.2.2-1.

$EXH.EF_{EXEMPT}$ = Sensible energy recovery ratio requirement for ventilation air associated with all exempt exhaust sources. See Table AA104.3.2.2-1.

AA104.3.3 Allowable Fan Horsepower. *Building total fan horsepower, including only fans regulated by IECC 2021 C403.8.1 or C403.8.2 shall not be greater than 90% of the total building allowable fan horsepower defined by IECC 2021 C403.8.1 or C403.8.2.*

AA104.3.4 Heat Pump Capacity. *The sum of all air-source, exhaust-source and ground-source heat pumps shall have installed space heating capacity equivalent to 5 Btu/h per building square foot, in accordance with Equation AA4-4.*

(Equation AA4-4)

$$\Sigma Btu/h \ / \ SF \geq 5 \ Btu/h\text{-}sf$$

where:

$\Sigma Btu/h$ = Sum of the installed space heating capacity of all air-source and ground-source heat pumps that supply space heating. For exhaust-source heat pump systems, the heating capacity must be determined with the exhaust energy recovery ventilation system in operation.

SF = Building gross floor area, not including areas exempt from Building Envelope Requirements.

Exceptions:

1. Buildings with a consistent source of heat generation from non-combustion internal loads may rely on the non-combustion internal loads as a source of thermal energy. The consistently available space heating capacity of the system that relies on internal loads may be deducted from the heat pump capacity required by AA104.3.4.

2. Passive House and PHIUS certified buildings may use electric resistance space heating capacity equivalent to the design net heating load, in lieu of heat pumps.

3. Buildings with total design heating load less than 3.4 Btu/h-sf (6.0 W/sm-K) may use electric resistance space heating capacity equivalent to the design net heating load, in lieu of heat pumps.

4. Buildings with total design heating load less than 5 Btu/h-sf (8.8 W/sm-K) may limit heat pump capacity to the design net heating load.

AA104.3.5 Service Water-heating Equipment Performance Efficiency. *Water-heating equipment shall comply with C404.2 of IECC 2021. In addition, water-heating equipment shall comply with the following:*

AA104.3.5.1 Thermal Efficiency. *The weighted average coefficient of performance (COP) of the building service water-heating equipment shall not be less than 1.0, in accordance with Equation AA4-5.*

$$[(Btu/h_1 \times COP_1) + (Btu/h_2 \times COP_2) + (Btu/h_3 \times COP_3)+\ldots)] \ / \ (\Sigma Btu/h_1 + Btu/h_2 + Btu/h_3 + \ldots)$$

(Equation AA4-5)

where:

Btu/h = Input heating capacity of the water-heating equipment.

COP = The coefficient of performance of the water-heating equipment.

Exceptions:

1. Central service water-heating systems in the following use types: residential, hotel, healthcare, laboratory.

2. Emergency and back-up service water-heating systems.

AA104.3.6 Internal Lighting Power Allowance. *The total lighting power allowance (watts) shall comply with C405.3.2 of IECC 2021.*

AA104.4 Performance Compliance Path. *Buildings shall comply with the mandatory requirements of ASHRAE 90.1-2019 and shall comply with ASHRAE 90.1-2019 Appendix G Performance Rating Method, with amendments as follows:*

> ***AA104.4.1 Additional Mandatory Prescriptive Requirements.*** *Buildings shall comply with all MA E-Z Code prescriptive path requirements, including sections AA104.3.1 (Building Thermal Envelope) through AA104.3.6 (Lighting Power Density). When using the performance compliance path, the prescriptive requirements shall be modified, as shown in Table AA104.4.1-1.*

Table AA104.4.1-1 Modifications to Prescriptive Path Requirements

Prescriptive Category	***Prescriptive Path Requirement (for reference only, see the prescriptive path for more information)***	***Performance Path Requirement (when following the performance path, the values listed below replace the prescriptive path value)***
AA104.3.1.1 Envelope Heating Load Limit	*5 Btu/h-sf*	*8 Btu/h-sf*
AA104.3.1.2.1 Fenestration U-value	*Fixed fenestration 0.28 Operable fenestration 0.35*	*Fixed fenestration 0.33 Operable fenestration 0.40*
AA104.3.1.3 Air Leakage-Thermal Envelope	*0.10 cfm/sf @ 75pa*	*0.12 cfm/sf @ 75pa*
AA104.3.2.2 Energy Recovery Effectiveness	*80%*	*75%*
AA104.3.3 Allowable Fan Horsepower	*90% of IECC 2021 allowable*	*110% of IECC 2021 allowable*

AA104.4.2 Performance Rating Method Metric. *In lieu of energy cost, the proposed design shall comply with ASHRAE 90.1-2019 Appendix G Performance Rating Method on either a site energy or source combustion fuel energy basis.*

> ***AA104.4.2.1 Source Energy Method.*** *For the purpose of quantifying the projected source combustion fuel energy consumption of a building, the site to source combustion fuel conversion factors in Table AA104.4.2.1-1 shall apply.*

Table AA104.4.2.1-1 Site to Source Combustion Fuel Conversion Factors

Load Type	*Factor*
Electricity (Grid Purchase) meter	*1.50[a]*
Electricity (On-site Solar or Wind)	*1.00*
Natural Gas	*1.05*
Fuel Oil	*1.01*
LPG	*1.01*
Purchased District Heating *Hot Water Steam*	*1.20* *1.20*
Purchased District Cooling	*0.91*
Combustion Fuels Not Listed	*1.10*
Purchased Combined Heat and Power District Heat	*1.00[b]*

a. The default electricity (grid purchase) meter conversion factor is based on the projected average annual grid combustion fuel input per unit of delivered site electricity of the ISO New England grid in 2030.[12]

b. Default purchased combined heat and power district heat value shall be used if a value has not been approved by the Massachusetts Department of Energy Resources ("DOER"). A source fuel conversion for purchased district heat supplied by a combined heat and power central utility will be published by the DOER on a per district system basis.

AA104.4.3 Zero Energy Performance Index. *The proposed building zero energy performance index without consideration of renewable energy ($zEPI_{PB,EE}$) shall be less than or equal to the zero energy performance index target ($zEPI_{Target,EE}$) when calculated in accordance with Equation AA4-6 and the Performance Rating Method of ASHRAE 90.1-2019 (Appendix G).*

(Equation AA4-6)

$$zEPI_{PB,EE} \leq zEPI_{Target,EE}$$

where:

$$zEPI_{PB,EE} = [EUI_{PB,EE} \ / \ EUI_{BB,EE}] \times 100$$

and:

$$zEPI_{Target,EE} = [(EUI_{BB,UEU} + (BPF \times EUI_{BB,REU})) \ / \ (EUI_{BB,EE})] \times 100$$

[12] This is an estimated value and should be revised by MA DOER prior to implementation of this code.

$zEPI_{PB,EE}$ = *the zero energy performance index of the proposed building without consideration of renewable energy, unitless (see equation).*

$zEPI_{Target,EE}$ = *the zero energy performance index target without consideration of on-site or off-site renewable energy, unitless (see equation).*

$EUI_{PB,EE}$ = *the proposed building EUI without renewable energy, kWh/m2-y, MJ/m2-y, or kBtu/ft2-y.*

$EUI_{BB,EE}$ = *the baseline building EUI, including both regulated energy use and unregulated energy use, kWh/m²-y, MJ/m²-y, or kBtu/ft²-y. The baseline building has no renewable energy systems and is defined in Standard 90.1-2019, Appendix G.*

$EUI_{BB,UEU}$ = *baseline building unregulated EUI, the portion of the baseline building EUI that is due to unregulated energy use, kWh/m²-y, MJ/m²-y, or kBtu/ft²-y.*

$EUI_{BB,REU}$ = *baseline building regulated EUI, the portion of the annual energy use of the baseline building design that is due to regulated energy use, kWh/m²-y, MJ/m²-y, or kBtu/ft²-y.*

BPF = *building Performance Factor from Table 5.2, unitless. For building area types not listed in Table 5.2 use "All others." Where a building has multiple building area types, the BPF shall be the area-weighted average of the building area types. In cases where both a general building area type and a specific building area type are listed, the specific building area type shall apply.*

Table AA104.4.3 Building Performance Factor (BPF)

Building Area Type[a]	***Building Performance Factor***
Multifamily	*0.70*
Healthcare/hospital	*0.57*
Hotel/motel	*0.50*
Office	*0.51*
Restaurant	*0.63*
Retail	*0.50*
School	*0.36*
Warehouse	*0.49*

All Others	*0.51*

a. In cases where both a general building area type and a specific building area type are listed, the specific building area type shall apply.

AA105 ELECTRIFICATION

AA105.1 Scope. *AA105. Electrification specifies requirements for building electrification and decarbonization.*

AA105.2 On-Site Combustion. *On-site combustion shall not be permitted for the provision of thermal energy to the building.*

Exceptions:

1. Laboratory Buildings and Laboratory Spaces.

2. Healthcare Buildings and Healthcare Spaces.

3. Centralized domestic hot water systems in buildings with floor areas of at least 10,000 square feet.

4. Commercial kitchens and commercial cooking appliances.

5. Public Health and Safety systems that support public health and safety buildings.

6. Industrial processes manufacturing, agricultural and food processing, kilns.

7. Emergency Standby Generators.

8. Emergency and Back-up Domestic Hot Water Systems.

AA105.3 Electric Vehicle Charging Infrastructure*.*

AA105.3.1 Electric Vehicle (EV) Charging (Mandatory). *Projects shall facilitate installation and use of Electric Vehicle (EV) Capable infrastructure and Electric Vehicle Supply Equipment (EVSE) in accordance with NFPA 70.*

AA105.3.1.1 EV Capable Parking Spaces. *A minimum of 60% of the total parking spaces shall be EV Capable. Calculated spaces shall be rounded up to the nearest whole number.*

AA105.3.1.2 EVSE Parking Spaces. *A minimum of 10% of the total parking spaces shall be EVSE-Installed. Calculated spaces shall be rounded up to the nearest whole number. It is permissible to serve multiple spaces with one EVSE, but each associated connector must be able to reach the individual parking space.*

AA105.3.1.3 Identification. *Construction documents shall indicate the raceway termination point and proposed location of future EV spaces and EVSE chargers. Construction documents shall also provide information on amperage of future EVSE, raceway methods, wiring schematics, and electrical load calculations to verify that the electrical panel service capacity and electrical system, including any on-site distribution transformers, have sufficient capacity to simultaneously charge all EVs at all required EV spaces at the full rated amperage of the EVSE.*

AA105.4 Demand Response Capable.

AA105.4.1. Demand Response Capable. *Buildings shall include demand responsive controls/infrastructure[13] capable of receiving a demand response signal with the capacity to achieve at least a two percent reduction in peak demand based on primary electric service capacity or ten percent of estimated peak demand, based on energy model simulation if an energy model is used for performance path.*

Exception: *Life safety facilities and health care facilities utilizing critical life support systems or where statute, ordinance, or regulation does not permit lighting and HVAC to be reduced are not required to have demand control ability.*

AA105.4.2 Controls. *Demand Responsive controls with the ability to receive demand response signals shall be installed for the following building systems utilizing applicable industry standards and protocols.*

1. *Demand Responsive Zonal HVAC Controls.*
2. *Demand Responsive Lighting Controls.*

Exception:

1. Spaces with lighting power density of 0.5 watts per square foot or less are not required to install demand controls;

2. Life Safety Facilities where statute, ordinance, or regulation does not permit the lighting to be reduced are not required to have demand responsive controls ability.

3. *Demand Responsive Electronic Message Control Center.*

Exception: *Electronic message centers that are not permitted by a health or life safety statute, ordinance, or regulation to be reduced.*

[13] Demand Responsive Controls / Infrastructure - i.e. interval recording meters with communications and ability for the buildings automation system to accept an external price or control signal for demand responsive programs or dynamic, real time pricing programs.

AA105.5 District Thermal Energy Systems

AA105.5.1 District Thermal Energy. *New commercial building projects connected to existing district energy plants for thermal energy shall be designed for low temperature building heating hot water less than or equal to 130F.*

Exception: *Service water heating (no set temperature limit).*

AA105.5.2 District Energy Renewable Offset. *See AA106 Renewable Energy.*

AA106 RENEWABLE ENERGY

AA106.1 Scope. *AA106.1 specifies requirements for renewable energy systems of adequate capacity to achieve net zero energy.*

AA106.2 Intent. *To offset building energy consumption on a net annual basis by utilizing renewable energy. On-site renewable energy generation shall be prioritized as the primary renewable energy source, supplemented by off-site renewable energy only as necessary to reach net zero energy compliance.*

AA106.3 Building Energy Consumption. *One Hundred Percent of the building's annual energy consumption shall be generated by one or a combination of on-site renewable energy systems and off-site renewable energy systems.*

AA106.4 Building Energy Determination (Prescriptive). *When AA104.3 Prescriptive Compliance Path is used for compliance, building energy shall be determined by multiplying the gross conditioned floor area plus the gross semi-heated floor area of the proposed building by an EUI selected from Table AA106.4.1. Energy Utilization Intensity for Building Types. Use a weighted average for mixed-use buildings.*

Table AA106.4 Energy Utilization Intensity for Building Types (kBtu/ft²-Y)

Building Area Type[a]	***Energy Utilization Intensity (kBtu/ft²-yr)***
Multifamily	*47*
Healthcare/hospital, Laboratory	*118*
Hotel/motel	*71*
Office	*29*
Restaurant	*531*
Retail	*52*
School	*39*
Warehouse	*23*
All Others	*57*

a. In cases where both a general building area type and a specific building area type are listed, the specific building area type shall apply.

AA106.5 Building Energy Determination (Performance). *When AA104.4 Performance Compliance Path is used for compliance, building energy shall be based on the energy model proposed building value.*

AA106.6 Renewables Required (Annual). *The amount of on-site or off-site renewable energy annually shall equal the difference between the Massachusetts Renewable Energy Portfolio Standard (RPS)[14] percent in that given year and 100 percent. The annual energy production from on-site renewable energy systems shall be determined using PVWatts software or other software approved by the code official.*

> ***AA106.6.1 Green Municipal Aggregations.*** *For buildings located within cities and towns that participate in a green municipal aggregation program for electricity supply that requires more Massachusetts Class I Renewable Energy Credits (RECs) in the program's default rate than*

[14] The 2020 RPS is 16 percent; the RPS increases two percent annually through 2030 then increases by one percent annually thereafter.

required by the RPS, the amount of on-site or off-site renewable energy annually shall equal the difference between the municipality's default rate percent in that given year and 100 percent.

AA106.6.2 Individual Competitive Electricity Supply Contracts. *For buildings whereby a competitive electricity supply contract is procured that requires more Massachusetts Class I Renewable Energy Credits (RECs) than required by the RPS, the amount of on-site or off-site renewable energy annually shall equal the difference between the percent of MA Class I RECs in that given year and 100 percent.*

AA106.7 Renewable Sources. *Renewable energy sources shall meet the following requirements:*

AA106.7.1 Weighting Factors. *There are no weighting factors. All acceptable renewable energy sources are calculated as a one-to-one value.*

AA106.7.2 Renewable Energy Sources. *One or combination of On-site renewable energy systems, and Off-site Renewable Energy systems.*

AA106.7.3 On-site Renewable Energy Systems. *The following on-site renewable energy systems are acceptable. All RECs generated by the system shall be retained and retired.*

1. *MA Class I (Excluding Combustible Sources)*

    a. *Solar photovoltaic*

    b. *Solar thermal electric*

    c. *Wind energy*

    d. *Small hydropower*

    e. *Marine or hydrokinetic energy*

    f. *Geothermal energy (without vapor compression cycle)*

        Exception: *For existing district energy plants that serve thermal energy to multiple buildings, all MA Class I renewable energy sources are acceptable, including: landfill methane, anaerobic digester gas, and eligible biomass fuel.*

AA106.8 Qualifying Off-site Procurement Methods. *The following are considered qualifying off-site renewable energy procurement methods:*

AA106.8.1 *Community Renewables: An off-site renewable energy system for which the owner has purchased or leased renewable energy capacity along with other subscribers.*

AA106.8.2 Power Purchase Agreement (PPA) or Virtual Power Purchase Agreement (VPPA). *Execute of a PPA or VPPA that enables the development of any new renewable energy system,*

from the list in 9.3.2.1, connecting to a Continental US Grid with an Emissions Factor greater than or equal to the ISO New England grid.

AA106.8.3 Direct Ownership. *An off-site renewable energy system owned by the building project owner.*

AA106.8.4 Direct Access to Wholesale Market. *An agreement between the owner and a renewable energy developer to purchase renewable energy.*

AA106.8.5 Renewable Energy Credits (RECs). *Purchase MA Class I RECs for lifetime of building. All RECs purchased shall be retained and retired.*

AA106.9 Requirements for all procurement methods. *The following requirements shall apply to all off-site renewable energy procurement methods.*

1. The building owner shall sign a legally binding contract to procure qualifying off-site renewable energy.

2. The procurement contract shall have duration of not less than 15 years and shall be structured to survive a partial or full transfer of ownership of the property.

a. Upon contract end: One or more of these mechanisms shall be utilized to access renewables to cover the load previously covered through the previous contract.

3. RECs and other environmental attributes associated with the procured off-site renewable energy shall be assigned to the building project and retired.

4. The off-site renewable energy producer shall maintain transparent accounting that clearly assigns production or RECs to the building. Records on power sent to or purchased by the building shall be retained by the building owner and made available for inspection by the code official upon request.

AA106.10 On-Site Renewable Energy.

AA106.10.1 Solar Ready. *Follow MA 780 CMR - CHAPTER 13: COMMERCIAL ENERGY EFFICIENCY, which references the IECC 2018 Appendix CA: Solar-ready Zone - Commercial.*

AA106.10.2 Rooftop Solar (Mandatory). *Buildings and buildings sites are required to include a solar energy system equivalent to a minimum of 50 percent of the roof area of buildings (excluding skylight area), additionally 90 percent of overhangs, covered parking areas, trellises, arbors, patio covers, carports, gazebos and similar accessory structures within 250 feet of the buildings or installed with the building project.*

Exemptions:

1. A project shall not be required to install a solar energy system on the roof when there is no solar-ready zone, or the solar-ready zone is shaded for more than 70% of daylight hours annually or for building conversions with insufficient structural load capacity.

2. If sufficient ground-mounted solar is installed, the roof-mounted requirement may be reduced or waived. The required amount of roof-mounted solar may be reduced in equal amount, or less, to the amount of ground-mount solar capacity installed.

3. Developers may seek an exemption from the inspector of buildings or building commissioner from the above requirements upon demonstration and verification in a form acceptable to the code official that a substitute renewable energy system, defined in "on-site renewable energy systems" above, will be installed at the time of construction, producing an equal or greater amount of electricity on an annual basis.

AA106.11 Assignment of Energy to Multiple Buildings on a Site. *For building sites with multiple buildings and that are employing district energy systems, the energy use associated with the building site shall be assigned to each building proportionally to the gross floor area of each building as a fraction of the total gross floor area of all buildings on the building site. Where energy is derived from either renewable or waste energy, or both sources, either located on the building site, within individual buildings or on individual buildings and delivered to multiple buildings, the energy so derived shall be assigned on a proportional basis to the buildings served, based on each served building gross floor area. Energy delivered from renewable or waste energy sources located on or within a building shall be assigned to that building.*

Exception: *Where it can be shown that energy to be used at the building site is associated with a specific building, that energy use shall be assigned to that specific building.*

AA106.12 District Energy Renewable Offset. *District energy shall be offset by renewable sources.*

Exception: *For buildings connected to existing district energy plants that provide thermal energy to multiple buildings, all MA Class I renewable energy sources are acceptable, including landfill methane, anaerobic digester gas, and eligible biomass fuel. Renewable energy is not required to offset this thermal energy.*

AA107 JURISDICTIONAL COMPLIANCE REQUIREMENTS

AA107.1 SCOPE. *Section AA107 contains compliance requirements that are specific to and selected by the jurisdiction.*

> ***AA107.1.1 Application.*** *The provisions contained in this code are applicable to buildings or portions of buildings. As indicated in Section AA103.1, buildings shall meet the requirements of 780 CMR, (Chapter 1 - Scope and Administration), and enforced by the building official, in accordance with M.G.L. c. 143, §§ 3, 3A, 3Y, and 3Z and M.G.L. c. 22, the building official shall include the building commissioner or inspector of buildings, local inspector, and state building inspector, and the requirements contained AA103.2 of this code.*

AA107.2 Jurisdictional Compliance Requirements. *AA107.2 requires that the jurisdiction indicate which specific provisions of Table AA107 are mandatory for buildings regulated by the MA E-Z code and, where applicable, the level of compliance required. All other provisions of this code shall be mandatory as applicable.*

Table AA107.2 - Compliance Documentation

Type of Documentation	***Documentation Timeline***
Life Cycle Assessment	*Certificate of Occupancy*
Global Warming Potential Refrigerants	*Certificate of Occupancy*
MA E-Z Code Building Commissioning	*Certificate of Occupancy*
Post Occupancy Evaluation (POE)	*18 Months from Certificate of Occupancy*
Benchmarking And Disclosure	*24 Months from Certificate of Occupancy; On-going annually*
Recommissioning	*36 Months from Certificate of Occupancy and thereafter every five years.*

AA107.3 Life Cycle Assessment.

> ***AA107.3.1 Life Cycle Assessment (Embodied Carbon).*** *A Life Cycle Assessment shall be performed. All projects shall report the embodied emissions intensity in kgCO2e/m², kgCO2e, and the equivalent annual embodied emissions intensity in kgCO2e/m²/year. Life Cycle Assessment shall be performed as per applicable International Standards Organization (ISO) and ASTM standards. Code officials may accept the Life Cycle Assessment reporting methodology of ASHRAE 189.1-2017, USGBC-LEED v4, Living Future Institute - Living Buildings Challenge 4.0, or equivalent.*

AA107.3.1.1 Life Cycle Assessment Reporting. *A report shall be prepared and shall comply with the reporting requirements of applicable ISO and ASTM standards.. The name and address of the registered design professional or other approved source verifying structural system material quantities shall be included. A critical review shall be performed by an external expert independent of those performing the LCA. The report shall be submitted to local code officials and to state, city, municipal authorities per state, city, or municipal laws and regulations.*

AA107.4 Global Warming Potential.

AA107.4.1 Refrigerant Evaluation (GWP/ODP). *A calculation of the Global Warming Potential (GWP) and Ozone Depleting Potential (ODP) impact of a one time release of 100 percent of the refrigerant charge and refrigerant release over the lifespan of the installed project equipment shall be performed as per applicable International Standards Organization (ISO) and ASTM standards.*

AA107.4.1.1 Refrigerant GWP/ODP Reporting. *A report shall be prepared and shall comply with the reporting requirements of applicable ISO and ASTM standards. The name and address of the registered design professional or other approved source verifying structural system material quantities shall be included. A critical review shall be performed by an external expert independent of those performing the LCA. Code officials may accept the Life Cycle Assessment reporting methodology of ASHRAE 189.1-2017, USGBC-LEED v4, Living Future Institute - Living Buildings Challenge 4.0, or equivalent. The report shall be submitted to local code officials and to state, city, municipal authorities per state, city, or municipal laws and regulations.*

AA107.5 MA E-Z Code Buildings Commissioning.

AA107.5.1 MA E-Z Code Buildings Commissioning. *Buildings shall be commissioned in accordance with this section and the MA 780 CMR International Energy Conservation Code - Commercial Provisions, ASHRAE 90.1, and other applicable standards. Commissioning shall be performed for the following systems and their associated controls:*

a. Building Envelope

b. HVAC (both mechanical and passive systems)

c. Lighting and daylighting

d. Domestic hot water systems

e. Demand Response Controls/Infrastructure

f. Renewable energy systems

AA107.5.1.1 Commissioning Report. *A Commissioning Report, completed and signed by a Qualified Commissioning Professional, shall be submitted to the local code official, and to state, city, municipal authorities per state, city or municipal laws and regulations, the report shall include, at a minimum, the following:*

a. The date(s) that the Commissioning was performed;

b. Identifying information for the Commissioning provider;

c. Information on the Base Building Systems and equipment both Commissioned; and

d. All Commissioning process activities undertaken, and Commissioning measures completed.

AA107.6 Post Occupancy Evaluation.

AA107.6.1 Post Occupancy Evaluation. *Within 18 months of the certificate of occupancy, the design professional, building owner, or building owners representative shall document 12 continuous months of operational energy consumed by the building(s) and site are equal to or less than the renewable energy associated with the building(s) renewable energy.*

AA107.6.1.1 Post Occupancy Performance Verification Reporting*. Reports shall be submitted to the local code official, in a form acceptable to the code official and to state, city, municipal authorities per state, city, or municipal laws and regulations.*

Normalization for Variant Conditions. *At the discretion of the code official, the owner or owner's representative may submit documentation that variant weather or occupancy conditions during the compliance period are responsible for variances in energy consumed with renewable energy produced on or off site and that the buildings would comply with Section AA106 Renewables under normal conditions.*

AA107.7 Energy Benchmarking and Disclosure

AA107.7.1 Energy / Water Benchmarking and Disclosure. *Building owners or building owner representatives shall annually disclose/benchmark and report building(s) energy and water performance utilizing disclosure/benchmarking tools specified by state, city, municipal disclosure/benchmarking laws, and regulations.*

Where no state, city, or municipal disclosure/benchmarking laws or regulation exists, buildings/projects shall annually benchmark building(s).

Buildings 25,000 sq ft or smaller shall conduct an ASHRAE Level Two Audit, utilize Energy Star Portfolio Manager or equivalent benchmarking tools/software applicable to the building topology, and approved by the local code official.

Buildings 25,000 sq ft and larger shall utilize Energy Star Portfolio Manager or equivalent benchmarking tools/software applicable to building topology approved by local code officials.

AA107.7.1.1 Benchmark Reporting. *Benchmarking Reports shall be provided to state, city, municipal authorities per state, city or municipal benchmarking and disclosure laws and regulations.*

Where no state, city, or municipal disclosure/benchmarking laws or regulation existing buildings/projects benchmarking reports shall be provided to local code officials and the Massachusetts Department of Energy Resources (DOER).

AA107.8 Energy Re-Commissioning

AA107.8.1 Energy Re-Commissioning. *Energy Re-Commissioning shall be performed in accordance with industry standard practices, including ASHRAE Guideline 0.2- 2015, Commissioning Process for Existing Systems and Assemblies, and other standards as may be defined by the State of Massachusetts.*

AA107.8.2 Re-Commissioning of the Base Building Systems*. The Re-Commissioning of the Base Building Systems shall ensure that all systems are maintained, cleaned and repaired, HVAC temperature, and humidity set points and setbacks are optimized, operating schedules reflect major space occupancy patterns and the current facility requirements, and that all operating parameters are adjusted to achieve efficient operations. The Re-Commissioning shall include, at a minimum, the following:*

a. Building Envelope

b. HVAC (both mechanical and passive systems)

c. Lighting and daylighting

d. Domestic hot water systems

e. Demand Response Controls/Infrastructure

f. Renewable energy systems

AA107.8.2.1 Re-Commissioning Report. *A Retro-Commissioning Report, completed and signed by a Qualified Retro-Commissioning Professional, shall be submitted to state, city, municipal authorities per state, city or municipal laws and regulations and shall include, at a minimum, the following:*

a. The date(s) that the Re-Commissioning was performed;

b. Identifying information for the Re-Commissioning provider;

c. Information on the Base Building Systems and equipment both before and after the Re-Commissioning; and

d. All the Re-Commissioning process activities undertaken and Re-Commissioning Measures completed.

AA108 REFERENCED STANDARDS

This section lists the standards that are referenced in various sections of this document. The standards are listed below by the issuing agency of the standard, the effective date and title, and the section or sections of this document that reference the standard.

ANSI/BOMA	*Building Owners and Managers Association* *1101 15th Street, N.W.* *Suite 800* *Washington, DC 20005*
Title	***Referenced in code section number***
2018 for Gross Areas: Standard Methods of Measurement (ANSI/BOMA Z65.3-2018)	*AA102.1*
ASHRAE	*American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc.* *1791 Tullie Circle, NE* *Atlanta, GA 30329-2305*
Title	***Referenced in code section number***
ASHRAE 90.1-2019	*AA102.2 (footnote)* *AA104.3.2.2 (footnote* *AA104.3.2.2-1(footnote)* *AA104.4* *AA104.4.2*

	AA104.4.3 *AA107.5.1*
ASHRAE/ASHE Standard 170	*AA104.3.2.2*
ASHRAE/ASHE Standard 62.1-2019	*AA102.2* *AA104.3.2.2*
ASHRAE Level 1,2, and 3 Energy Audits	*AA107.7.1*
ASHRAE 189.1-2017	*AA107.3.1* *AA107.4.1.1*
ASHRAE Guidelines 0.2- 2015	*AA107.8.1*
OPSI	*Office of Public Safety and Inspection* *1000 Washington St* *Suite 710* *Boston, MA 02118*
Title	***Referenced in code section number***
Massachusetts State Building Code 780 CMR	*AA103.1* *AA104.3.2.2* *AA107.1.1* *AA107.5.1*
780 CMR 13.00	*AA101.4.1.1* *AA103.2* *AA103.2.1* *AA101.4.1.2* *AA101.4.2* *AA102.1*
780 CMR 51.00	*AA101.4.1.2* *AA101.4.2*
ICC	*International Code Council, Inc.* *500 New Jersey Avenue, NW* *6th Floor Washington, DC 20001*
Title	***Referenced in code section number***
IECC 2018 Appendix CA: Solar Ready Zone-Commercial	*AA106.10.1*
IECC 2021	*AA104.3.1.1* *AA103.1.2* *AA104.3.1.2.1* *AA104.3.2.2*

	AA104.3.1.3 *AA104.3.2* *AA104.3.2.1* *AA104.3.3* *AA104.3.5* *AA104.3.6* *AA104.4.1-1*
ILFI	*International Living Future Institute (ILFI)-Global Headquarters* *1501 E Madison Street* *Suite 150* *Seattle, WA 98122*
Title	***Referenced in code section number***
The Living Buildings Challenge 4.0 (LBC 4.0)	*AA107.3.1* *AA107.4.1.1*
USGBC	*U.S. Green Building Council* *2101 L Street, NW* *Suite 500* *Washington, DC 20037*
Title	***Referenced in code section number***
USGBC LEED v4	*AA107.3.1* *AA107.4.1.1*
NFPA	*National Fire Protection Association* *1 Batterymarch Park* *Quincy, MA 02169-7471*
Title	***Referenced in code section number***
NFPA 70	*AA105.3.1*
PHIUS	*Passive House Institute US (PHIUS)* *116 West Illinois Street* *Suite 5E* *Chicago, IL 60654, USA*
Title	***Referenced in code section number***
PHIUS Certified	*AA104.3.1.1 (footnote)* *AA104.3.4*

Additional Resources

Building Industry Professionals Net Zero Stretch Code Support Letter here: https://builtenvironmentplus.org/net-zero-stretch-code-letter/

Passive House Inst U.S.: https://www.phius.org/phius-certification-for-buildings-products/project-certification/phius-2018-getting-to-zero

Zero Code (Architecture 2030): https://architecture2030.org/zero-code/

Energy Star Portfolio Manager: https://www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/use-portfolio-manager

California Title 24: https://www.energy.ca.gov/programs-and-topics/programs/building-energy-efficiency-standards

District of Columbia - Appendix Z: https://dgs.dc.gov/sites/default/files/dc/sites/dgs/publication/attachments/Amendment%204%20Attachment%20C%20%20-%20NetZero%20Energy%20Compliance%20Path.pdf

Massachusetts Comprehensive Energy Plan Commonwealth and Regional Demand Analysis Massachusetts Department of Energy Resources December 12, 2018: https://www.mass.gov/files/documents/2019/01/10/CEP%20Report-%20Final%2001102019.pdf

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