Commonwealth of Massachusetts

Executive Office of Energy and Environmental Affairs

DEPARTMENT OF ENERGY RESOURCES

Executive Order No. 594

LEADING BY EXAMPLE: DECARBONIZING AND MINIMIZING ENVIRONMENTAL IMPACTS OF STATE GOVERNMENT

Section 3 Guideline

Massachusetts LEED Plus 2.0 Standard for New Construction

Guideline Effective Date: November 15, 2021

Background and Purpose

On April 22, 2021 Governor Baker signed Leading by Example Executive Order 594, *Decarbonizing and Minimizing Environmental Impacts of State Government* (the "Order").

The Order sets forth targets and establishes policies, programs, and strategies to substantially reduce greenhouse gas emissions from state government operations at state owned and managed buildings, facilities, and campuses, as well as enhance their resilience. This will be achieved by advancing high performance buildings for new construction; expanding energy efficiency and decarbonizing fuels in existing buildings; acquiring fuel efficient and zero emission vehicles and continuing the deployment of new renewable energy.

This document is intended to provide guidance regarding Section 3 of the Order, that relate to implementation of the Massachusetts LEED Plus 2.0 Standard for New Construction (the "Standard"). This includes information about the requirements for certification pathways, EUI baselines and targets, eligible renewable thermal technologies, resilience, renewable energy generation, electric vehicle charging infrastructure, greenhouse gas emissions reduction actions, and the exemption process. Additional LBE Executive Order 594 guideline documents can be downloaded from the LBE web page at https://www.mass.gov/info-details/leading-by-example-executive-order-594-decarbonizing-and-minimizing-environmental-impacts-of-state-government.

Scope

The Standard applies to all new construction of "buildings for use by state agencies or on state lands" that have not initiated a study as of July 1, 2021. Executive branch departments that fund

or manage projects not owned by the state or not sited on state lands are encouraged to incorporate the Massachusetts LEED Plus 2.0 Standard into their funding and management processes.

Definitions

a) **DC Fast Charging (DCFC) -** Typically requires 208V/408V three-phase input, provides a maximum current of 80 or 400 amps, a maximum output power of 80 kW or 400 kW, and involves an electric utility for installation. DCFC provides rapid charging compared to AC Level 1 and Level 2 units but is considerably more expensive to install and operate. Not every EV is capable of DC fast charging.

b) **Energy use intensity (EUI)** – A building's gross annual site energy relative to its gross square footage. Site EUI is measured as kBtu per square foot (kBtu/sf). All energy consumed by the building, regardless of the source, shall be included in the EUI calculations. Energy used for zero emission vehicle charging is excluded from building total energy consumption for EUI calculations.

c) **EV-ready, new construction/major renovations** – For state projects subject to the Massachusetts LEED Plus 2.0 Standard, refers to parking areas designed and built to accommodate EV charging infrastructure as defined by the current Massachusetts Building Energy Code (Chapter C405.10).

d) **Level 1 electric vehicle charging (AC) -** Requires a standard 120V AC supplied by any standard electrical outlet and typically provides a maximum current of 15 amps and a maximum output power of 3.3 kW. This type of charging is relatively easy and inexpensive to install but provides the slowest charge. Level 1 chargers may be configured as a standalone station or as a plug with a Level 1 charging cable.

e) **Level 2 electric vehicle charging (AC) -** Requires a 240V or 208V AC input, which may need to be installed by a licensed electrician, and typically provides a maximum current of 80 amps and a maximum output power of 14.4 kW. This type of charging is the most versatile and appropriate for various use cases, provides a faster charge than Level 1 units, but can be more expensive. Level 2 chargers may be configured as a standalone station or as a Level 2 plug with an updated outlet.

f) **Parking area -** Includes both open and covered parking lots as well as parking garages owned by the Commonwealth.

g) **Resilience** – The ability of a system and its component parts to anticipate, absorb, accommodate, or recover from the effects of a hazardous event in a timely and efficient manner.

h) **Solar-ready** – Designed and built to accommodate the installation of a solar energy system as defined by the current Massachusetts Building Energy Code (Chapter C402.3). Solar-readiness includes but is not limited to identified locations, reduced shading, structural capacity, inverter locations, conduit, and grid interconnect locations.

i) **Substantial renovations** – Any project that includes extensive heating, ventilation, and air conditioning (HVAC) renovation; extensive envelope modifications; and extensive interior rehabilitation. Sizeable projects that are not considered substantial renovations are still encouraged meet the Standard if possible, or otherwise must adhere to the existing building requirements outlined in Section 4 of the Order.

j) **Zero net energy building** – Formal definition forthcoming. Section 31 of Chapter 8 of the Acts of 2021 directs the Department of Energy Resources (DOER) to develop and promulgate a municipal opt-in specialized stretch energy code that will include a definition of net-zero buildings. Upon promulgation, this definition of net-zero buildings will apply to the context of the Order and this guideline will be updated accordingly.

Massachusetts LEED Plus 2.0 Standard: Guidance on Section 3 of the Order[1]

Language directly from the Order is italicized below.

For all new construction of buildings over 20,000 square feet for use by state agencies or on state lands that have not yet initiated a study as of July 1, 2021, the Division of Capital Asset Management and Maintenance (DCAMM) and any other agency covered by this Order shall ensure that all projects adhere to the following standards:

Part I: LEED Certification and Energy Performance

a. Certify buildings to the Silver Level or higher of the most recent version of the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) Standard.

The most recent version of the LEED certification program is the official version that is in effect[2] at the start of the building design development.

[1] DOER shall confer periodically with DCAMM and other construction agencies to review progress under this section and to make modifications to guidance as needed.

[2] For the purposes of the Standard, an available beta version of LEED is not the minimum requirement. However, project proponents may elect to register under either the official or beta version, and choose between versions during a LEED concurrency period.

b. Reduce proposed building EUI by at least 20% lower than an equivalent building that meets the Massachusetts Energy Code.

When calculating building EUI baselines, agencies shall use American Society of Heating, Refrigeration, and Air-Conditioning Engineers (ASHRAE) Appendix G 2013 and all amendments in the current Massachusetts Building Energy Code. Required EUI reductions shall be achieved by prioritizing:

- *Improved envelope performance*
- *Reduced air infiltration*
- *Ventilation heat recovery*
- *External shading and reduction in solar heat gains*

As noted in the definitions section of this guideline, the Standard utilizes site EUI; the intent of the site-based requisite is to ensure that efficiency gains in new construction are specific to the building itself and not the source of any fuels used.

To meet the requirements of section 1b above, state new construction and major renovation projects subject to the Order must adhere to the requirements of one of the pathways below:

- **Pathway 1 -- 20% Better Energy Performance than ASHRAE 90.1-2013 Appendix G**: To adhere to the requirements of the Order and the Massachusetts building energy code, project proponents are strongly encouraged to utilize ASHRAE 90.1-2013 Appendix G with all current Massachusetts energy code amendments to model and establish an EUI baseline. The proposed building EUI must be at least 20% lower than the baseline building on a site energy basis. Project proponents must also ensure that the proposed building meets or exceeds current energy code requirements including all Massachusetts amendments. To streamline compliance with current building energy code requirements, project proponents should consider following the elements of the prescriptive pathways in ASHRAE 90.1-2016 or IECC 2018 when selecting energy improvements.

- **Pathway 2 -- 20% Better Energy Performance than Current Code Requirements**: If Pathway 1 is not selected, project proponents may alternatively utilize the current building energy code (ASHRAE 90.1-2016, ASHRAE 90.1-2016 Appendix G, or IECC 2018), with all current Massachusetts energy code amendments, to establish a baseline EUI. A proposed building must then be designed to 20% better on a site EUI basis. Note that when using ASHRAE 90.1-2016 Appendix G, the proposed building should have an EUI that is 20% lower than the EUI of a building ***after*** application of the Building Performance Factors in Table 4.2.1.1.[3]

Notwithstanding the pathway being adhered to, the proposed building must utilize modifications to the envelope, air infiltration, heat recovery, and external shading to achieve the required 20%

[3] A copy of the ASHRAE 90.1-2016 Building Performance Factors can be found as Table 1 in Section 1.3 of the PNNL *Performance Rating Method Reference Manual*.

improvement in energy performance. Energy reductions achieved through fuel switching from fossil fuels to efficient electric heating and cooling technologies shall also be considered appropriate strategies to meet this requirement.

The requirement for 20% energy performance improvement over a baseline building is in effect until DOER promulgates the municipal opt-in specialized stretch energy code, which must occur within 18 months of the effective date of Chapter 8 of the Acts of 2021. All applicable new construction and substantial renovation projects that initiate a study later than six months following the promulgation of the new specialized stretch energy code must comply with it in place of the requirement in Section 1b of the Order. All other requirements of the Standard will remain in effect.

Until the advent of the new specialized stretch energy code, project proponents may also consider the Passive House standard and model the technical and cost implications of a certified Passive House project. If modeling demonstrates technical and fiscal feasibility, Passive House would be considered a suitable alternative method for meeting the 20% energy performance improvement requirements of Section 1b of the Order, however, all projects must still be in compliance with the Massachusetts Energy Code.

The LBE Program and its partners will collect and provide available information on relevant projects, measures, and best practices that may be helpful to design teams in implementing the energy performance requirements of the Standard.

Part II: Eligible Renewable Thermal Technologies for Space Heating

Use only efficient electric or renewable thermal technologies as defined in Leading by Example Guidelines for all space heating and cooling.

Renewable thermal technologies for space heating and cooling must prioritize electrified, non-combustion solutions. Eligible options include one or a combination of the following systems:

- Air-source heat pumps
- Ground-source (geothermal) heat pumps
- Solar thermal systems

In cases where electrified renewable thermal technologies are not feasible for supporting all or some of the building heating and cooling loads, the following eligible alternatives[4] may be pursued:

- Woody biomass systems
- B100 (target) liquid biofuels
- Biogas systems

[4] In limited circumstances (e.g., backup power/resilience, meeting peak demand), there may be other technologies or strategies that are appropriate, but these must still minimize emissions impacts.

- Compost heat exchange (e.g., anaerobic digestion)

These systems and any renewable thermal fuels shall meet the minimum performance and sustainability standards as defined by the DOER Alternative Energy Portfolio Standard (APS).

In cases where adhering to the APS requirements for air-source heat pump equipment proves too restrictive or financially burdensome, projects must alternatively use a heat pump system that is ENERGY STAR® Certified. For smaller systems that cannot meet the APS requirements, it is recommended that equipment be both ENERGY STAR Certified and included on the current Northeast Energy Efficiency Partnerships (NEEP) Cold Climate Air-Source Heat Pump Specification Product List.

Ground-source heat pumps must meet the applicable size-based APS equipment requirements (small/intermediate or intermediate/large)[5], which may include testing and rating standards, Operating Coefficient of Performance (COP), and Operating Energy Efficiency Ratio (EER). See the APS webpage for additional information and resources.

Part III: Eligible Renewable Thermal Technologies for Water Heating

Use only efficient electric or renewable thermal technologies as defined in LBE Guidelines for service water heating to the greatest extent possible.

Preferred technologies for service water heating include heat pump water heaters, high-efficiency electric point of use (POU) or on-demand water heaters, geothermal systems, and solar hot water systems. The system(s) selected should take into account both lifetime emissions reductions and cost-effectiveness.[6] The following recommendations shall serve to guide system selection.

- Electric heat pump water heaters should strive to be ENERGY STAR® Certified and when possible, include the following optional ENERGY STAR® features: performance reporting, energy savings reporting, and predictive maintenance alerts.

- Geothermal systems should strive to meet the minimum performance and sustainability standards as defined by the APS.

- For solar hot water systems, solar thermal collectors should target certification per the current OG-100 standard by an accredited testing laboratory, such as the Solar Rating

[5] Ground-source heat pumps can be excluded from the APS well-depth requirements (if necessary); if the system meets the other APS equipment requirements, the exemption process is not required.

[6] In limited circumstances when the preferred water heating technologies are not suitable (e.g., very small hot water loads, peak loads), there may be other technologies or strategies that are appropriate, but these must still minimize emissions impacts.

and Certification Corporation (SRCC) or the International Association of Plumbing and Mechanical Officials (IAPMO).

Part IV: Energy Use Intensity (EUI) Targets

Establish and design to an Energy Use Intensity (EUI) target that meets or exceeds best in class EUI for newly constructed buildings by type and climate zone.

Each project will establish as low a target site EUI during schematic design. Such targets should be based on achieved site EUI ratings of other projects that are similar in type, size, and end use, and that are located in the same or a similar climate zone.

When establishing a "best in class" EUI, design teams shall include information on how the established target was derived and, where applicable, provide specific examples of other building EUI ratings or datasets examined.

Part V: Renewable Energy Generation

Maximize installation of onsite renewable energy and, when not possible, ensure that the project is solar-ready. Extent of solar readiness should exceed minimum code requirements as much as possible.

Where possible, projects shall ensure that renewable electricity generation technologies are installed during or directly following project completion, with a prioritization of solar PV deployment. Renewable energy attributes do not need be retained; see the U.S. Environmental Protection Agency's Solar Power Use Claims Guidance for best practices in making renewable energy use claims. When onsite renewable energy is not possible (e.g., not technically or fiscally feasible[7]) as part of the project, buildings must be designed to be solar-ready when applicable.

Part VI: Resilience

Incorporate long-term climate resiliency into design and siting decisions.

Resilience involves preparing physical assets and energy systems to account for projected changes in precipitation, temperature, sea level rise, and extreme weather events to position the Commonwealth to effectively reduce the risks associated with natural hazards and the impacts of climate change. Applicable projects shall assess resilience using the DCAMM Resilience

[7] Examples of solar not being technically feasible might include, but not be limited to: a lack of sufficient roof or other space to host solar, a site that is mostly or fully shaded, and/or building or site orientation not conducive to solar. Examples of solar not being fiscally feasible can include, but not be limited to: sizable costs associated with unforeseen interconnection requirements, considerable roof upgrades, and/or substantial site remediation costs.

Checklist and/or the RMAT Climate Resilience Design Tool, and develop appropriate design strategies to address the identified risks.

For related planning resources, see the Massachusetts State Hazard Mitigation and Climate Adaptation Plan (SHMCAP) and the Resilient MA Action Team Climate Resilience Design Standards and Guidelines Project.

Part VII: Electric Vehicle Supply Equipment (EVSE)

For all new or fully reconstructed parking areas, install at least one electric vehicle supply equipment (EVSE) charging port in parking areas up to 25 spaces, with at least two EVSE charging ports to be installed in parking areas greater than 25 spaces. In parking areas with more than 10 spaces, at least twenty percent (20%) of the spaces must be "EV-ready" as defined by the current Massachusetts Building Energy Code. EVSE spaces may be included in EV-ready space requirements.

Electric vehicle (EV) charging infrastructure installation can include chargers for use by agency fleets, employees, students, visitors, and/or the general public, depending on the use of the parking lot in question. A holistic approach should be taken for station installation siting and prewiring locations, assessing the parking area as a whole in anticipation of future charging needs with the increase of both state and publicly operated EVs.

State entities receiving public access charging grants from the Massachusetts Electric Vehicle Incentive Program (MassEVIP) must ensure that at least 5% of the site's EV charging spaces, but not less than one such space, be accessible to persons with disabilities; this requirement is per parking area and is based on the combined total of new plus existing EV charging spaces. It is recommended that other projects subject to this section of the Order still adhere to the MassEVIP requirements to the greatest extent feasible. For additional information and specifications, see the accessibility section of the MassEVIP requirements. Accessibility strategies for station placement will largely be site-specific and therefore it is advisable that a qualified, design professional review all planned installation locations for code-required factors.

In general, projects should install Level 2 electric vehicle charging stations as they are the most applicable to the widest range of drivers. When the primary use is agency fleet charging, or when parking duration is overnight, Level 1 EV chargers or 120V plugs may also be considered and will meet the requirements for EVSE installation.

Projects should take advantage of all available funding to support EV charging installations.

Part VIII: Additional Directives

These requirements (parts 1-7 above) *shall also apply to substantial renovations when such projects are deemed similar to new construction as defined in LBE Guidelines.*

See definition of substantial renovations above.

All building projects under 20,000 square feet shall meet the requirements set forth above, excluding the Paragraph 1 LEED or Passive House certification requirements. Such projects shall strive to meet the certification requirements set forth in Paragraph 1 above whenever possible.

New construction or major renovation projects for state use or on state land under 20,000 square feet are not required to receive LEED certification but are strongly encouraged to meet the LEED prerequisites and to achieve LEED or Passive House certification. All projects, regardless of size, must meet the energy performance requirements of the Order (Paragraph 1b of Section 3 of the Order).

This following paragraph shall apply to all new construction of buildings and substantial renovations, as described above, that are subject to the Specialized Stretch Energy Code authorized by Section 31 of Chapter 8 of the Acts of 2021. All such construction and renovation projects that initiate a study later than 6 months following DOER's promulgation of the Specialized Stretch Energy Code shall comply with the Specialized Stretch Energy Code (as amended from time to time) in place of all requirements set forth in paragraph 1b of this Section 3.

By statute, DOER will develop and adopt a municipal opt-in specialized stretch energy code that will be incorporated as an appendix to the Massachusetts Building Energy Code by November 2022. Upon its promulgation, this specialized stretch energy code will replace the requirement that state new construction and substantial renovation projects achieve an EUI reduction 20% better than the current Massachusetts Building Energy Code as required in Paragraph 1b of Section 3 of the Order.

Additionally, to maximize the potential greenhouse gas emissions reductions, new construction, and substantial renovations, where possible and cost-effective, shall

- *Strive to achieve zero net energy, where sufficient renewable energy is generated onsite to offset the building's annualized energy consumption.*
- *Implement energy storage wherever possible, especially when paired with onsite renewables.*
- *Prioritize sites that provide access to public transportation and alternative modes of transportation.*
- *Evaluate and implement strategies to reduce embodied carbon contained in building materials.*

Until the definition of zero net energy buildings is finalized as part of forthcoming specialized stretch energy code promulgation, it is still the intent for building projects to target designs that are fossil fuel-free, optimize efficiency, and balance building energy use with equivalent onsite generation of electricity from renewable technologies.

Energy Storage: Projects shall evaluate and include energy storage where appropriate or plan for the location and interconnection of future[8] energy storage solutions where possible. Installed energy storage may be Commonwealth-owned or owned by a third party and should prioritize use with onsite renewable energy generation whenever possible.

Public and Alternative Modes of Transportation: Where site selection is part of the project scope, proximity to public transit and access/availability to alternative modes of transportation shall be prioritized and included in the site evaluation criteria.

Embodied Carbon: Designs shall consider embodied carbon in construction materials, focusing on the most carbon-intensive materials (e.g., concrete) and seeking appropriate substitutions.

Exemptions

The Commissioner of DCAMM or their counterpart in appropriate agencies may grant exemptions to one or more specific requirements of this section if such requirements are determined to be inconsistent with other state priorities.

In the special circumstance where one or more requirements contained in the Standard may not be feasible, an exemption may be granted by the Commissioner of DCAMM or counterpart in other agencies managing the construction process. Exemptions shall be granted only when it can be clearly demonstrated that a requirement cannot be achieved due to a significant technical challenge[9] or if a requirement is in conflict with other key state priorities when balanced against the relative impacts and benefits of potential emissions reductions. All final determinations related to exemptions shall be included in the project file.

It is the intent of this section that exemptions will be granted rarely.

[8] E.g., a solar PV system can be designed with the intention of adding energy storage later by specifying an inverter that can easily integrate a battery into the setup, ensuring that interconnection and electrical requisites are addressed accordingly, and incorporating the intended location of the battery as part of the design.

[9] Other sub-sections of this Guideline provide content related to technical feasibility -- specifically facility heating and cooling, water heating, and onsite renewable energy.