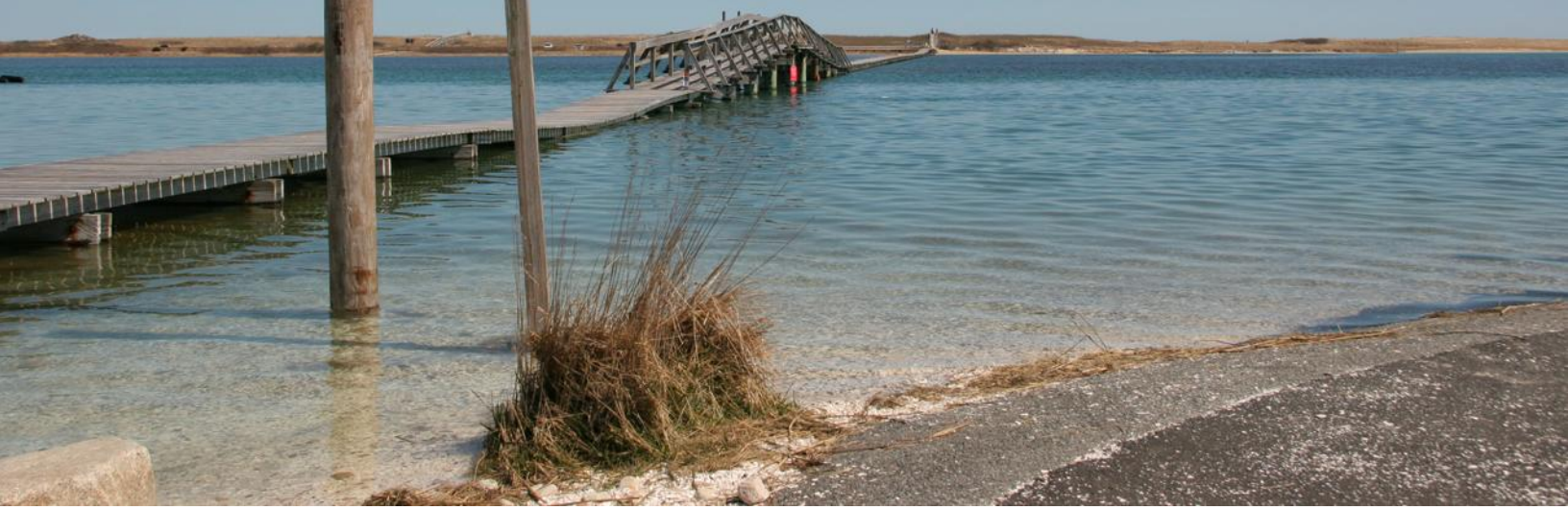

Climate Change

This guidance is intended to clarify how the Climate Change Goal and Objectives of the Regional Policy Plan (RPP) are to be applied and interpreted in Cape Cod Commission Development of Regional Impact (DRI) project review. This technical bulletin presents non-exhaustive, non-exclusive methods by which a project can meet the goal and objectives.

Climate Change Goal: To increase the region's resiliency to climate change impacts and mitigate climate change by supporting and contributing as a region to the Commonwealth's greenhouse gas reduction goals and initiatives, including a state-wide net zero carbon target by 2050.

- ***Objective CC1*** *– Promote low or no carbon transportation alternatives and technologies*
- ***Objective CC2*** *– Promote electrification and low or no carbon technologies for building energy use, including appliances, lighting, and heating, ventilation and cooling (HVAC) systems*
- ***Objective CC3*** *– Promote carbon sequestration and other emissions removal practices as appropriate to context*
- ***Objective CC4*** *– Promote low or no carbon energy generation as appropriate to context*
- ***Objective CC5*** *- Promote strategies to address climate change induced impacts such as wildfire and extreme temperatures and changes in precipitation*

The applicability and materiality of the RPP goals and objectives to a project will be determined on a case-by-case basis considering a number of factors including the location, context (as defined by the Placetype of the project's location), scale, use, and other characteristics of a project.

THE ROLE OF CAPE COD PLACETYPES

The RPP incorporates a framework for regional land use policies and regulations based on local form and context as identified through categories of Placetypes found and desired on Cape Cod.

The Placetypes are determined in two ways: some are depicted on a map contained within the RPP Data Viewer located at www.capecodcommission.org/RPPDataViewer adopted by the Commission as part of the Technical Guidance for review of DRIs, which may be amended from time to time as land use patterns and regional land use priorities change, and the remainder are determined using the character descriptions set forth in Section 8 of the RPP.

The project context, as defined by the Placetype of the project's location, provides the lens through which the Commission will review the project under the RPP.

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INTRODUCTION

Climate change is one of the most pressing global problems, and also presents localized impacts especially pronounced in coastal communities like Cape Cod. However, there are actions that communities can take to address this global issue and its more localized effects.

The Climate Change goal and objectives focus on lowering greenhouse gas (GHG) emissions and promoting strategies to address the impacts of greenhouse gas emissions on the region. This goal ties directly into the Commonwealth of Massachusetts' well-structured legal, policy and regulatory regime, originating with the Global Warming Solutions Act (St. 2008, c. 298) and Green Communities Act (St. 2008, c. 169), which seeks to lower GHG emissions economy-wide from 1990 levels to net zero by 2050.

A critical piece in lowering emissions and meeting state carbon reduction targets is reducing the economy's reliance on fossil fuel use and transitioning to clean, renewable energy sources. This transition will require infrastructure investment in renewable energy generation, transmission, and storage. As shown by the Cape Cod Greenhouse Gas Emissions Inventory, the transportation and stationary energy sectors are the primary contributors to regional GHG emissions, similar to the rest of Massachusetts. The Climate Change objectives support and advance progress in these sectors through the reduction or elimination of project specific and regional greenhouse gas emissions.

At the same time as we decrease our contributions to the causes of climate change, the effects of climate change are already being felt on Cape Cod. As presented in the Cape Cod Climate Action Plan, sea level, drought, and marine heat waves, for example, are expected to continue to increase in the coming decades and beyond. The Climate Change objectives increase project and regional resilience to current and future hazards.

Methods primarily intended to satisfy other RPP goals and objectives may contribute to satisfying the Climate Change goal and objectives, and vice versa.

DEFINITIONS

Direct Current (DC) Fast Charging EVSE: DCFC EVSE delivers high voltage (typically 200-450V) DC power directly into the EV's battery system, enabling rapid charging. An 80% charge can be provided in 30 minutes or less for many all-electric vehicles, compared to several hours for Level 2 charging.

Electric Vehicle (EV): An automotive-type vehicle for on-road use, such as passenger automobiles, buses, trucks, vans, neighborhood electric vehicles, electric motorcycles, and the like, primarily powered by an electric motor that draws current from a rechargeable storage battery, fuel cell, photovoltaic array, or other source of electric current. Informational Note: defined as in 527 CMR 12.00: Massachusetts Electrical Code (Amendments) section 625.2.

Electric Vehicle Capable Space (EV Capable Space): A vehicle space with electrical panel space and load capacity to support a branch circuit and necessary raceways, both underground and/or surface mounted, to support EV charging.

Electric Vehicle Charging Port (EV Charging Port): The EVSE component which connects to vehicle charging inlets. One EVSE unit may contain multiple charging ports, which are also referred to as "plug connectors" or "heads". Level 1 ports include connectors supplied by level 1 EVSE as well as any standard 120V outlets able to supply 15 or more amps of current to be used with the level 1 EVSE supplied by vehicle manufacturers.

Electric Vehicle Charging Station: The public or private parking space(s) served by EVSE, including all signs, information, pavement surfaces, surface markings, fee collection systems, and protective equipment, in which a vehicle is recharged.

Electric Vehicle Ready Parking Space (EV Ready Space): A designated parking space which is provided with wiring and electrical service sufficient to provide AC Level 2 or equivalent EV charging, as defined by Standard SAE J1772 for EVSE servicing light duty Electric Vehicles.

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. Informational Note: defined as in 527 CMR 12.00: Massachusetts Electrical Code (Amendments) section 625.2.

Electric Vehicle Supply Equipment Parking Space (EVSE Space): A designated parking space which is provided with a dedicated EVSE connection.

Level 1 EVSE: EVSE which uses a 120V AC connection to a standard residential/commercial electrical outlet typically supplying 15 amps of current, for a power draw around 1.4 – 1.8 kW when charging. All EVs come equipped with Level 1 chargers from auto manufacturers.

Level 2 EVSE: EVSE which uses a 208/240V AC connection to supply increased power to EVs, reducing the amount of time required to charge the EV battery. Level 2 EVSE can provide up to 80 amps of current and 19.2 kW of power, although most current EVs can only accept 3.3 to 10 kW as determined by the vehicle's onboard charger. Current Level 2 EVSE equipment typically uses 208/240V 40-50 amp supply circuits.

Low Power Level 2 EVSE: A 208/240-volt 20-ampere minimum branch circuit and a receptacle for use by an EV driver to charge their electric vehicle or hybrid electric vehicle.

Low Power Level 2 EV Ready Space: A designated parking space which is provided with wiring and electrical service sufficient to serve a Low Power Lever 2 EVSE.

SUMMARY OF METHODS

GOAL | CLIMATE CHANGE

To increase the region's resiliency to climate change impacts and mitigate climate change by supporting and contributing as a region to the Commonwealth's greenhouse gas reduction goals and initiatives, including a state-wide net zero carbon target by 2050.

Objective CC1 – Promote low or no carbon transportation alternatives and technologies

METHODS

- Employ and quantify the GHG-reduction benefit of strategies to reduce vehicle miles traveled
- Include EV or hybrid vehicles for fleet vehicles, business use, or car sharing
- Incorporate EV charging infrastructure within parking facilities
- Support the expansion of a regional EV charging network
- Prepare for medium- and heavy-duty charging infrastructure needs

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Objective CC2 – Promote electrification and low or no carbon technologies for building energy use, including appliances, lighting, and heating, ventilation and cooling (HVAC) systems

METHODS

- Design buildings to be all electric
- Design buildings to be Passive House certifiable
- Design buildings in compliance with the Municipal Opt-in Specialized energy code (Specialized Code)
- Include in development ground or air source electric heat pumps, in place of fossil fuel HVAC systems
- Include in projects site scale battery storage paired with renewable energy generation or emergency generators that use renewable fuels
- Include in project electric appliances such as induction stoves or water heaters
- Include non-fossil fuel energy use

Objective CC3 – Promote carbon sequestration and other emissions removal practices as appropriate to context

METHODS

- Reuse buildings, incorporate reuse of building materials, use recycled building materials, or include building materials certified as low carbon
- Plant new and replacement trees (see Community Design Technical Bulletin Objective CD1 Methods: Provide appropriate landscaping and pedestrian amenities)
- Project proposes on- or off-site planting or restoration with native vegetation, including trees in appropriate habitat settings (see Wildlife and Plant Habitat Technical Bulletin)
- Permanently protect forest or other naturally vegetated areas which sequester carbon (see Open Space Technical Bulletin Objective OS3 Methods)
- Incorporate methane gas capture and conversion technology in capped landfill projects

Objective CC4 – Promote low or no carbon energy generation as appropriate to context

METHODS

- Employ and quantify the GHG-reduction benefit of the strategies used to incorporate low or no carbon energy generation
- Include in new buildings and redevelopment installed green energy systems (solar or other renewable energy generation) on roofs, as solar car-ports, or on disturbed sites (see Energy Technical Bulletin Objective EN1 Method: Incorporate on-site renewable energy)
- On-site renewable energy generation (energy generation, distribution, or storage) (see Energy Technical Bulletin Objective EN1 Method: Incorporate on-site renewable energy)
- Commit to purchase renewable energy (see Energy Technical Bulletin Objective EN1 Method: Green Power Purchase)
- Incorporate alternative renewable energy sources for onsite building development such as geothermal heating and cooling
- Propose, contribute to, or tie into a Microgrid

Objective CC5 – Promote strategies to address climate change induced impacts such as wildfire and extreme temperatures and changes in precipitation

The following are methods a project may use to achieve consistency with Objective CC5. *Applicants are encouraged to propose alternate methods to meet Objective CC5 based on best practices for the type of project proposed, or as new strategies or technologies are developed and available.*

METHODS

- In Rural and Natural Areas Placetypes, project site selection or layout demonstrate consideration of firebreaks
- Use fire resistant building materials
- Use firescaping to reduce fire risk
- Incorporate green or cool roof design
- Size stormwater management infrastructure to accommodate the 100-year, 24-hour size storm

DETAILED DISCUSSION OF METHODS FOR MEETING OBJECTIVE CC1

Objective CC1 *– Promote low- or no-carbon transportation alternatives and technologies*

The purpose of Objective CC1 is to support and advance low- or no-carbon transportation alternatives and technologies to support a regional transition away from fossil fuels in the transportation system. The following is a discussion of the methods that may be implemented to meet Objective CC1.

Employ and quantify the GHG-reduction benefit of strategies to reduce vehicle miles traveled

Reducing vehicle miles traveled can be accomplished through a combination of strategies including implementation of Transportation Demand Management (TDM) strategies and provision of healthy transportation options. Details on these methods are presented in the Transportation Technical Bulletin. Using industry best practices, the Applicant should quantify GHG reductions anticipated though these measures. For example, if the implementation of a TDM plan is anticipated to reduce site-generated traffic by 25%, the avoided GHG emissions should be quantified.

Include EV or hybrid vehicles for fleet vehicles, business use, or car sharing

Many industries are beginning to use EVs, including both Battery Electric Vehicles (BEVs, also referred to as all-electric vehicles) and Plug-in Hybrid Electric Vehicles (PHEVs) for fleet vehicles or they are making EVs available for business use on a reservation basis. Where practical, EVs are preferred for these applications.

Fleet operators should consider electrifying their fleets and installing EV chargers. Fleets that consist of light-duty vehicles (LDVs) which travel on fixed routes and return to the same facility after each route may be well positioned to cost-effectively electrify. Medium- and heavy-duty fleets, where electrification may not currently be cost-effective or where electric alternatives may be limited, should consider installing EV Capable Spaces and/or EV Ready Spaces for future installation of EV chargers as fleet-suitable EV availability improves. Where EVs are currently impractical for these applications, PHEV vehicles may be considered.

A car share, defined as a vehicle that is available by reservation for a business or non-business use, are often used in combination with TDM strategies that promote transportation to the site without use of a personal automobile. Where practical, EVs are preferred for this application.
A charger is generally needed to support the EVs being proposed for fleet vehicles, for business use, or for ride sharing.

Incorporate EV charging infrastructure within parking facilities

To promote EV adoption, projects which include buildings where residents or visitors will dwell for periods of time should, where feasible, install EV chargers and include the appropriate number of EV-Ready and EV-Capable spaces. Guidance varies for different types of buildings and may include one or more of the following types of parking spaces:

a) EV Capable Spaces have electrical capacity and raceways to support future EV charging installation.
b) EV Ready Spaces add wiring capable of providing EV charging.
c) Electric Vehicle Supply Equipment (EVSE) spaces have an EVSE installed on occupancy to provide charging services.

To meet anticipated future demand for EV charging, installed parking spaces should follow guidelines outlined in Table 1. The Applicant should provide justification if the proposal for EV charging infrastructure and spaces does not meet the guidelines in Table 1.

Calculations for spaces should be rounded up to the nearest whole number but should always be a value of at least one EV Charging Port to be available at the time of development occupancy. Installed EVSE Spaces that exceed the minimum recommend number of EVSE Space may be ducted from the number of recommended EV Ready Spaces. EV Ready Spaces that exceed the minimum recommended number of EV Ready Space may be ducted from the number of recommended EV Capable Spaces.

TABLE 1: EV CHARGING GUIDELINES

Occupancy Classification[1] / Building Type	Requirement
Multifamily dwellings with less than 20 dwelling units	A minimum of 10% EV Capable Spaces, 25% Low Power L2 EV Ready Spaces
Multifamily dwellings with greater than 20 dwelling units	A minimum of 10% EV Capable Spaces, and 25% Low Power L2 EV Ready Spaces, and 5% EVSE Spaces
Hotels and motels (transient) with less than 20 sleeping units or guest rooms	A minimum of 10% EV Capable Spaces, and 25% EV Ready Spaces
Hotels and motels (transient) with greater than 20 sleeping units or guest rooms	A minimum of 10% EV Capable Spaces, 25% EV Ready Spaces, and 5% EVSE Spaces
All other R-use and Group B (Businesses)	A minimum of 10% EV Capable Spaces, 25% EV Ready Spaces, and 5% EVSE Spaces
All other occupancies	A minimum of 10% EV Capable Spaces, and 25% EV Ready Spaces

Per Massachusetts' Commercial Stretch code and Specialized Opt-in code,[2] EV charging can be met with either dedicated electric branch circuits, or with an automatic load management service (ALMS) that allows multiple spaces to be served by a higher amperage circuit, thus improving overall charging capacity at a lower installed cost.

EV chargers should be installed at businesses, multifamily dwellings, and hotels and motels with greater than 20 guest rooms. Projects at all other sites should consider installing EV-Capable and EV-Ready parking spaces during initial construction, which

[1] 2015 International Building Code (IBC), Chapter 3, Use and Occupancy Classification: https://codes.iccsafe.org/content/IBC2015P4/chapter-3-use-and-occupancy-classification

[2] Massachusetts 2023 Commercial Stretch code and Specialized Opt-in code DOER Final Draft 9-19-22 Redline: https://www.mass.gov/doc/commercial-and-other-stretch-energy-code-and-specialized-opt-in-code-language-redline/download

would allow the cost-effective installation of EV chargers in the future, as EV adoption increases.

Consideration of the appropriateness, type, and number of EVSE to meet Objective CC1 is based on the following factors:

- The type of use(s) on the site;
- The location of the project, including proximity to other on- or off-site EVSE;
- The nature and scale of the project;
- Any constraints to EVSE implementation;
- The anticipated cost of the potential improvement; and
- The anticipated benefit of the potential improvement.

Where an applicant proposes the provision of EVSE, best practices in terms of implementation should be followed. While best practices will continue to evolve, the following should be considered:

- Level 2 EVSE or higher should be considered for most land uses. Level 1 EVSE may be appropriate in limited applications.[3]
- To allow for the widest user base, connectors that allow for use by a variety of vehicle makes is encouraged.
- Broad public access to EVSE is desirable, though some locations may restrict use to residents, employees, patrons, and/or other particular site users as needs dictate.
- Appropriate signage and pavement markings should be provided. Charging equipment should be labeled with information on power levels, safety requirements, contact information for reporting when the equipment is not operating or other problems, and, as applicable, any use limitation on use (i.e. patrons only), hour of operations, time limits, and usage fees.
- All EVSE placed and proposed shall be compliant with the Americans with Disabilities Act and with applicable Massachusetts Architectural Access Board rules and regulations.

[3] The terms Level 1 (often referred to as slow charging), Level 2 (often referred to as medium charging), and Direct Current Fast Charging are the most common charging levels used to refer to the electrical power and voltage of the EVSE.

- Where EVSE is provided or proposed within an adjacent pedestrian circulation area, such as a sidewalk or accessible route to the building entrance, the charging equipment must be located to not interfere with accessibility requirements.

Additional information on Electric Vehicle Infrastructure best practices is available at www.capecodcommission.org/EVguidance.

Support the expansion of a regional EV charging network

The EV charging network on Cape Cod will be built out over time. Further development of this network will require a cooperative, coordinated approach with both public and private partners. The pace of EV adoption in the region will rely on investments in regional EV charging infrastructure at various levels. To the extent feasible and appropriate, a project should support the build-out of the regional EV charging network by installing publicly available Level 2 and Direct Current Fast Charging as sites that would be desirable to the general public.

The provision of ESVE is desirable not just for residential and office settings but also sites that serve the general public where visitors dwell for longer periods of time. Given the nascency of the electric vehicle and charging market, it is difficult to forecast the potential demand for EV charging. Typical best practices for EVSE forecasting relate the number of EV chargers to locally registered EVs, but this approach does not work as well in areas like the Cape with an influx of summer residents and visitors. Ideally, publicly available EV charging infrastructure will be installed at slightly faster rate than EV adoption, which will allow the charging ecosystem to stay one step ahead in supporting EV drivers' charging needs. Public EV charging infrastructure should first be installed where drivers most often dwell and should be encouraged in the following Placetypes: Community Activity Centers, Industrial Activity Centers and Military and Transportation Centers For reference, the Cape Cod Commission Electric Vehicle Charging Station Siting Analysis Tool maps the following site characteristics:

- Within Community Activity Centers;
- Proximate to a high concentration of community and/or business activity sites;
- Includes large parking lots; and
- Located in areas that currently lack publicly available charging stations.

Prepare for medium- and heavy-duty charging infrastructure needs

As appropriate, to avoid future demolition when adding EV supply and distribution equipment, space raceway(s) or busway(s) and adequate capacity for transformer(s), service panel(s) and/or subpanel(s) should be installed at the time of construction for future medium and heavy duty (M/HDEV) charging in accordance with MA Electrical code. Requirements can be targeted to building use types which may involve fleet and delivery operations well positioned for electrification such as grocery stores, warehouses, and retail establishments. Requirements can be designed to encourage the installation of additional raceway, busway, and electrical panel capacity during new construction or alternations, and can be tailored based upon building size and/or the number of off-street parking spaces.

DETAILED DISCUSSION OF METHODS FOR MEETING OBJECTIVE CC2

Objective CC2 – *Promote low or no carbon technologies for building energy use, including appliances, lighting, and heating, ventilation and cooling (HVAC) systems*

The purpose of Objective CC2 is to advance the use of energy efficient appliances and building heating and cooling systems that use alternatives to transition from fossil fuels, preferably powered by renewable energy sources. The following is a discussion of the methods that may be implemented to meet Objective CC2.

Design buildings to be all electric, Passive House certifiable, or in compliance with the Municipal Opt-in Specialized energy code

To support state targets for GHG reductions from the building sector, the 2021 "An Act Creating a Next-Generation Roadmap for Massachusetts Climate Policy" (M.G.L. c. 25A, § 6) mandated the creation of a municipal opt-in specialized stretch energy code where compliance pathways are consistent with a net-zero economy in 2050. Compliance pathways include all-electric and Passive House building standards.

Passive House design and the opt-in specialized energy code support low or no-carbon energy use technologies for buildings.

Information on Massachusetts energy codes can be found at Building Energy Code and more detailed information on Passive House design can be found at PassiveHouse.com.

See Energy Technical Bulletin Detailed Description and Resources. *Applicants are not required to seek certification through the Passive House Institute (PHIUS)* but must provide information that the project is certifiable.

Include ground or air source electric heat pumps, in place of fossil fuel HVAC systems

Fossil-fuel based heating and cooling systems can be replaced with efficient air or ground-source heat pumps in new development and redevelopment to reduce a building's reliance on fossil fuels. These systems use electricity for power, and when paired with an on-site renewable energy generation system, an older building can greatly reduce its fuel use. An HVAC retrofit should typically be paired with energy

efficiency upgrades to reduce heating and cooling leakage through an older structure's building envelope.

Include site scale battery storage paired with renewable energy generation or emergency generators that use renewable fuels

Applicants are encouraged to include on-site renewable energy paired with site scale battery storage to enhance the reliability and extend the usefulness of renewable energy generation. Where a generator is needed on-site, renewable fuel sources should be used, whenever possible. Coupling generators with on-site battery storage will also extend the usefulness of the generator to times when the grid may be down or for other emergency needs. On-site or fleet EVs may also be connected to the building's energy system, providing back-up energy during times when renewable energy sources are unavailable (poor weather or at night).

Include electric appliances such as induction stoves or water heaters

Similar to an all-electric building, electric appliances and systems can contribute to promoting electrification and low or no carbon technologies. Energy efficient lighting and appliances can decrease the amount of energy needed to operate lighting or appliances.

Include non-fossil fuel energy use

Projects may incorporate on-site renewable energy generation or alternative energy use, other than solar photovoltaic (PV) panels, including but not limited to: wind, solar thermal, geothermal, solar carport, fuel cells, the use of biofuels. These fuels and technologies use alternatives to fossil fuels and can be renewable forms of energy generation, promoting electrification and low or no carbon technologies.

DETAILED DISCUSSION OF METHODS FOR MEETING OBJECTIVE CC3

Objective CC3 – *Promote carbon sequestration and other emissions removal practices as appropriate to context*

The purpose of Objective CC3 is to advance the capture and storage of carbon to balance the impacts of development on the causes of climate change (greenhouse gases). The gases that contribute to climate change move through natural cycles from solid to gaseous states. On Cape Cod, the region's emissions of carbon dioxide from daily activities like driving and heating buildings far exceed the region's contributions of other climate-harming gases.

Fortunately, the carbon cycle can be harnessed to mitigate some of the impacts associated with human activities. Plants absorb carbon dioxide through photosynthesis and incorporate carbon into plant structures. Trees and other plants, as long as they are alive, store – or sequester – carbon in this way. Once plants are cut, decomposition releases carbon back into the atmosphere.

The following is a discussion of the methods that may be implemented to meet Objective CC3.

Reuse buildings, incorporate reuse of building materials, use recycled building materials, or include building materials certified as low carbon

Carbon emissions can be created during all life-cycle stages of building material product development, from mining and sourcing of raw materials to their manufacture and transport to their disposal. Known as "embodied carbon" these emissions contribute to climate change. Reusing existing building materials or using recycled building materials that reduce or eliminate the greenhouse gases associated with creating new building materials can reduce a project's greenhouse gas emissions. Additionally, using recycled building materials that are certified as low carbon can also reduce the greenhouse gas emissions associated with building construction.

More information on embodied carbon can be found through the Rocky Mountain Institute. Examples of low embodied carbon materials can be found through The New School Healthy Materials Lab. Designers should check with materials manufacturers

and suppliers for availability and certification of recycled and/or low carbon building materials and provide materials certifications.

Plant new and replacement trees or provide restoration with native vegetation

As noted above, trees and other vegetation store carbon within their structures, and will continue to absorb and store carbon as long as they are alive. Thus, tree planting, and plantings with other native vegetation can contribute to carbon sequestration.

Trees are especially good at sequestering carbon due to their size, and tree planting is encouraged wherever suitable and appropriate to context. More urbanized areas, within Community Activity Centers or villages, and within commercial developments, are appropriate areas to focus tree planting, especially where mature trees can enhance cooling, streetscape appearance, or buffering between land uses.

See Wildlife and Plant Habitat Technical Bulletin Objective WPH2 Methods for specific guidance on tree planting, and Community Design Technical Bulletin Objective CD1 Methods: Provide appropriate landscaping and pedestrian amenities.

Permanently protect forest or other naturally vegetated areas which sequester carbon

As noted above, trees and other vegetation store carbon within their structures, and will continue to absorb and store carbon as long as they are alive. Thus, protecting forest or other naturally vegetated areas can contribute to carbon sequestration.

See Open Space Technical Bulletin Objective OS3 Methods for more information on the protection and preservation of Open Space.

Capped landfill methane gas capture

Capped landfills generate the most potent type of harmful greenhouse gas, methane; however, landfill gases can be captured and converted to carbon dioxide (CO_2), generating energy in the process. While CO_2 is a climate-harming GHG, it is less powerful in affecting climate change processes than the methane that is emitted from capped landfills. Conversion of methane gas to CO_2 through specialized technology can reduce the GHG emissions from landfills while also generating energy.

DETAILED DISCUSSION OF METHODS FOR MEETING OBJECTIVE CC4

Objective CC4 – *Promote low or no carbon energy generation as appropriate to context*

The purpose of Objective CC4 is to encourage the generation of renewable energy on Cape Cod. The following is a discussion of the methods that may be implemented to meet Objective CC4.

Employ and quantify the GHG-reduction benefit of the strategies to incorporate low or no carbon energy generation

All projects incorporating low or no carbon energy generation should quantify the GHG-reduction benefits of such method(s). See Energy Technical Bulletin Objective EN1 Method: Incorporate on-site renewable energy and application requirements related to quantifying GHG emissions below.

Install green energy systems in new buildings and redevelopment

Solar or other renewable energy generation on roofs, as solar car-ports, or on disturbed sites can provide low or no carbon energy generation for new buildings and redevelopment.

On-site renewable energy generation

Renewable energy generation, distribution, and storage can support low and no carbon energy use. Utility scale renewable energy facilities should be designed and sited in a manner sensitive to the Cape Cod regional context while supporting Massachusetts goals for renewable energy generation. Applicants proposing utility scale solar energy generation facilities should consult the Commission's solar screening tool and companion document “Siting Large-Scale Solar Photovoltaic Projects on Cape Cod” (see References and Resources) when locating their project and should plan for safety and decommissioning.

Where feasible, battery storage facilities should be co-located with renewable energy generation systems or where electricity consumption is high and reliability is essential (e.g., emergency shelters, hospitals, long-term care facilities, schools, large businesses). Battery storage facilities should be contained within a structure with the following features: a temperature and humidity-maintained environment; an impervious floor with a containment system for potential leaks of hazardous substances; a smoke/fire

detection, fire alarm, and fire suppression system; a thermal runaway system; and a local disconnect point or emergency shutdown feature. The structure and systems must be designed and installed in accordance with all applicable State codes and safety requirements as well as safety measures recommended by the National Fire Protection Association's Standard for the Installation of Stationary Energy Storage Systems. See the Water Resources Technical Bulletin for guidance on secondary containment systems and Hazardous Substances.

Commit to purchase renewable energy

Under the Massachusetts Renewable Energy Portfolio Standard (RPS), for every megawatt hour (MWh) of electricity added to the New England electric grid from a renewable energy generator, a Renewable Energy Certificate (REC) is generated. These RECs are available for purchase, supporting the Commonwealth's goal to increase renewable energy generation. The Alternative Energy Portfolio Standard (APS) is a similar approach that focuses on the sale and purchase of renewable energy generated from alternative methods, such as biofuels, geothermal technology, or food waste, as examples. The sales and purchase of RECs claim a portion of the renewable energy generated regionally and added to the regional electric grid for use. Options for the purchase of renewable energy power may include a Power Purchase Agreement (PPA) or Net Metering Credit Purchase Agreement (NMA) with an electric utility provider or a third-party energy provider.

Applicants contracting with a renewable energy generator should provide documentation that the generator has the energy capacity to provide for such purchase.

More information about purchasing Green power can be found through the Cape Light Compact, Green Energy Consumers Alliance, or by contacting your utility provider. Projects proposing to meet Objective CC4 by purchasing Green power should provide documentation of the commitment and identify the renewable energy generator, utility, or other entity that is a party to the agreement. See Energy Technical Bulletin Objective EN1 Method: Green Power Purchase.

Incorporate alternative renewable energy sources for onsite building development such as geothermal heating and cooling

A project may include an alternative renewable energy source such as biomass or biofuels, geothermal technology, or hydrogen fuel cell technology. Biofuels are

predominantly transportation fuels derived from plants or plant material such as agricultural crops and byproducts. Geothermal technology uses heat below the Earth's surface in the form of steam or hot water for use in electricity generation, direct usage applications, or in heat pumps for building heating and cooling. Hydrogen fuel cells generate electricity that can be used in buildings, for backup power supply such as an emergency generator, or in transportation. There are many alternative energy sources and an applicant may propose an alternative energy source other than those listed here.

Propose, contribute to, or tie into a Microgrid

The United States Department of Energy Microgrid Exchange Group defines a microgrid as a group of interconnected loads and distributed energy resources (DERs) within clearly defined electrical boundaries that acts as a single controllable entity with respect to the grid. A microgrid can connect and disconnect from the grid to enable it to operate in both connected or island-mode.

Projects proposing to meet Objective CC4 by developing or connecting to a microgrid should provide information on how the microgrid will serve a specific area or documentation on how connection to a microgrid will be incorporated into the project.

DETAILED DISCUSSION OF METHODS FOR MEETING OBJECTIVE CC5

Objective CC5 – *Promote strategies to address climate change induced impacts such as wildfire and extreme temperatures and changes in precipitation*

The purpose of Objective CC5 is to help address and mitigate the impacts of climate change on wildfire risk, increases in extreme temperatures, and increases in precipitation events and patterns. The following is a discussion of the methods that may be implemented to meet Objective CC5. Applicants are encouraged to propose alternate methods to meet Objective CC5 based on best practices for the type of project proposed, or as new strategies or technologies are developed and available.

In Rural and Natural Areas Placetypes, project site selection or layout demonstrate consideration of firebreaks

Cape Cod is vulnerable to wildfire. Cape fire departments are responding to an increasing number of wildfire events annually, and that number could further increase with increased temperatures and drought. There are many resources available to help residential and commercial property owners take steps to reduce their exposure to wildfire, including Firewise USA.

From the regional perspective, there are actions that will help improve the community's resiliency to wildfire risk. These actions are particularly relevant and applicable in Natural Area and Rural Area Placetypes, where applicants may demonstrate consistency with this method by identifying and maintaining firebreaks – typically linear areas including roads, fireroads, and transmission easements, but which can also include walkways, parking lots and maintained lawn. Where new development is proposed within Natural Area and Rural Area Placetypes, applicants should demonstrate that the project will not exacerbate the risk of wildfire and that following consultation with the local fire department, if indicated, wildfire breaks are incorporated into project layout or design. Consideration for consistency with this method may include noting the location of existing firebreaks within the vicinity of the project site.

USE FIRE RESISTANT BUILDING MATERIALS

Using roof and siding materials that are fire resistant will reduce a building's vulnerability to wildfire. Roof materials rated Class A offer the greatest fire resistance and include concrete or clay roof tiles as well as some metal roof systems. Fiber cement

and other engineered wood products like synthetic wood shakes, available as roof shingles and in various forms of shingle or clapboard siding, can also provide high levels of fire resistance. Class B rated roof materials are most commonly pressure-impregnated fire-retardant treated shakes or shingles. A non-fire-retardant-treated wood shake or shingle roof covering is unrated and is not desirable, though in some cases an underlayment may be added to a roof system to provide Class A protection. In addition to selecting appropriate roof materials, it is important to consider how roof edges can be designed to limit vulnerability to fire. Removing accumulated vegetative debris from roof valleys and replacing combustible siding at roof edges with 6 inches of non-combustible siding such as fiber cement or flashing materials can reduce vulnerability to fire.

Use Firescaping to reduce fire risk

Applicants may also demonstrate consistency with this objective through the use of suitable landscaping, or "Firescaping." Firescaping is the use of plants or maintenance of landscaping that will reduce the flammability of a property. Not all sites will require firescaping, but sites within Natural Area or Rural Area Placetypes, or within heavily wooded Suburban Placetype settings, may demonstrate consistency with this method through the following best practices:

- **Use less flammable materials**: Certain plants containing volatile oils and resins, dense growth habits, and thin leaves or needles (evergreens) are typically more flammable than plants without oils or resins, more open growth habits, and broader leaves. Similarly, certain mulches, typically those which have been composted, are less flammable than woodchips or straw.
- **Modify plant materials (potential fuels):** Pruning, thinning, and placement and spacing of plantings relative to buildings will help reduce the ability of fire to spread horizontally along the ground or through the tree canopy. Pruning "ladder fuels" from the ground to 10 ft height along tree trunks will help reduce the ability of ground fires to climb into the canopy. Including firebreaks as a component of landscape design will also help control the spread of wildfire; and
- **Maintain the firescape:** Ongoing maintenance consistent with these principles will help lessen the risk of wildfire spread.

Information on firescaping may be found in these resources:

University of Georgia Warnell School of Forestry and Natural Resources, Firescaping: Wildfire Resistant Landscaping in Georgia https://resources.ipmcenters.org/resource.cfm?rid=24029

National Wildfire Coordinating Group NWCG Wildland Urban Interface Mitigation Field Guide https://co-co.org/wp-content/uploads/2025/04/NWCG-Wildland-Urban-Interface-Mitigation-Field-Guide.pdf

Incorporate green or cool roof design

Green roofs utilize plants to absorb rainwater and cool structures, providing benefits through stormwater management, reducing energy costs for building cooling, and reducing the heat island effect in the surrounding environment. Green roofs may be extensive or intensive, and may be proposed over the entire roof or a portion thereof. Extensive roofs tend to have lower additional structural requirements, use low growing plants with a shallower medium, and require less maintenance. Intensive green roofs have deeper soil beds to support larger plants, including shrubs and trees, and require greater structural support. Intensive roofs may also serve to help manage stormwater and can serve as a building amenity when designed as a rooftop garden or exterior space. Because there are structural considerations for buildings incorporating green roofs, their applicability is best for new construction[4]. Applicants proposing larger structures in Community Activity Centers and other densely developed areas are encouraged to consider a green roof design to help reduce ambient summer air temperatures.

Cool roofs are designed to reflect, as opposed to absorb, sunlight by applying a light colored paint, coating or material to the surface of a roof exposed to the sun. A cool roof surface could be as much as 50 degrees cooler than a standard or dark colored roof, thereby reducing the amount of energy needed to cool a building. Cool roofs can decrease building air conditioning needs, lower peak electricity demand, and reduce the local air temperature. Cool roofs can be used in new construction and in certain roof retrofits depending on other building conditions, and can be used on sloped or flat roofs. For certain buildings where a flat roof is incorporated into the design, making the roof reflective, or a “cool roof” is encouraged.

[4] https://www.epa.gov/heatislands/using-green-roofs-reduce-heat-islands accessed August 2025

More information about cool roofs can be found through the Department of Energy.

Size stormwater management infrastructure to accommodate the 100-year, 24-hour size storm

Our changing climate is impacting precipitation patterns that the region experiences today and are anticipated to experience in the future. To best account for changing patterns in precipitation, updated projections for extreme precipitation events should be used whenever designing new stormwater systems as detailed in Objective WR4 (manage and treat stormwater to protect and preserve water quality) in the Water Resources Technical Bulletin.

APPLICATION REQUIREMENTS

GHG IMPACT ANALYSIS AND MITIGATION PLAN

An applicant shall provide a narrative analysis describing its anticipated contributions and impacts with respect to regional greenhouse gas (GHG) emissions from its proposed development, based on the categories of sources, as project-relevant, set out in the Barnstable County GHG Inventory (e.g., transportation, stationary energy, etc.). The applicant will lay out in the narrative methods by which it proposes to mitigate, minimize or avoid GHG emissions from its proposed development.

Note that the Barnstable County GHG Inventory deals primarily with the most prevalent type of GHG, carbon dioxide (CO_2), which should similarly be the focus of the applicant's GHG Impact Analysis and Mitigation Plan. (Other GHG emissions may be significant in certain types of projects, and should be addressed in the analysis, as the case may be). There should be sufficient detail in plans and other information submitted with the DRI application to support the analysis and proposed mitigation approaches (e.g., construction plans/notes describing the building size, envelope attributes, operation schedule, building systems, occupancy, and other information necessary to describe the building relative to estimating energy consumption and calculating GHG emissions; transportation documents like TIAS, TDM plans, etc.)

In order to better frame a project's impacts and evidence the effectiveness of its proposed mitigation approaches, an applicant should submit a quantitative estimate of its GHG emissions under existing and proposed conditions, including different scenarios with or without proposed mitigation factored into the calculations. An applicant who proposes to submit estimated GHG emissions calculations for DRI review can reference the MEPA GHG policy (which includes guidance on calculating emissions from development for purposes of MEPA review) as well as the Barnstable County GHG Inventory. For DRI projects that were also subject to MEPA (and which prepared GHG calculations for MEPA review), an applicant can submit these calculations for the Commission to consider under DRI review. As part of this quantification, an applicant could estimate the anticipated building energy use of the building/s for the proposed project using energy modeling software, including all fuels proposed to be used on-site.

RESOURCES FOR GHG IMPACT ANALYSIS AND MITIGATION PLAN

World Resources Institute/World Business Council for Sustainable Development Greenhouse Gas Protocol Initiative (www.ghgprotocol.org)

Calculation Tool for Direct Emissions from Stationary Combustion Sources: "GHG Tool for Stationary Combustion" (https://ghgprotocol.org/calculation-tools#sector_specific_tools_id)

Emissions Factors and GWPs: MassDEP Emissions Factor Calculations "GWPs & EFs" tab, located at Massachusetts Greenhouse Gas (GHG) Reporting Program Data (https://www.mass.gov/lists/massachusetts-greenhouse-gas-ghg-reporting-program-data)

ISO New England Electric Generator Air Emissions Reports (https://www.iso-ne.com/system-planning/system-plans-studies/emissions)

U.S. Energy Information Administration Energy Conversion Calculators (https://www.eia.gov/energyexplained/units-and-calculators/energy-conversion-calculators.php)

U.S. Energy Information Administration Carbon Dioxide Emissions Coefficients (https://www.eia.gov/environment/emissions/co2_vol_mass.php)

U.S. Department of Energy Building Energy Modeling (https://www.energy.gov/eere/buildings/building-energy-modeling)

"Revised MEPA Greenhouse Gas Emissions Policy and Protocol", effective date May 5, 2010 http://www.env.state.ma.us/mepa/downloads/GHG%20Policy%20FINAL.pdf .

REFERENCES AND RESOURCES

Massachusetts energy codes (Building Energy Code)

Passive House Institute US (PHIUS) (https://www.phius.org/home-page)

"Siting Electric Vehicle Charging Stations on Cape Cod" (https://capecodcommission.org/ev-siting-analysis)

Cape Cod Greenhouse Gas Emissions Inventory (https://capecodcommission.org/our-work/greenhouse-gas-emissions-inventory/)

Solar Screening Tool (https://www.capecodcommission.org/our-work/solar-screening-tool/)

U.S. Department of Energy National Renewable Energy Lab Solar Ready Planning (https://www.nrel.gov/solar/market-research-analysis/blog/posts/solar-ready-building-design-a-summary-of-technical-considerations) and "Solar Ready Buildings Planning Guide", December 2009 (https://www.nrel.gov/docs/fy10osti/46078.pdf)

Information on embodied carbon (Rocky Mountain Institute and The New School Healthy Materials Lab).

Cape Light Compact (https://www.capelightcompact.org/)

Green Energy Consumers Alliance (https://www.greenenergyconsumers.org/)

Department of Energy Cool Roofs (https://www.energy.gov/energysaver/cool-roofs)