City of Cambridge
Getting to Net Zero Action Plan

Fiscal Year 2019 Progress Report

February 2020

City of Cambridge
CLIMATE PROTECTION ACTION COMMITTEE

November 14, 2019

Dear Mr. DePasquale,

The City of Cambridge's Climate Protection Action Committee (CPAC) is tasked with overseeing the City's Net Zero Action Plan (Plan) and assessing its progress on an annual basis. This letter serves as the fourth annual progress assessment (Assessment), which includes comments and recommendations regarding both the content of the Plan, as well as the implementation of the Plan by the Community Development Department (CDD) and other City officials. The Assessment is based upon the annual *City of Cambridge Getting to Net Zero Action Plan – Fiscal Year 2019 Progress Report* (Progress Report) drafted by CDD (attached), as well as the deliberations of CPAC.

Since the Net Zero Action Plan was finalized and adopted by the City in 2015, the science surrounding climate change, the impacts of climate change and social awareness of climate change have all advanced and become more compelling. Meanwhile, the implementation of some of the key actions within the Net Zero Action Plan have fallen behind schedule. As noted in more detail below, CPAC recommends increased resources, legislative action and sense of urgency to facilitate the achievement of the Plan's carbon neutrality goals.

The following are specific comments and recommendations aimed at getting the Plan "back-on-track" and in a position to meet Plan milestones:

1. Legislative Actions – CPAC strongly supports all six of the legislative recommendations outlined in the Progress Report, but particularly the two described below. As stated in the Progress Report: *As the Plan moves from an emphasis on feasibility and design to the implementation of recommendations, there is an increased need for legislative action by the Cambridge City Council and related stakeholders…Legislative actions may include amendments to existing Zoning or City Ordinances or the creation of new regulations.* Two policy adoptions that are core to the Plan and require action according to the following schedule are*:*

    a. *Fall 2019: Amend Article 22 of the Zoning Ordinance to Increase Green Building Requirements [from LEED Silver to Gold] (Plan Action 2.3), and Remove Barriers to Increased Insulation (Plan Action 2.5).*
    These proposed Ordinance changes have undergone thorough stakeholder vetting and after significant delay are poised to be adopted by the City Council. In order to keep on pace with the Net Zero Action Plan schedule and have a

meaningful impact, the next round of green building requirements is due for adoption in FY21. CPAC recommends that the City Manager and staff maintain the commitment to this schedule of phased increases in green building stringency and promptly move forward with this next set of requirements.

b. *Fall/Winter 2019: Submit Building Energy Use Disclosure Ordinance (BEUDO) amendments to introduce performance requirements. (Plan Action 1.1.2)*
As noted in CPAC's 2018 Assessment, BEUDO is moving from data gathering/measurement to managing/reducing emissions which requires energy performance requirements for existing buildings. The BEUDO performance requirements were due to be adopted in FY19 and are now behind schedule. CDD has proposed the performance requirement that all BEUDO buildings improve their GHG emissions by 20% every 5-years. CPAC supports this effort to advance performance requirements and strengthen the impact of BEUDO for existing buildings to reduce their GHG emissions, and encourages the City and BEUDO stakeholders to pursue a stringent approach to these requirements. Expeditious adoption of these amendments is needed to meet the City's GHG reduction commitments.

2. Collaboration and Alignment of City Climate Initiatives
    a. CDD should monitor the various climate resiliency and energy efficiency initiatives occurring in the City and integrate them, where appropriate, into the Net Zero Action Plan to strengthen support for Plan goals and policies and to avoid redundancy. Energy efficiency investments and retrofits are easier to monetize than resiliency investments, and energy efficiency and resilience investments can be mutually reinforcing. As such, CDD should provide incentives and technical support for both of these investments to be done simultaneously whenever possible.

    Such initiatives include: Envision Cambridge (in particular the recommendations of the Climate and Environment Working Group), the Climate Resilience Zoning Task Force (recommendations expected in early 2020), and the Urban Forest Master Plan. The findings and recommendations of these initiatives should be studied and integrated as part of the 5-year Comprehensive Review required under the Plan, which will occur in FY20. (The City's participation in various regional Climate initiatives, such as the Zero Cities Initiative and Metro Mayors Coalition, should also be monitored and integrated into the Plan as relevant.)

    b. CDD should also monitor and support ongoing Council ordinance proposals that align with the goals of the Plan and integrate them into the Plan as appropriate. One such recent ordinance proposal from Council aims to ban natural gas hook-ups in new construction and force new buildings to be all-electric, in anticipation of increased grid supplied renewable energy.

3. Budgeting
   The Plan released in 2015 was adopted with a 5-year budget that expires in FY20. CDD needs to propose, and the City Manager and Council approve, a reasonable Plan implementation budget to bridge the gap between the expiration of the original Plan budget and the development and approval of a new 5-year Plan budget as part of the 5-year Comprehensive Review occurring in 2020. Examples of near-term funding needs include increased staff and tools to manage BEUDO data analysis and implementation of the proposed performance requirements, and funding for implementation of the recommendations of the Low Carbon Energy Supply Strategy.

4. As previously noted, the 2015 Plan required a Comprehensive Review in 2020, its 5-year anniversary. The Plan review committee should re-assess Plan policies and timing within the context of experience and rates of progress to date and updated scientific and technological knowledge. In order to achieve the City's commitment to 100% carbon neutrality by 2050, it is likely that the policies under the Plan will need to become more aggressive, implemented sooner and require substantial additional funding. CDD should commence the 5-year Comprehensive Review as soon as possible and aim to have it completed prior to the FY22 budgeting cycle.

CPAC commends the City for its efforts to date developing and implementing the Plan, which is necessarily multi-pronged and evolving. In order to attain the goals of the Plan, the City must implement Plan findings and recommendations in a timely manner. CPAC urges the City Manager and City Council to fully support the implementation of the Net Zero Action Plan, including the recommendations outlined above combined with those described in CDD's Fiscal Year 2019 Progress Report. Time is of the essence.

Respectfully,

Melissa Chan, Chair

Attachment: City of Cambridge Getting to Net Zero Action Plan – Fiscal Year 2019 Progress Report

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INTRODUCTION

Background

The City of Cambridge shares increasing global concerns about the crisis of climate change and the many challenges it presents. This crisis threatens the ability of the planet to support secure, healthy, productive, and enriching lives for current and future generations. The City of Cambridge has long been steadfast in addressing climate change. In 2002, the City adopted the Climate Protection Action Plan, our first attempt at proposing emissions reduction targets and recommendations to reduce greenhouse gas (GHG) emissions. Since then, the City has committed to a range of initiatives to support sustainable lifestyles and move the community toward greater resilience to climate change. In 2016, the City made a commitment through the Metro Mayors Coalition[1] to achieve carbon neutrality by 2050. In Cambridge, buildings are both the problem and the solution for addressing climate change: more than 80% of our greenhouse gas emissions result from building operations and, as a sign of our thriving economy, new building development steadily continues. If the city can get to net zero emissions in the building sector, we will have made major progress towards achieving the U.N.'s goal of carbon neutrality in our cities.

In 2013, in response to community concern that continued construction activity would make the goal of reducing greenhouse gas emissions harder, the City convened the Getting to Net Zero Task Force to foster a deep conversation among stakeholders to advance the goal of setting Cambridge on a trajectory to becoming a "net zero community," with a focus on carbon emissions from building operations. **For Cambridge, 'net zero' refers to a building or a community of buildings for which, on an annual basis, all greenhouse gas emissions resulting from building operations are offset by carbon-free energy production**. Achieving the net zero objective relies on a combination of energy efficiency improvements, renewable energy production and, where necessary, purchase of carbon offsets or, potentially, credits (that meet specific criteria). After fifteen months of intensive discussions, outside expert analysis, and consultation across sectors including the general public, the Task Force delivered a 25-year framework for setting Cambridge on the trajectory to becoming a net zero community.[2]

[1] http://www.mapc.org/metro-mayors-coalition

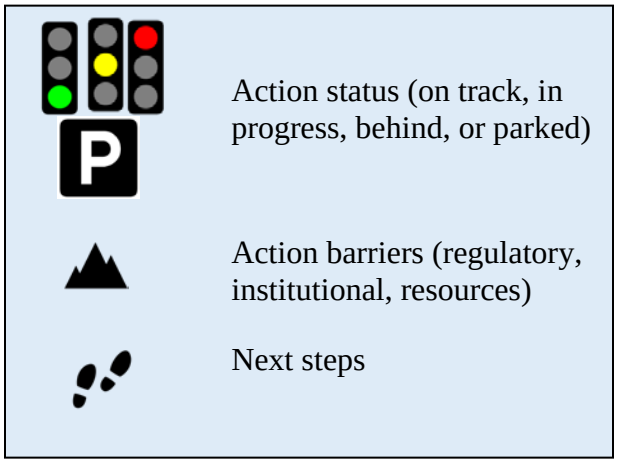
[2] This language is drawn from the Getting to Net Zero Framework report, which can be found along with additional materials about the Cambridge Net Zero Action Plan at http://www.cambridgema.gov/CDD/Projects/Climate/NetZeroTaskForce

Annual Report Purpose and Structure

In accordance with the recommendations of the Net Zero Action Plan (see Action 5.2), the Cambridge Community Development Department (CDD) has committed to conduct ongoing monitoring and reporting of progress towards the Net Zero Action Plan goals. In collaboration with the Climate Protection Action Committee (CPAC) which has agreed to provide oversight of the Plan, CDD committed to providing an annual report to CPAC and the public to summarize progress towards each action slated for the previous fiscal year.[3] This is the fourth such report.

Net Zero Action Plan annual reports are intended to provide an overview of each action planned for that year, including the action items, progress made, and next steps to reach the annual goals. The annual report will also provide quantitative outputs as appropriate for each action, for example the number of green buildings permitted during the past year, as well as broader outcomes such as changes in community-wide GHG emissions. The first citywide comprehensive GHG Community Inventory was completed in early 2017 and serves as a baseline indicator for the Net Zero Action Plan. Because GHG emissions are measured at the community scale in Cambridge, however, attributing changes in GHG emissions to individual Net Zero actions will likely be challenging. Therefore, annual building performance measured through the Building Energy Use Disclosure ordinance and individual action outputs and their alignment with the assumptions of the Net Zero GHG Model[4] will serve as an indicator of the direction and magnitude of potential GHG reductions that can be attributed to the Plan.

This report is structured to parallel the Net Zero Action Plan, with actions falling into five categories. In addition to detailed information, a summary box such as the one to the right is provided for each action. The green, yellow, or red light indicates the overall status of the action and whether it is on track, making progress but delayed, or behind, respectively. The parking symbol was introduced in FY18 to represent actions that are "parked" because they are completed or not being pursued at this time. They will remain parked in future reports unless it is determined that they should be reinvestigated. Note that the progress status is based on what was accomplished towards the FY19 action items through fall 2019. The mountain symbol represents key challenges to successful implementation of the action including regulatory, institutional, and resource barriers. The footprints represent next steps for the action.



Following discussion of qualitative progress towards each of the actions is a section summarizing quantitative indicators and their change over time.

[3] For the full Plan schedule, see Appendix 1 ; City of Cambridge fiscal years run from July 1-June 30

[4] http://www.cambridgema.gov/CDD/Projects/Climate/~/media/89814C94911A49388ECDBAAEAE7366A6.ashx

FISCAL YEAR 2019 ACTION PROGRESS UPDATES

Fiscal Year 2019 is the fourth year of Net Zero Action Plan implementation. Initial pilot activities are beginning to be reviewed and policy designs are ready for implementation. FY19 included actions in all five categories: Action 1 – Energy Efficiency in Existing Buildings, Action 2 – Net Zero New Construction, Action 3 – Energy Supply, Action 4 – Local Carbon Fund, and Action 5 – Engagement and Capacity Building.

Legislative Action

As the Net Zero Action Plan moves from an emphasis on feasibility and design to the implementation of recommendations, there is an increased need for action by the Cambridge City Council and related stakeholders in order to advance implementation of the actions. Legislative actions may include amendments to existing Zoning or City Ordinances or the creation of new regulations. To identify the need for such measures, **Legislative Action** has been flagged within each individual action as appropriate. Below is a summary of these actions in approximate chronological order of potential adoption:

- Fall 2019: Amend Article 22 of the Zoning Ordinance to Increase Green Building Requirements (Action 2.3) and Remove Barriers to Increased Insulation (Action 2.5)
- Fall/Winter 2019: Submit Building Energy Use Disclosure Ordinance amendments to introduce performance requirements for BEUDO buildings (Action 1.1.2)
- Winter 2020: Adopt Net Zero Requirement for New Construction of Municipal Buildings (Action 2.4.1)
- Winter 2020: Propose recommendations for a Height and FAR Bonus through zoning for buildings that achieve net zero emissions ahead of the required schedule (Action 2.2.2)
- Winter 2020: Propose a Rooftop Solar Installation Requirement for new buildings (Action 3.2)
- 2020: If feasible, propose policy recommendations for Upgrades at Time of Renovation or Sale (Action 1.1.3)

Action 1 – Energy Efficiency in Existing Buildings

The intent of this action is to ensure that all buildings are operating optimally and, where necessary, are retrofitted to maximize efficiency. In FY19, there was continued pilot implementation of the Custom Retrofit Program for multi-family buildings and stakeholder engagement around voluntary retrofit program design for larger residential and commercial buildings (Action 1.1.1) to complement additional Building Energy Use Disclosure Ordinance requirements (Action 1.1.2). Further research was conducted to consider policy options for required Upgrades at Time of Renovation or Sale (Action 1.1.3).

Action 1.1.1: Custom Retrofit Program

Introduction

Multi-Family Energy Pilot in implementation. Custom Retrofit Program for BEUDO buildings ready for implementation.

Ongoing program tracking and evaluation.

Pilot program evaluation and Custom Retrofit Program launch

With the Multi-Family Energy Pilot custom retrofit program in place for its third year, FY19 was determined to be an appropriate time to begin the design of an energy retrofit program for other building sectors in Cambridge, one year ahead of the original Net Zero Action Plan schedule. With a focus on those buildings subject to the Building Energy Use Disclosure Ordinance (BEUDO), the expanded custom retrofit program is intended to provide buildings with a voluntary, cost-effective pathway to help achieve the energy savings and GHG emission reductions that will be required by upcoming BEUDO amendments (see Action 1.1.2). Lessons from the Multi-Family Pilot design and implementation were used as a starting point for an expanded program design, including (1) build trust between building occupants/owners and the utilities/energy efficiency providers by adopting a performance-based approach to building upgrades and payments; (2) ease administration of the assessment and retrofit process by assigning each building owner a single owner's agent to manage all aspects of the process; (3) connect building owners to accessible financing options, including existing state and utility incentives; (4) integrate renewable energy solutions such as solar PV into the energy efficiency retrofit process to streamline the renovation process; and (5) conduct a targeted marketing process to efficiently identify and enroll prospective building owners.

FY19 Action Items

Review the results of the Multi-Family Energy Pilot. Design an expanded custom retrofit program for other building types, including those subject to the Building Energy Use Disclosure Ordinance requirements.

Progress Towards FY19 Action Items

The Cambridge Multi-Family Energy Pilot continued to be offered in FY19 in coordination with Eversource and their multi-family contractor, CLEAResult. The pilot program is meant to provide multi-familiy buildings with 5-49 units comprehensive energy assessment and retrofit

services with a single point of contact. Building owners and tenants can enroll in the program directly with Eversource/CLEAResult or through the Cambridge Energy Alliance. [5] Cambridge has retained the services of a green building nonprofit, New Ecology Inc, to serve as a Retrofit Advisor and provide additional support to buildings that are seeking to implement energy-saving measures. In addition, the City has hired Zapotec Energy as the program's Solar Advisor to help provide solar assessments and guidance to buildings interested in installing solar.

Starting in the summer of 2019, Cambridge streamlined the Pilot to provide a more comprehensive, easy-to-access program for multifamily owners and tenants. The Retrofit Advisor works with multifamily buildings from the beginning, helping them determine which type of energy assessment and which services will best meet their needs. Once building owners have a better understanding of the retrofit opportunities, the Retrofit Advisor helps them identify qualified vendors, compare bids, review project financials, and connect with financing opportunities. Marketing initiatives for the Pilot include online media, street signs, BlueBikes station posters, flyers, and postcards, as well as canvassing through the Cambridge summer high school internship program. **As of September 2019, approximately 50 properties, encompassing 1450 units, have enrolled in the program.** Nearly all enrolled buildings have taken advantage of the opportunity to get a solar assessment through the pilot, collectively identifying a total of 1.2 MW of solar potential. Projects that the Retrofit Advisor has helped owners pursue include insulation, air sealing, high-efficiency heating and cooling, and investigating conversion to heat pump systems. The uptake of more in-depth measures and solar installation has proven challenging, as the upfront costs, decision-making processes in condominium associations, and limited bandwidth for self-managed buildings can present significant challenges.

Beginning in November 2018, the City, supported by Cadmus consultants, facilitated a series of four stakeholder workshops and three focus groups to inform the design of an expanded custom retrofit program to serve buildings subject to the Building Energy Use Disclosure Ordinance. By examining the needs, barriers, and opportunities for achieving comprehensive energy savings in large buildings in Cambridge, the stakeholder process led to a detailed proposal for a custom retrofit program for BEUDO buildings implemented collaboratively by CDD, Eversource, and the building stakeholders.[6] The centerpiece of the program is a "concierge" service provided by Eversource to connect buildings to customized MassSave resources to help achieve their energy efficiency goals, supported by an energy efficiency "hub" resource website.

Next Steps

The Multi-Family Pilot is continuing to be offered through FY20 with support from a state grant that will enable the City to make changes to the Pilot based on evaluation results; goals for the coming year include expanding participation through targeted outreach and working with interested buildings to implement comprehensive, multi-measure retrofits. Since the completion

[5] http://www.cambridgeenergyalliance.org

[6] For the full report of program development and implementation plan, see https://www.cambridgema.gov/CDD/publications/alphabeticaldocumentfolders/B/buedocustomretrofitprogramdesignfinalreport

of the BEUDO custom retrofit program design, CDD has continued to collaborate closely with Eversource to plan program rollout and implementation, and the program officially launched on October 25, 2019.[7] The program plan includes ongoing tracking and oversight by a steering committee with representatives from the City, Eversource, and BEUDO stakeholders.

Action 1.1.2: Additional BEUDO Requirements

Introduction

Amendment proposal is ready to move forward but behind original schedule

Determining policy details and implementation logistics

Begin regulatory process
Legislative action: Submit BEUDO amendments in fall/winter 2019

The Cambridge Building Energy Use Disclosure Ordinance (BEUDO), enacted in 2014, requires parcels with non-residential buildings totaling 25,000 square feet or greater as well as parcels with residential buildings totaling 50 or more units to annually report and disclose their energy and water use.[8] BEUDO did not initially include any required actions beyond the annual reporting because the Net Zero Action Plan was in development. This action aims to determine potential requirements to help BEUDO buildings reduce energy and water consumption. Actions initially contemplated by the Net Zero Action Plan include audits, retro-commissioning, and operations and energy management plans to be completed on a regular basis.

FY19 Action Items

Complete the design of additional BEUDO requirements and amend the ordinance to begin implementation. Engage BEUDO stakeholders in the requirement design, including consideration of schedule, compliance pathways, and exemptions for participating buildings.

Progress Towards FY18 Action Items

FY19 BEUDO requirement design built off of "phase 1" and "phase 2" studies completed in FY17 and FY18, respectively. Phase 1 included research into the structure of requirements in other jurisdictions, analysis of the impact of different performance tiers within the BEUDO dataset, and examination of the potential impact of requirements for these buildings.[9] Phase 2 was stakeholder-driven and designed to build consensus around requirements and program structure for BEUDO buildings, establish operations and maintenance plan templates for new

[7] For more information or to enroll, see https://www.cambridgema.gov/Services/buildingretrofitprogram

[8] 2015 reporting applied to parcels with 50,000 square feet or greater; Disclosure not required in 2015; for more details, see http://www.cambridgema.gov/CDD/zoninganddevelopment/sustainablebldgs/buildingenergydisclosureordinance.aspx ; See also the 2015 BEUDO Summary Report: http://www.cambridgema.gov/CDD/zoninganddevelopment/sustainablebldgs/~/media/809369A43E674BA485E6CC546E1C11D8.ashx; For the full reported data set for 2016, see the Cambridge Open Data Portal: https://data.cambridgema.gov/Planning/2016-Cambridge-Building-Energy-and-Water-Use-Data-/72g6-j7aq

[9] See the full report and analysis at: http://cambridgeenergyalliance.org/wp-content/uploads/Memo_MasterCambridgeBEUDOPhase1.pdf

and existing buildings, and begin development of a comprehensive retrofit program design and structure to enable all buildings subject to BEUDO reporting to achieve the requirements established for the ordinance as well as voluntary energy and GHG savings.[10] This scope of work combines elements from Action 1.1.2 (Additional BEUDO Requirements), 1.1.1 (Custom Retrofit Program), and 1.1.4 (O&M Plan Requirement) of the Net Zero Action Plan. It makes sense to take a coordinated approach to these actions because they will affect an overlapping set of buildings, can share resources, and through parallel implementation can provide building owners with a full set of options to maximize their energy savings in as streamlined and cost-effective a manner as possible.

While FY19 stakeholder engagement focused on the voluntary comprehensive retrofit program design, concurrent with this process staff continued to research and refine the BEUDO requirement straw proposal developed with stakeholders in 2018 based on further stakeholder feedback. A concerted effort was made to develop compliance pathways specific to campuses and laboratories in collaboration with stakehoders from each of those sectors, the latter of which was led by the Compact for a Sustainable Future's Net Zero Laboratory Working Group (See Action 5.3). Staff also observed the adoption of building emissions performance standards in New York City, Washington DC, and Washington state and considered lessons that could be applied in the Cambridge context. In May 2019, an updated performance requirement straw proposal based on a GHG savings framework was presented to stakeholders, and two additional BEUDO stakeholder meetings were held over the summer to gain feedback on the updated proposal and inform BEUDO amendment language to be presented to City Council in fall 2019.

Next Steps

Staff are working to complete draft amendments to the BEUDO language incorporating stakeholder and legal feedback to submit to City Council for consideration. The additional time to detail the amendment proposal has pushed the BEUDO amendments about one year beyond the original Net Zero Action Plan schedule.

Legislative Action

The proposed BEUDO amendment framework will be submitted to City Council for consideration in fall 2019. Depending on when the amendment is advanced, the performance compliance period could begin in 2021.

[10] See final report at https://www.cambridgema.gov/~/media/Files/CDD/Climate/beudocustomretrofitprogramdesignfinalreport10319.pdf

Action 1.1.3: Upgrades at Time of Renovation or Sale

Introduction

Time of Renovation or Sale requirement feasibility assessment ongoing through Zero Cities project

Assess equity impacts to avoid unintended consequences

Complete stakeholder engagement to inform policy recommendations
Legislative Action: If feasible, propose policy recommendations in 2020

Building renovations or sales can be valuable opportunities to increase the energy performance of the building in coordination with upgrades that are being undertaken. Typically, any requirements at time of renovation or sale are modest and target poor performers within a building class, though such transaction points may also represent opportunities for deeper energy retrofits. In the analysis of potential policies, careful consideration will be given to ensure that any proposed program or regulation will not result in adverse unintended consequences, such as decreases in housing affordability or further disinvestment in poorly maintained buildings

FY19 Action Items

Complete a study to explore a requirement for energy upgrades at the time of renovation or, if appropriate, sale of a property. To assess the feasibility of such requirements, a market analysis should be undertaken to determine an appropriate scope of renovation to regulate, which building types would be included in the requirement, what measures are appropriate to require and over what time period, and whether the retrofit would be the responsibility of the buyer or seller when properties are sold.

Progress Towards FY19 Action Items

Through the Urban Sustainability Directors Network Zero Cities project, CDD has continued work with Architecture 2030 and the Rocky Mountain Institute to a) assess current building transaction and renovation activity, b) develop projections for future building transactions and renovations, c) assess potential energy savings and emission reductions from existing buildings to meet potential energy upgrade requirements, and d) assess potential economic impacts of requirements for upgrades at time of renovation or sale. Initial findings show that nearly all buildings in Cambridge will be sold or renovated multiple times between today and 2050, providing opportunities for energy upgrades, with smaller buildings undergoing more frequent sales and larger buildings more frequent renovations. Building off of these quantitative findings, Resource Media, a communications research organization, is in the process of conducting stakeholder engagement to more fully understand the roles of building owners, occupants, energy efficiency providers, and financiers in upgrades at time of sale or renovation to inform policy recommendations.

Next Steps

The stakeholder engagement will lead to potential policy recommendations for further consideration in context of other Net Zero Action Plan measures.

Legislative Action
If requirements at time of renovation or sale are determined to be feasible, policy recommendations could be adopted as new requirements in 2020.

Action 1.1.4: Operations and Maintenance Plan Requirement

Introduction

This action recommends that the City require, as a condition of building occupancy, that applicants submit energy management plans detailing how the building will be operated to meet the intent of the energy efficient design. While the requirement would apply to new construction, its objective is to ensure future existing buildings are operated to their maximum potential.

BEUDO process included the creation of O&M plan template

O&M plans are implemented on a case-by-case basis after occupancy

O&M planning is captured through Green Building Requirements; no need for further action

Since operations and maintenance planning is captured through Green Building Requirements, there is no need for further action.

FY19 Action Items

No further action at present

Progress Towards FY19 Action Items

No further action at present

Next Steps

No further action at present

Action 2 – Net Zero New Construction

While newly constructed buildings contribute a small portion of Cambridge's total GHG emissions, targeting net zero for new buildings is a bold step that will stimulate investments in net zero innovation that can benefit both new and existing buildings. The process and governance framework for new requirements is to ensure that meaningful financial analysis can take place and industry capacity is commensurate with the requirements. It is important to note that the recommended net zero target years will be evaluated at regular intervals and regulatory changes will be proposed at least 24 months prior to final enactment.

Table 1 - Targets for net zero new construction by sector

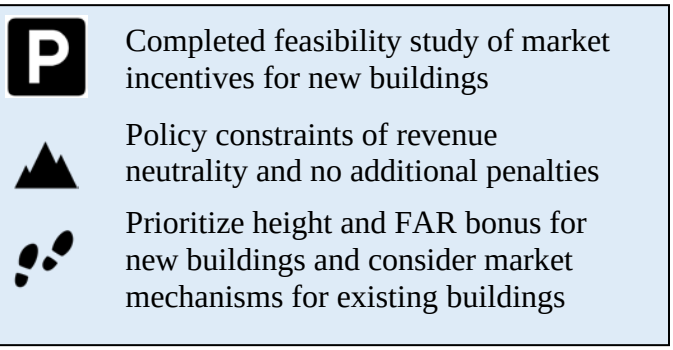
Type:	Municipal	Residential	Multi-Family	Commercial	Institutional	Labs
Target Year:	2020	2022	2025	2025	2025	2030

The following set of actions are designed to support and incentivize achievement of net zero GHG emissions performance in newly constructed buildings in Cambridge.

Action 2.2.1: Market Based Incentive Program

Introduction

In order to achieve net zero buildings in advance of the proposed requirements, Cambridge should explore the use of financial mechanisms to motivate the market and accelerate innovation. MIT and Harvard have agreed to collaborate with the City on this investigation in order to determine the most effective incentives for the Cambridge context. These could include tools such as green building bonds, "green banks", and adjusting pricing of permit fees (or rebates) based on performance.



FY19 Action Items

No further action at present

Progress Towards FY19 Action Items

No further action at present

Next Steps

No further action at present

Action 2.2.2: Height and FAR Bonus

Introduction

Delayed by Envision Cambridge but now moving forward independently

Needs to be prioritized in context of other density-related policies

Propose policy based on technical recommendations
Legislative Action: Pursue recommended density bonus in FY20

To generate early action, the City should explore the potential impact of offering additional floor area allowance (FAR) and extra height to projects that achieve net zero emissions. Projects will need to demonstrate and commit to net zero emissions through their design in order to meet eligibility requirements for additional FAR award. Projects should also have to agree to share lessons on how net zero was achieved in their projects. FAR incentives have proven effective in other dense jurisdictions where building space is at a premium. For example, in Arlington County, Virginia, nearly all new "site plan" (similar to Cambridge Special Permit) projects have voluntarily pursued LEED certification since additional FAR was offered as an incentive beginning in 2008.[11] However, density bonuses are limited in nature and run the risk of being over-utilized by competing program priorities so much be deployed strategically. The incentive would phase out as the net zero requirements are adopted or transition to encourage other environmental benefits.

FY19 Action Items

Complete a feasibility study and establish criteria for offering height and/or FAR bonuses to new Cambridge buildings that commit to pursuing net zero emissions. Begin program implementation.

Progress Towards FY19 Action Items

In FY18, the Envision Cambridge planning project studied the potential amount of FAR needed to incentivize net zero buildings and included an "environmental performance" FAR bonus in a list of potential development scenarios. It was decided not to advance these incentives through the Envision Cambridge process, but to instead pursue a separate FAR bonus for net zero buildings as a zoning amendment. In FY19, with support of consultants from the Zero Cities project, CDD completed a technical study of potential criteria to define net zero emissions for new construction to be elegible for a density bonus. Criteria elements include standards for energy efficiency, on and off-site renewable energy, and the avoidance of fossil fuel consumption. In June 2019, a stakeholder meeting was held to provide initial feedback on the technical recommendations.

[11] https://environment.arlingtonva.us/energy/green-building/green-building-bonus-density-program/

Next Steps

In FY20, staff are working to use the technical recommendations as the basis for a density bonus policy proposal. This proposal will be developed with additional input from those stakeholder who might take advantage of the policy, including consideration of the amount of FAR incentive needed to support net zero new construction. If the policy is determined to be viable, it will be submitted to City Council for consideration.

Legislative Action
The technical study and stakeholder feedback will lead to a recommended FAR bonus policy which can be considered and advanced by City Council in FY20, potentially in coordination with the Rooftop Solar Installation Requirement (see Action 3.2, below).

Action 2.3: Increase Green Building Requirements in Cambridge Zoning Ordinance

Introduction

Previously delayed requirements are ready for implementation following legislative process

Begin study of next round of green building requirements
Legislative Action: Zoning amendment package submitted to City Council September FY20

Article 22 of the Cambridge Zoning Ordinance, *Sustainable Design and Development*, promotes environmentally sustainable and energy-efficient design and development practices in new construction and renovation of buildings in the city.[12] Article 22 currently requires that new buildings 25,000-50,000GFA (gross floor area) meet the requirements of the Leadership in Energy and Environmental Design (LEED) Green Building Rating System at the level 'Certified' or better, and that new buildings 50,000GFA or greater meet the requirements of LEED 'Silver' or better. Increasing the Green Building Requirements in the Cambridge Zoning Ordinance was identified by the Net Zero Task Force as a measure with significant potential impact on future GHG emissions.

FY19 Action Items

Implement the Cambridge Green Building Requirement that all new construction and major renovation projects over 25,000GFA to meet LEED criteria at the 'Gold' level or better. Projects should also achieve a minimum of 6 points under LEED's Optimize Energy Performance credit and the requirements of the Enhanced Commissioning credit to ensure superior energy efficient design and operation.

Progress Towards FY19 Action Items

Staff have completed drafting a revised Article 22, which was submitted to City Council as a zoning amendment on September 23, 2019. It was determined that the state building stretch energy code, which came into effect on January 1, 2017, meets the 6-point improvement targeted by the Net Zero Action Plan. However, some new buildings in Cambridge that are subject to Special Permit requirements are smaller than the thresholds that trigger the amended Stretch Code; these are being strongly encouraged to meet the same energy performance voluntarily through the design review process. In fall 2016, Cambridge adopted the latest version of LEED (Version 4) under the current Article 22 permitting requirements, increasing the stringency of building energy performance. New buildings are also being asked to present a decarbonization pathway plan along with their application, which acknowledges that while the buildings may not

[12] See http://www.cambridgema.gov/CDD/zoninganddevelopment/Zoning/Ordinance for the full Zoning Ordinance

achieve net zero emissions today, developers should plan for a technically achievable pathway to do so within the life of the building.[13]

In FY19, 16 projects were permitted following Green Building Review.[14] Eleven of the sixteen are certifiable at the level of LEED Gold, and five at the level of LEED Silver. Six are solar-ready and two installed solar panels. In aggregate, the projects represent almost 3.5 million square feet of development, 2 million of which is residential with over 1,300 units.

In FY19, staff completed refinement of the proposed Article 22 revisions to incorporate Passive House and Enterprise Green Communities as optional standards and to improve the efficiency and quality of the Green Building Review process,[15] including mechanisms to give input earlier in the design process and options for cost-effective third-party review of energy models. The draft language was informed by stakeholder and legal review, and was submitted to City Council for consideration on September 23, 2019.

Next Steps

In anticipation of the next round of green building requirements due in FY21, staff are researching options for performance-based building requirements that would not conflict with the state building code. The Zero Cities Project (see Action 1.1.3 for details) will devote additional resources to developing performance-based models for cities. Staff are also engaging in activity at the state level that could provide alternative pathways, such as a voluntary net zero stretch code. In May 2019, the City Manager of Cambridge along with the Mayors of Boston and Somerville submitted a letter to the state Board of Building Regulations and Standards in support of development of a net zero stretch energy code.[16]

Legislative Action

The zoning amendment package for LEED Gold, enhanced commissioning, and eliminating barriers to increased insulation was brought to City Council for potential adoption on September 23, 2019.

[13] For examples of such pathways for different building types, see the New York "One City Built to Last" technical working group report: *Transforming New York City Buildings for a Low-Carbon Future*; http://www1.nyc.gov/assets/sustainability/downloads/pdf/publications/TWGreport_04212016.pdf

[14] For more information, see the Green Building Dashboard: https://app.powerbi.com/view?r=eyJrIjoiZTk0OWZmYTctZDljNy00N2MxLTg0OWUtYTEyYzZiZWY1YTNkIiwidCI6ImMwNmE4YmU3LTg0NzktNGQ3My1iMzUxLTkzYmM5YmE4Mjk1YyIsImMiOjN9

[15] http://www.cambridgema.gov/CDD/zoninganddevelopment/sustainablebldgs/greenbldgrequirements

[16] http://cambridgeenergyalliance.org/wp-content/uploads/Tri-city-letter-on-stretch-code-5-28-19.pdf

Action 2.4.1: Net Zero Requirement for New Construction of Municipal Buildings

Introduction

New municipal buildings being constructed to achieve net zero-ready

Detailing net zero definitions in anticipation of requirements

Complete definitions for net zero standard for 2020
Legislative Action: Adopt muni net zero new construction standard in FY20

To demonstrate leadership it is important that the City establish policies to pursue net zero emissions in municipal buildings. Specifically, new construction should target net zero or be 'net zero ready' in the near term. Net zero ready buildings ared designed to achieve maximum energy savings (e.g. >80% more efficient than code requirement) and accommodate 100% of annual energy consumption by on or off-site renewable sources through zero on-site combustion, recognizing that constraints such as site area or location may preclude access to sufficient onsite renewable energy to meet 100% of energy demand.[17] This policy would also be applicable to "gut renovations" where a building is being completely renovated with new electrical, mechanical, interior, and envelope systems.

FY19 Action Items

Implement the established policy that new construction of municipal buildings should target net zero readiness. Plan for adoption of a net zero emissions building standard in 2020.

Progress Towards FY19 Action Items

The Net Zero Action Plan adopted by City Council in 2015 serves as the policy guiding new municipal building construction. Staff have defined net zero-ready construction as highly efficient buildings that are fossil fuel-free to enable the consumption of renewable electricity. Current municipal construction projects are pursuing net zero readiness: the King Open School was completed in fall 2019 and is fossil fuel free, and 859 Mass Ave was completed in September 2018 and includes a variable refrigerant flow system along with solar hot water and PV panels. Staff have continued to meet regularly to define criteria for the net zero emissions standard that will take effect for new municipal buildings beginning in 2020.

Next Steps

Staff will complete the definition of the net zero emissions standard for new municipal buildings including criteria for energy efficiency and reneable energy, incorporating findings from the Net Zero Density Bonus design (Action 2.2.2) and Local Carbon Fund feasibility study (Action 4).

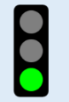
Legislative Action
Net Zero Requirements for new municipal buildings should be adopted in FY20 for buildings permitted beginning in calendar year 2020.

[17] As defined on page 16 of the Net Zero Action Plan Summary of Proposed Actions: http://www.cambridgema.gov/CDD/Projects/Climate/~/media/BF531928BB7D4526AE2D8538E025E0BA.ashx

Action 2.4.2: Renewal of Municipal Buildings

Introduction

Cambridge also seeks to set an example by showing leadership in the energy efficient renewal of existing municipal buildings. The Task Force recommends introducing greenhouse gas reductions as a key component throughout the municipal facilities improvement strategy and integrating it with other priorities, such as life safety, and accessibility.



Continued implementation of Municipal Facilities Improvement Plan

Resource limits to achieve multiple institutional goals

Continue implementation and tracking of results

FY19 Action Items

Continue design and begin implementation of a phased municipal building improvement strategy where (1) greenhouse gas reduction is a priority when constructing facility improvement projects and (2) operational improvements are implemented to achieve targets established and tracked by the Cambridge Department of Public Works. The strategy will involve continuous self-evaluation requiring increased performance levels as technology and local capacity is improved.

Progress Towards FY19 Action Items

In FY17, the initial Municipal Facilities Improvement Plan (MFIP) was completed to (1) assist the City in developing performance metrics and goals for its building portfolio in key facility disciplines; (2) perform and document a needs and condition assessment of 41 municipal facilities; (3) develop and document a phased Capital Improvement Plan of identified facilities; and (4) develop a GHG emissions reduction plan for municipal facilities. The City has committed $5 million per year for 5 years to implement the plan recommendations. Implementation of improvements to municipal buildings is in progress: **12 energy efficiency were upgrades completed in FY19 and another 13 projects are underway. These include installation of HVAC upgrades, LED lighting retrofits, and buildings controls and retrocommissioning resulting in annual savings of over 1,400 MWh, 34,000 therms, and $268,000 in energy costs to the City.**

Next Steps

Implementation of MFIP improvements will continue throughout FY20. The nature and impact of these renovations on energy use will be tracked and reported.

Action 2.5: Removal of Barriers to Increased Insulation

Introduction

Previously delayed requirements are ready for implementation following stakeholder engagement

Potential opposition to reducing setback limitations

Legislative Action: Zoning amendment package submitted to City Council September FY20

One strategy to improve building efficiency is to increase the amount of insulation on the exterior of buildings. Because the addition of insulation effectively increases the footprint of a building and may incur into side yard set-back requirements, the Zoning Ordinance can introduce regulatory barriers to this retrofit. Currently, Article 22 of the Zoning Ordinance allows Yard Exceptions for existing buildings to install exterior insulation as long as it does not increase the thickness of the exterior wall by more than 4 inches or result in the wall being less than 7 feet, 2 inches from the nearest property line.[18] This action calls for development of an approach to remove barriers in the Zoning Ordinance to enable the addition of exterior insulation with the purpose of improving the energy efficiency of residential buildings.

FY19 Action Items

Implement a potential new policy through amendments to the Cambridge Zoning Ordinance to remove barriers to increased exterior insulation during residential building renovations.

Progress Towards FY19 Action Items

In FY17, staff completed a study of the technical options for exterior insulation, the compatibility of potential insulation approaches with the current Cambridge Zoning Ordinance, and the feasibility and impacts of potential revisions to the Zoning Ordinance to allow for additional exterior insulation.[19] It was found that many buildings are out of conformance with yard setbacks and therefore additional changes to the Zoning Ordinance would be needed to allow additional exterior insulation. Potential language that would allow for this flexibility has been drafted as part of the Article 22 amendment package. In FY19, this package completed stakeholder and legal review, and it was submitted to City Council for consideration on September 23, 2019.

Next Steps

Legislative Action

The zoning amendment package for LEED Gold, enhanced commissioning, and eliminating barriers to increased insulation was brought to City Council for potential adoption on September 23, 2019.

[18] Article 22.43.2: Yard Exceptions for Added Exterior Insulation

[19] See full report at: http://cambridgeenergyalliance.org/wp-content/uploads/A22_InsulationStudy_FullReport.pdf

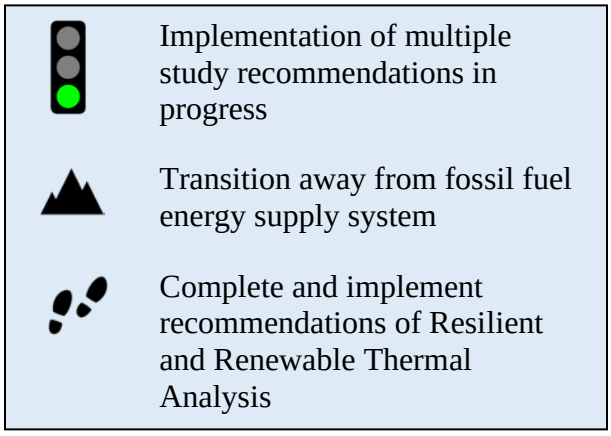
Action 3 – Energy Supply

While maximizing building efficiency is the first priority of the Net Zero Action Plan and will lead to the most GHG savings, to achieve net zero and improve community resiliency will also require a significant shift in the supply of the remaining energy needs of Cambridge buildings away from fossil fuel-based sources and toward low- or zero-carbon sources. This will include realizing a significant portion of the city's solar potential (both PV and thermal), taking advantage of all opportunities to harvest waste heat, and expanding and developing additional district energy capacity. As part of a regional grid served by a regional utility, it is also important for Cambridge to engage with this utility in order to secure its cooperation and support to help Cambridge achieve its Net Zero goals.

Action 3.1: Low Carbon Energy Supply Strategy

Introduction

The Low Carbon Energy Supply Strategy enables the City to understand the opportunities and pathways to achieve a transformation of its energy supply system.



Key conclusions of the Low Carbon Energy Supply Strategy study include: [20]

- Limited renewable energy supply resources within Cambridge requires the import of clean energy resources from outside the city
- Electrification of buildings with grid-supplied renewable electricity is a key means of enabling this transfer of clean energy
- Use of district energy systems in high energy demand areas increases system efficiency, resilience, and flexibility of energy sources, while lowering implementation expenses
- Regional collaboration is essential to achieve the clean energy supply transition

FY19 Action Items

Continue implementation of Low Carbon Energy Supply Strategy study recommendations.

Progress Towards FY19 Action Items

In FY19, staff have taken a number of actions to advance the key findings listed above:

[20] See the full report at www.cambridgema.gov/low-carbon

- District energy
    - To set the regulatory groundwork for district energy systems, Cambridge, Boston, and Somerville applied for and were selected to receive a District Local Technical Assistance award to study state and local governance frameworks for water-based district energy systems. The study included an international literature review, expert interviews, and a half-day stakeholder workshop. The final report was completed in 2019 and concluded that while predictable regulation can help advance district energy system development, local and state government can also play essential roles by providing technical support and convene potential district energy stakeholders.
    - The high-level district energy system design schematic for the Alewife neighborhood completed previously was used as the basis for engaging landowners in the neighborhood to consider opportunities to pursue a shared district energy system, supported by additional technical and economic analysis. The City and stakeholders are considering the value of seeking partnership with a district energy developer to advance these activities.
- The Cambridge Community Electricity municipal aggregation program was redesigned in fall 2018 in order to directly support the development of new solar projects within Cambridge,[21] while installation of solar on residential and commercial buildings in Cambridge continued to be supported by existing City programs such as the Multi-Family Energy Efficiency Pilot[22] and Sunny Cambridge.[23]
- In spring 2019, CDD kicked off a Resilient and Renewable Thermal Analysis to develop a roadmap for resilient and equitable electrification of the Cambridge building stock. The analysis includes identification of typical building typologies and the technical and economic pathways to electrifying these buildings; assessment of the resilience and equitability implications of these pathways; and development of program strategy and policy recommendations. The Analysis is being informed by a steering committee of building owners and experts in the field, and will inform the City's ongoing strategy to achieve a transition to renewable building thermal systems.

Next Steps

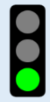
In FY20, staff are continuing to implement the regional collaboration, electrification and renewable energy supply, and district energy initiatives described above. The Resilient and Renewable Thermal Analysis will be completed in early 2020 and lead to additional policy and program recommendations. Staff are also continuing to pursue options for 100% renewable municipal electricity supply which can inform strategies to procure additional reneable energy for the community as a whole.

[21] See https://masspowerchoice.com/cambridge for more details
[22] http://cambridgeenergyalliance.org/current-efficiency-promotions
[23] http://www.sunnycambridge.org

Action 3.2: Rooftop Solar Ready Requirement

Introduction

The Rooftop Solar Requirement is intended to help meet the Net Zero goal by encouraging additional onsite renewable energy generation, with a focus on solar. The Action should begin with the exploration of a requirement that all roofs on new construction projects must be solar ready. "Solar ready" means that buildings are designed to accommodate the future installation of roof-mounted solar panels including either photovoltaic or solar thermal. In the future, the City will consider options to require onsite solar installations for new buildings and major roof replacements.



Solar installation requirement technical analysis completed

Accomodating solar on different building types

Develop policy proposals for City Council consideration **Legislative Action:** Pursue recommended solar installation requirements in FY20

FY19 Action Items

Study the feasibility of a potential rooftop solar installation requirement.

Progress Towards FY19 Action Items

In spring 2019, as an extension of the Zero Cities project, CDD worked with consultants to conduct an analysis of technical options for a solar installation requirement. The analysis included review of policy precedents in other jurisdictions and building code proposals, solar cost data review, and a comparison of the installation impact of three sample policy pathways. Stakeholders provided feedback on the analysis results during a meeting in June 2019, and reached consensus that the amount of solar required to be installed should be based on meeting a certain percentage of projected building energy demand and should include both on-site and off-site compliance pathways.

Next Steps

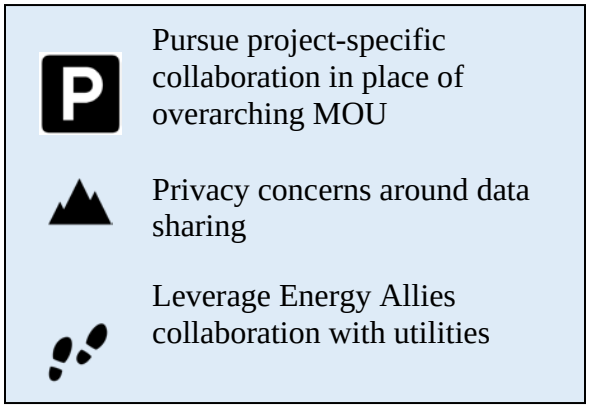
Staff are working in fall 2019 to develop potential policy proposals based on the technical analysis to be refined with further stakeholder input and then brought to City Council for consideration in 2020.

Legislative Action

The technical study and stakeholder feedback will lead to a recommended solar installation requirement policy which can be considered and advanced by City Council in early 2020, potentially in coordination with the Height and FAR bonus (see Action 2.2.2, above).

Action 3.3: Develop a Memorandum of Understanding with Local Utilities

Introduction



Cities can collaborate with utilities on projects of mutual interest to result in energy use and emissions reductions. City-utility data sharing is particularly essential to understanding where and how energy is used in the city and what opportunities exist to decrease and green this energy use. The declaration and definition of this collaboration can impact its effectiveness, so a formal agreement on how the City of Cambridge, Eversource and Veolia can work together on the following areas is recommended:

- Investigating and piloting smart grid projects
- Investing in incentive programs
- Data sharing
- Investigation, development and expansion of district energy systems
- Interconnection issues that limit deployment of solar PV and co-generation
- Using solar PV to strategically address distribution congestion
- Work to increase resiliency of the electric, gas, and steam systems

FY18 Action Items

Continue implementation of a memorandum of understanding (MOU) with Eversource and Veolia based on areas of mutual interest and have senior officials meet regularly to monitor and manage progress. Explore if there is benefit to including the state government and regional partners to this collaboration.

Progress Towards FY18 Action Items

Given ongoing challenges to secure an overaching MOU with local utilities, in FY18 staff determined that a more effective approach is to collaborate with the utilities on a project-by-project basis. For example, the Cambridge Energy Alliance continued to work closely with Eversource on implementation of the Multi-Family Pilot Program (see Action 1.1.1), despite some barriers around privacy which limits data sharing. Both Eversource and Veolia participated in the Low Carbon Energy Supply Strategy (LCESS) Advisory Committee along with Eversource (see Action 3.1) and through this forum participated in regular conversations about the future of energy planning in Cambridge.

Next Steps

New in FY19 is Cambridge's participation in the Energy Allies exchange program which aims to foster collaboration between government and civil society organizations such as utilities in the

clean energy transition through a series of international peer-learning workshops.[24] Cambridge chose Eversource as one of its partners in this exchange program, and through the workshop process the City and utility are identifying areas of targeted collaboration. Potential focus areas would align with the newly adopted state 3-year energy efficiency plan,[25] including strategic electrification. Cambridge and Eversource will meet to flesh out collaborative actions and report back to the Energy Allies organizers on their progress.

Eversource is also an active partner in the design of comprehensive retrofit program pathways for BEUDO buildings (see Action 1.1.2, above).

[24] http://www.gmfus.org/energy-allies-transatlantic-multi-stakeholder-dialogues-local-energy-transition
[25] http://ma-eeac.org/wordpress/wp-content/uploads/Exh.-1-Final-Plan-10-31-18-With-Appendices-no-bulk.pdf

Action 4 – Local Carbon Fund

For Cambridge to become a net zero community, it will require an annual energy balance across the entirety of the city's building stock. Where it is not possible or is exceptionally challenging for individual projects to achieve net zero emissions through the combination of efficiency and renewable energy generation, an alternative approach is to introduce a locally managed carbon fund that provides an option to purchase carbon offsets on a voluntary basis. The money collected would go into a local carbon fund, the proceeds of which will support Cambridge-based greenhouse gas reduction initiatives and renewable or low-carbon energy projects. Ideally, a locally based carbon fund would be developed and operated independently or at arm's length of the City.

Action 4: Investigate Local Carbon Fund

Introduction

Virtual pilot complete but behind implementation schedule

Resource needs and institutional structure to establish Local Carbon Fund; utilization uncertainty

Use virtual pilot results to inform Local Carbon Fund design and begin establishment

A Local Carbon Fund would serve as a vehicle that is easy to use as an alternative method to achieve net zero emissions over the short and medium term. The preliminary analysis should explore issues such as the development of a methodology for determining validity of offset projects. The offsets need not be "gold level" certified, but the accreditation methodology should be robust. In contrast to traditional offset frameworks, which typically are limited to supporting large-scale projects, a local carbon fund should be structured such that it can support a range of Cambridge-based emission reduction projects regardless of the scale of the project.

FY19 Action Items

Build off of the Local Carbon Fund feasibility assessment with a virtual pilot to test out policy components and demand for carbon offsets. Prepare for potential FY20 implementation.

Progress Towards FY18 Action Items

Building off of the Local Carbon Fund feasibility assessment completed in FY18, in FY19 staff worked with consultants from the Cadmus Group to run a "virtual pilot" of the Local Carbon Fund concept with Cambridge building stakeholders. The virtual pilot entailed constructing a basic building energy/cost model in Excel to model potential pathways to achieve net zero emissions in Cambridge buildings. The model selected the combined use of energy efficiency, renewable energy, and carbon offsets that would minimize upfront and operational costs for building owners. Stakeholders provided feedback on the model construction and data from actual building projects to help test out the model and its conclusions in a hypothetical setting.

The goal of the model was to further investigate the utility of a Local Carbon Fund while gathering data to answer key questions about offset cost, purchase timing, and differentiation of

separate offset types. While modeling and data limitations precluded detailed conclusions for all of these questions, it remains clear based on the results and stakeholder feedback that a local carbon offset option can be an important pathway for net zero emissions standard compliance.

Next Steps

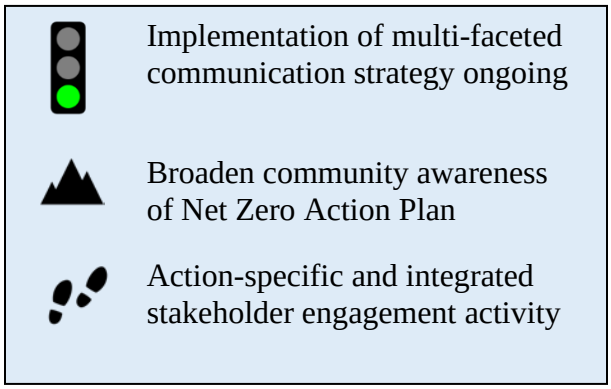
Based on the conclusions of the virtual pilot, in FY20 the City and stakeholders should continue to determine options for Local Carbon Fund establishment and implementation. The Fund could also serve as a pathway for achieving compliance with proposed BEUDO performance requirement compliance beginning in 2021 (see Action 1.1.2) and small residential net zero emissions compliance beginning in 2022 (see Action 2.1).

Action 5 – Engagement and Capacity Building

The strength of the Net Zero Action Plan is built on the comprehensive stakeholder engagement which led to its formation. Therefore, continued engagement of stakeholders throughout Cambridge and related interest groups is crucial to the successful implementation of the plan. The Task Force recommended that the City continue to invest staff time and resources into identifying tools, innovative ideas, training opportunities, grants and other resources to support residents and commercial property owners in working toward the aggressive goals of the Plan.

Action 5.1: Communication Strategy

Introduction



To maintain a high level of stakeholder engagement around the Net Zero Action Plan, the City should develop a comprehensive long-term communications strategy around the Cambridge Net Zero objective. The strategy will ensure that key stakeholders including City officials, the building industry, and Cambridge residents remain aware of the progress toward net zero and engaged with the initiative as needed or desired. The strategy will also enable the Net Zero Action Plan to serve as a touchpoint for broader energy and climate education in Cambridge, encouraging residents to take personal responsibility for helping Cambridge to meet its ambitious climate change mitigation and adaptation goals.

FY19 Action Items

Continue implementation of a comprehensive communications strategy around the Net Zero Action Plan objectives and components. Integrate stakeholder engagement and public communications into each Action as appropriate.

Progress Towards FY19 Action Items

Regular communication and outreach around the Net Zero Action Plan continued in FY19. Ongoing interest in net zero planning amoung communities across the greater Boston region led to multiple requests for presentations and consultation to support planning processes. Particular promising are collaborative efforts to enable net zero-related initiatives as the regional and state level, such as by advocating for a net zero state stretch energy code.[26]

[26] See joint comment letter at http://cambridgeenergyalliance.org/wp-content/uploads/Tri-city-letter-on-stretch-code-5-28-19.pdf

The Net Zero Newsletter was sent to over 800 stakeholders and community members in July, 2019.[27]

Extensive stakeholder engagement was undertaken to support the development of the BEUDO performance requirements (Action 1.1.2) and Custom Retrofit Program (Action 1.1.1). Staff have been collaborating with the CDD Communications Director and Eversource marketing team to prepare for the public launch of the Program, which will include press engagement, targeted stakeholder communications, and a launch event hosted by a stakeholder institution. The program will be supported by a new "resource hub" website to help BEUDO building owners and operators understand the resources and opportunities to help them lower energy use and GHG emissions.

Next Steps

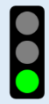
In FY20, staff will continue to implement outreach and communication for the Net Zero Action Plan. Action-specific stakeholder engagement will continue, as well as additional efforts to help stakeholders understand and provide feedback on overlap between the multiple net zero actions moving forward in parallel.

[27] See https://www.cambridgema.gov/CDD/Projects/Climate/~/media/DD19C76DAC6A42A58DB3C692212FDDDD.ashx

Action 5.2: Develop Ongoing Capacity to Manage Getting to Net Zero Project

Introduction

While the Cambridge Net Zero Action Plan was completed by the Getting to Net Zero Task Force in early 2015, in the years that follow the initiative will be led by the City of Cambridge along with partners and community stakeholders. As such, it is essential that the initiative be resourced accordingly so that its objectives will be met over the duration of the project.



On track with implementation of NZAP management and reporting structure

Ensure continued coordination among partner institutions

Complete annual report review and begin the Program Wide Review

FY19 Action Items

Continue monitoring roles and responsibilities for implementing the Cambridge Net Zero initiative over the long term. This includes assigning project leads for each of the actions, identifying research and implementation partners, and maintaining a reporting structure and a governance structure to ensure that the project remains on track and consistent. Prepare for 5-year Program Wide Review.

Progress Towards FY19 Action Items

In FY18, the Cambridge Climate Protection Action Committee (CPAC) continued to serve as the governing body responsible for ongoing oversight of the Plan. Staff provide NZAP updates at monthly CPAC meetings. CPAC also received and reviewed the FY18 annual report outlining progress towards actions for the previous year and results of these actions on clean energy measures and GHG emissions in Cambridge. As laid out in the Plan, Program Wide Reviews are scheduled for every five years to involve a wide range of stakeholders in a comprehensive review of progress along the Plan and necessary adjustments moving forward based on changes in technology, policy, and other influential factors. The first of these reviews is due to occur in FY20 and in FY19 staff began working with CPAC to draft the scope for the review process.

The Cambridge Net Zero Energy Planner continued to oversee daily implementation of the Plan, including scoping projects, hiring consultants, and managing projects throughout their timelines. Research and implementation partners were engaged as appropriate, for example the Cambridge Compact for a Sustainable Future Net Zero Laboratory working group to investigate laboratory-specific BEUDO requirements (Action 5.3).

Next Steps

This report was reviewed by CPAC, including any feedback on program management and communications. In FY20, the first comprehensive Program Wide Review will be undertaken to evaluate progress to date and make necessary adjustments to the Plan trajectory based on a stakeholder-driven process. Individual actions will be monitored and managed on an ongoing basis to provide opportunities for CPAC and outside stakeholder feedback and guidance, including periodic engagement of the Net Zero Task Force.

Action 5.3: Net Zero Lab Standards

Introduction

Commercial and academic laboratories are responsible for approximately one third of the current energy demand in Cambridge. Given this large impact, the challenges for laboratories to significantly reduce their energy use while meeting operational, health, and regulatory standards, and the lack of net zero lab examples, the Net Zero Action Plan includes a stakeholder-based process to research and develop new standards for lab operations that support lower energy use.

In progress through Compact for a Sustainable Future workplan

Diversity of laboratory uses and energy needs

Derive conclusions and recommendations from additional benchmarking

FY19 Action Items

Continue work by a coalition of industry stakeholders, research institutions and industrial hygienists to collaborate on new standards for reducing energy use that can be trialed without compromising safety or research integrity. Develop initial standards to be piloted in future years.

Progress Towards FY19 Action Items

The Cambridge Compact for a Sustainable Future[28] continued a productive working group to consider the feasibility of potential standards for reducing energy use in Cambridge laboratories, with support from City staff. The working group met regularly to discuss a variety of related topics and began a second data-collection exercise to more fully benchmark and derive conclusions from current laboratory energy use patterns.

Following the Additional BEUDO Requirement stakeholder workshops in summer 2018 (Action 1.1.2), it was determined that separate requirements should be established for laboratories given their unique operational constraints. Over the course of fall 2018, the laboratory working group collaborated to generate feedback regarding a compliance track for labs including laboratory definitions, tenant engagement, performance requirements, and monitoring and compliance.

Next Steps

In FY20, the laboratory working group will complete a second round of energy benchmarking study that will create a richer dataset to inform future performance standards and pilot program opportunities.

[28] https://cambridgecompact.org/

FISCAL YEAR 2019 QUANTITATIVE INDICATORS

While the bulk of this first-year report has focused on the progress toward each of the Net Zero Plan Actions, data from the 2012 Community GHG Inventory and the 2017[29] Building Energy Use Disclosure Ordinance reports serve as initial quantitative indicators of building energy use and emissions in Cambridge. These indicators serve as a helpful baseline for measuring progress towards Cambridge becoming a net zero community and evaluating the effect of the Net Zero Action Plan in future years.

Community Greenhouse Gas Inventory

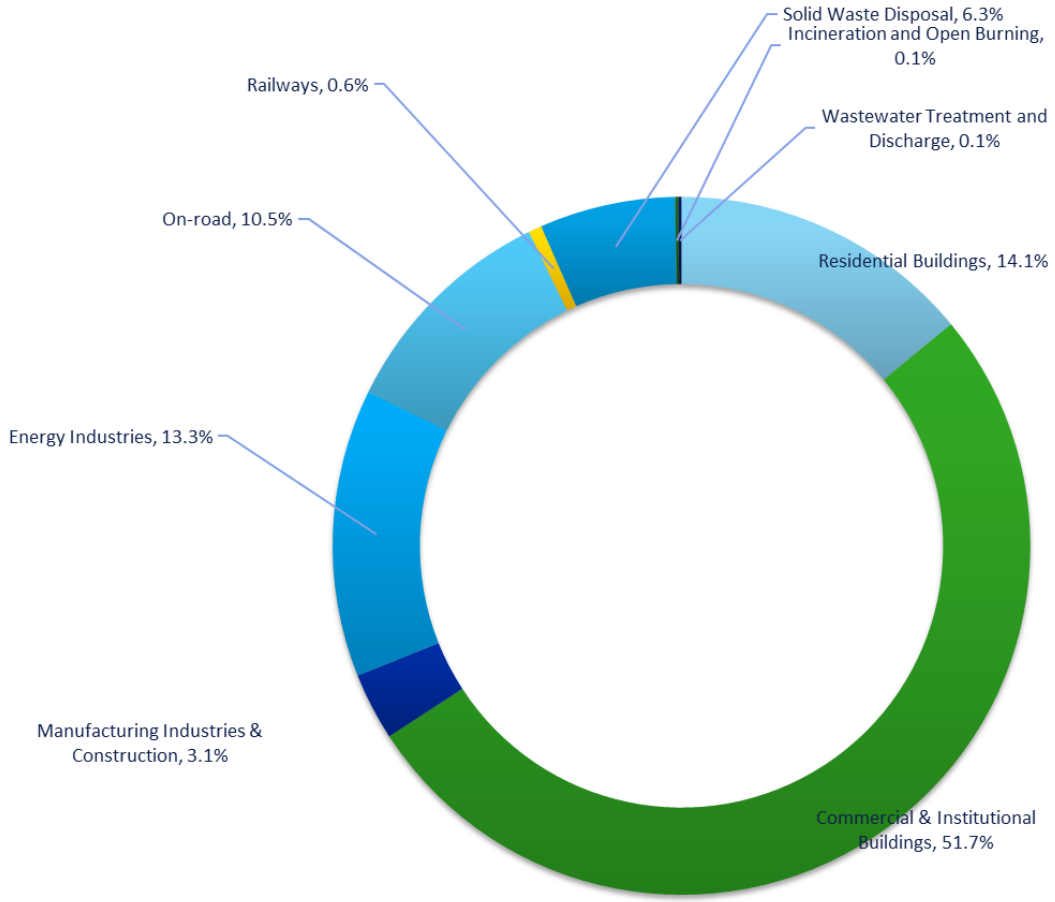
In FY17, the City of Cambridge completed a community-wide GHG inventory to meet its commitment as a participant in the Compact of Mayors[30] to mitigate climate change. A comprehensive GHG inventory helps the City better understand where GHG emissions are generated and then develop strategies for reducing these GHG emissions. The inventory was completed for 2012 because of data availability and alignment with the municipal inventory. External limits to data prevent annual updates to the Inventory, so this analysis has not changed from the FY16 Annual Report. The 2020 5-Year Program Wide Review will include the evaluation of the plan's impact to date and establish quantitative indicators moving forward. It will also provide an update to the community-wide GHG inventory for buildings.

As seen in the summary graph below, the majority of GHG emissions generated in Cambridge are related to building energy use, including residential buildings, commercial and institutional buildings, manufacturing industries and construction, and energy industries such as combined heat and power plants that provide energy to buidlings in Cambridge, for a total of 82%. This emphasizes the importance of the Net Zero Action Plan's goal of eliminating GHG emissions from building operations in Cambridge. Total stationary 2012 GHG emissions are 1,202,956 MT CO_2e.

[29] Due to data quality issues in the 2018 BEUDO reports, the data analysis was not available in time for the writing of this report. The full set of BEUDO data will be included in the Net Zero Action Plan 5-Year Review evaluation process.

[30] https://www.compactofmayors.org/

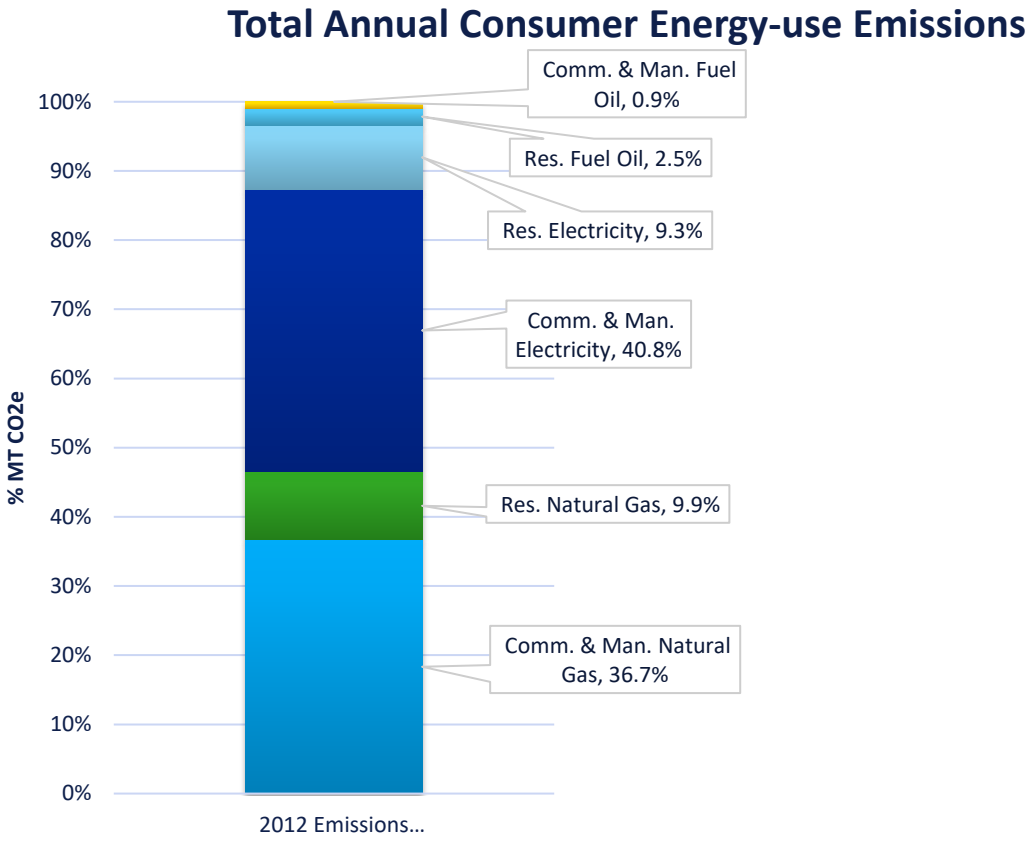
2012 Cambridge Community GHG Inventory



A deeper dive into the emissions data related to building operations shows that natural gas and electricity are each responsible for a little under than half of building energy emissions, and fuel oil for less than 1%. Natural gas consumed on-site currently has a lower emissions factor than electricity generated off-site,[31] but does not have the long-term potential to eliminate these GHG emissions. Therefore, transitioning to cleaner electricity sources, as is being explored in the Low Carbon Energy Supply Study (Action 3.1), is crucial both to reducing GHG emissions from the current electricity demand and providing a carbon-neutral energy supply option to replace natural gas in the long term.

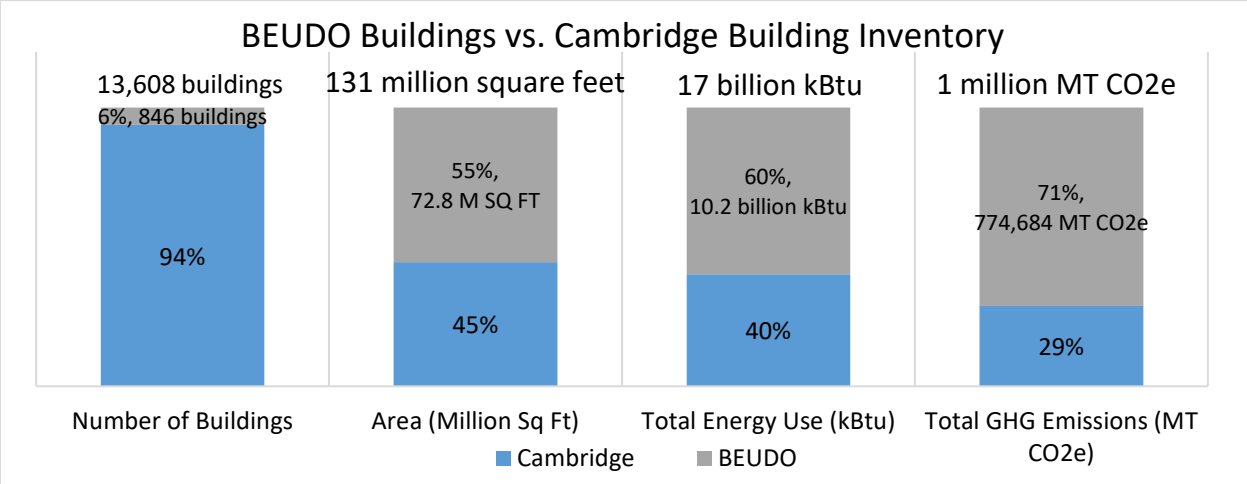
[31] There are concerns about GHG emissions from fugitive methane emissions due to leaks in the natural gas production process and transmission infrastructure, for example: http://www.nrel.gov/docs/fy16osti/62820.pdf

2012 Building Energy Emissions, by Sector and Fuel



Building Energy Use Disclosure Ordinance

The Cambridge Building Energy Use Disclosure Ordinance (BEUDO) requires parcels with non-residential buildings of a total of 25,000 square feet or greater as well as parcels with residential buildings totaling 50 or more units to annually report and disclose their energy and water use.[32] By requiring the largest buildings to report their energy use, Cambridge can gain important information about the majority of the energy consumption and GHG emissions in the City while streamlining the data collection process to the largest energy consumers, as illustrated by the graph below.[33]



Due to data quality issues in the 2018 BEUDO reports, the data analysis was not available in time for the writing of this report. The full set of BEUDO data will be included in the Net Zero Action Plan 5-Year Review evaluation process.

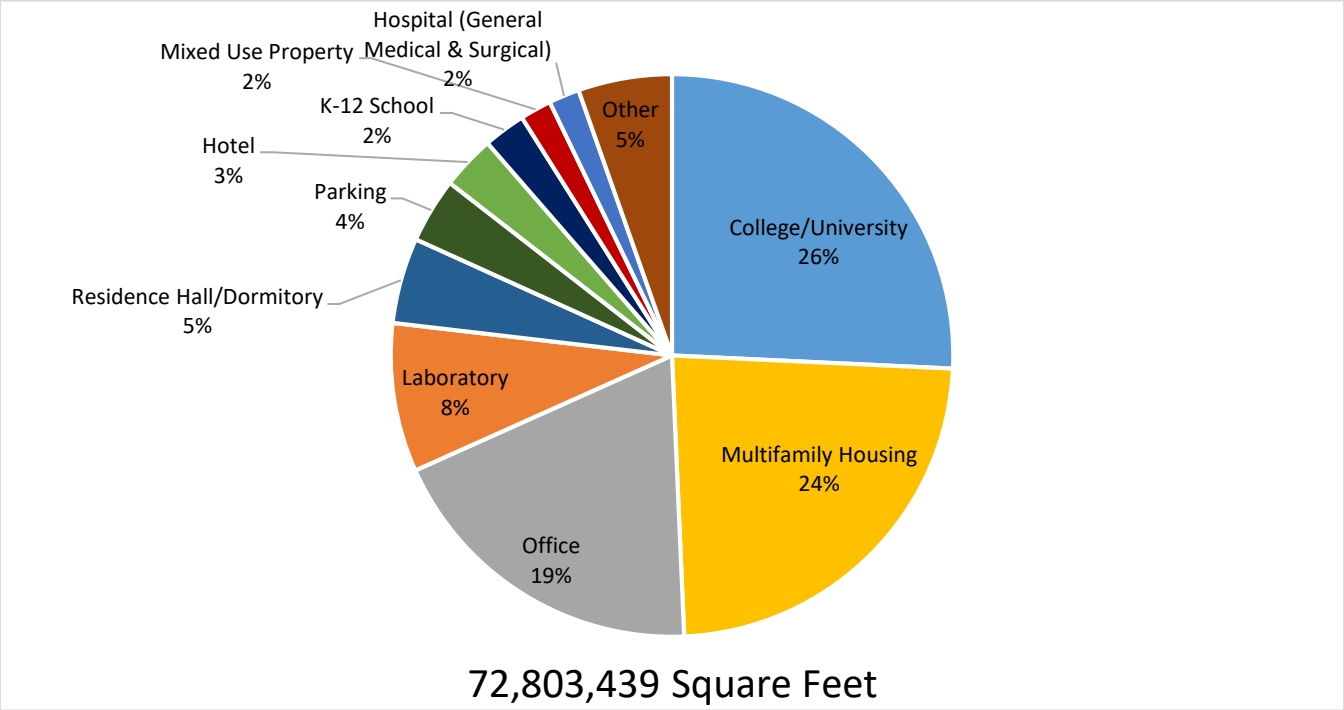
The graphs below summarize the data collected in the 2017 BEUDO reports.[34] Academic properties make up the largest proportion of BEUDO reporters by area, followed by multifamily housing and office buildings. However, energy use for laboratories, even though they consist of only 8% of the reported building area, is 22% of the total energy use, illustrating the much higher energy intensity of laboratories.

[32] 2015 reporting applied to parcels with 50,000 square feet or greater; Disclosure not required in 2015; for more details, see http://www.cambridgema.gov/CDD/zoninganddevelopment/sustainablebldgs/buildingenergydisclosureordinance.aspx

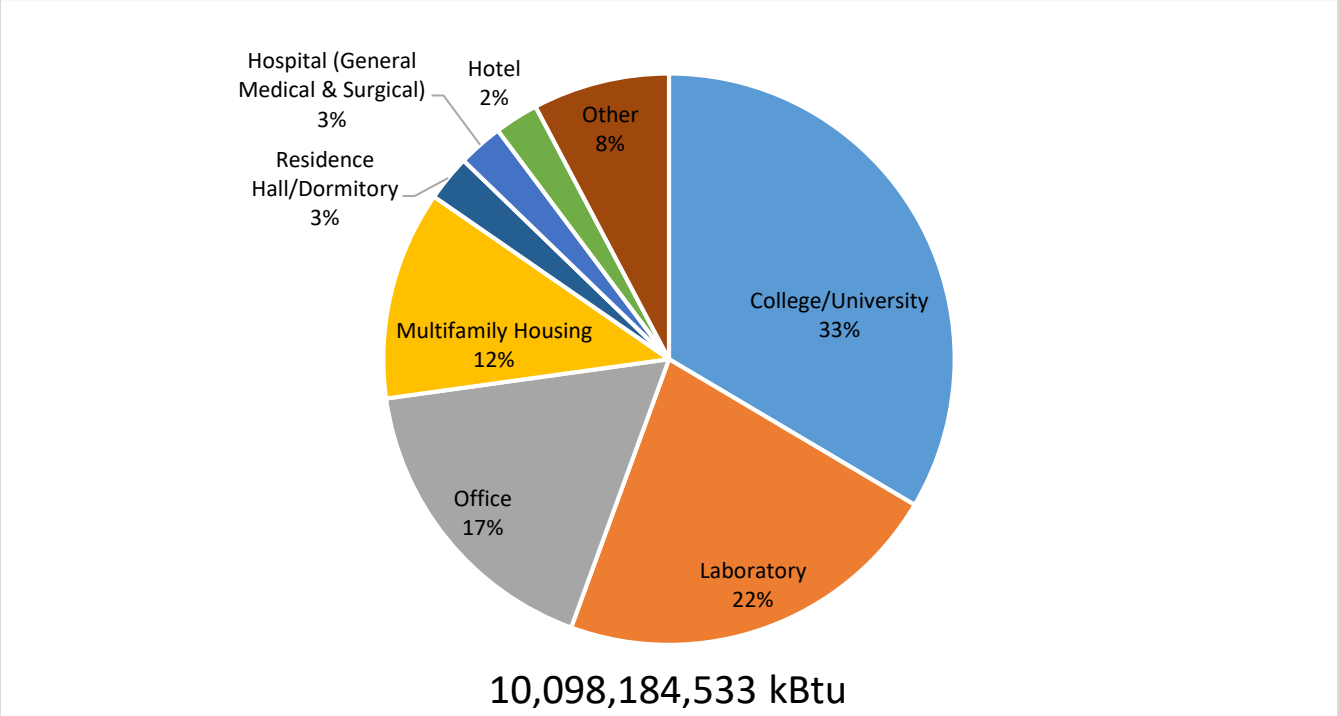
[33] Data sources: 2012 Cambridge GHG inventory, including co-generation serving Cambridge buildings; 2017 BEUDO reports

[34] Calendar year 2017 data is reported to the City in summer 2018

Total Area (Square Feet) by Property Type in 2017 BEUDO Analysis[35]



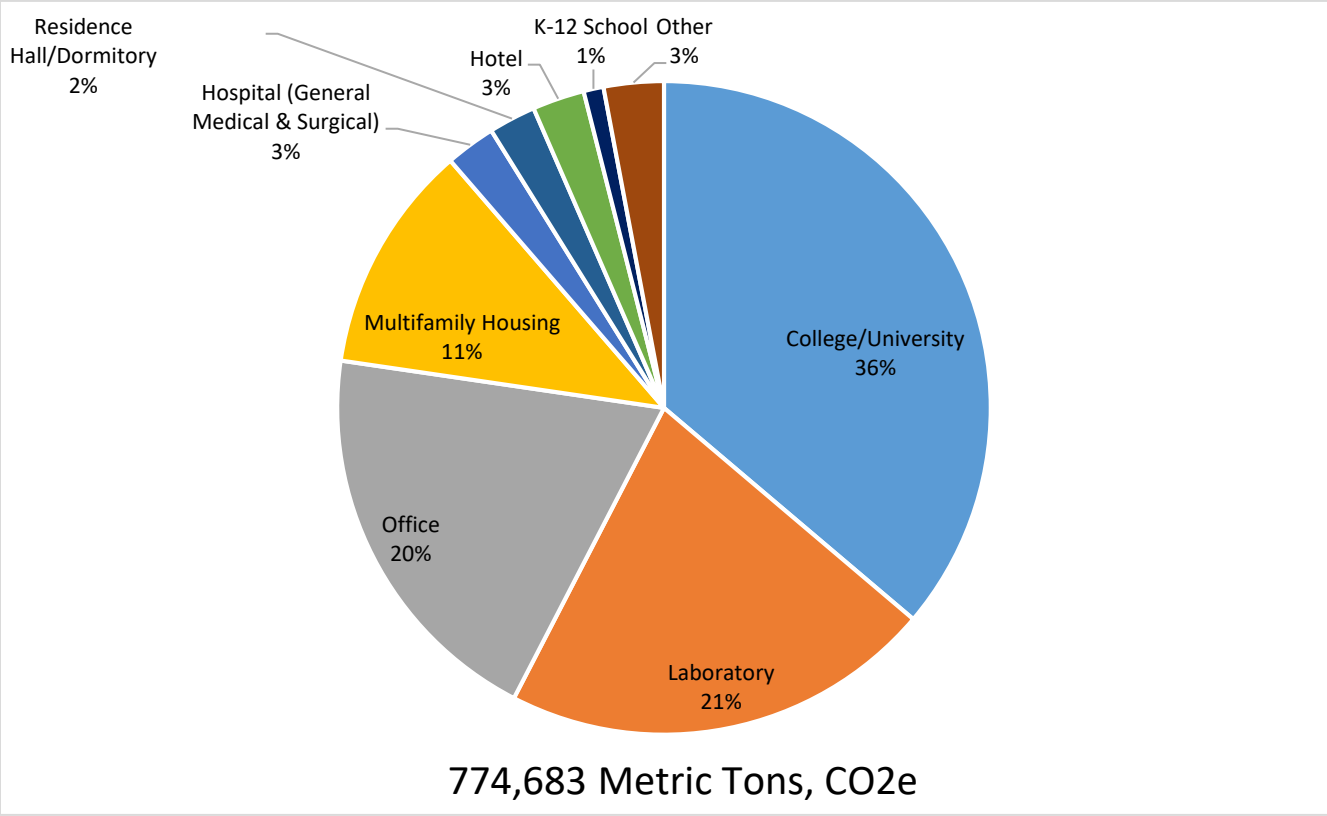
Total Site Energy Use (kBtu) by Property Type in 2017 BEUDO Analysis



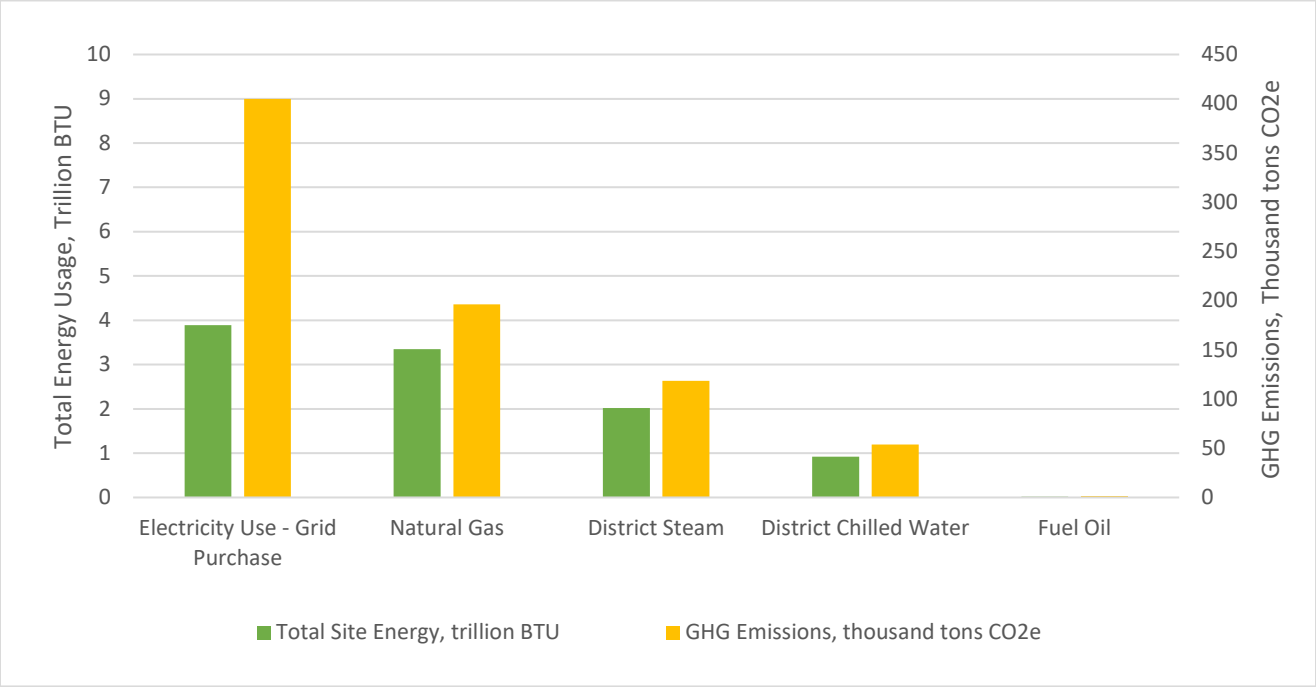
[35] "Residence Hall" or dormitories are not included in college/university to distinguish between residential building energy use profiles and those of academic, administrative, and research buildings on campuses.

Greenhouse gas emissions are tied not only to total energy usage, but also to the mix of fuel types used at each property type. The pie chart below shows the share of total emissions contributed by each property type. Emissions are a product of energy use and the GHG intensity of each fuel. Electricity currently has a higher GHG emissions factor than natural gas, as seen in the first bar graph. A comparison of fuel mix across property types is located in the second bar graph.

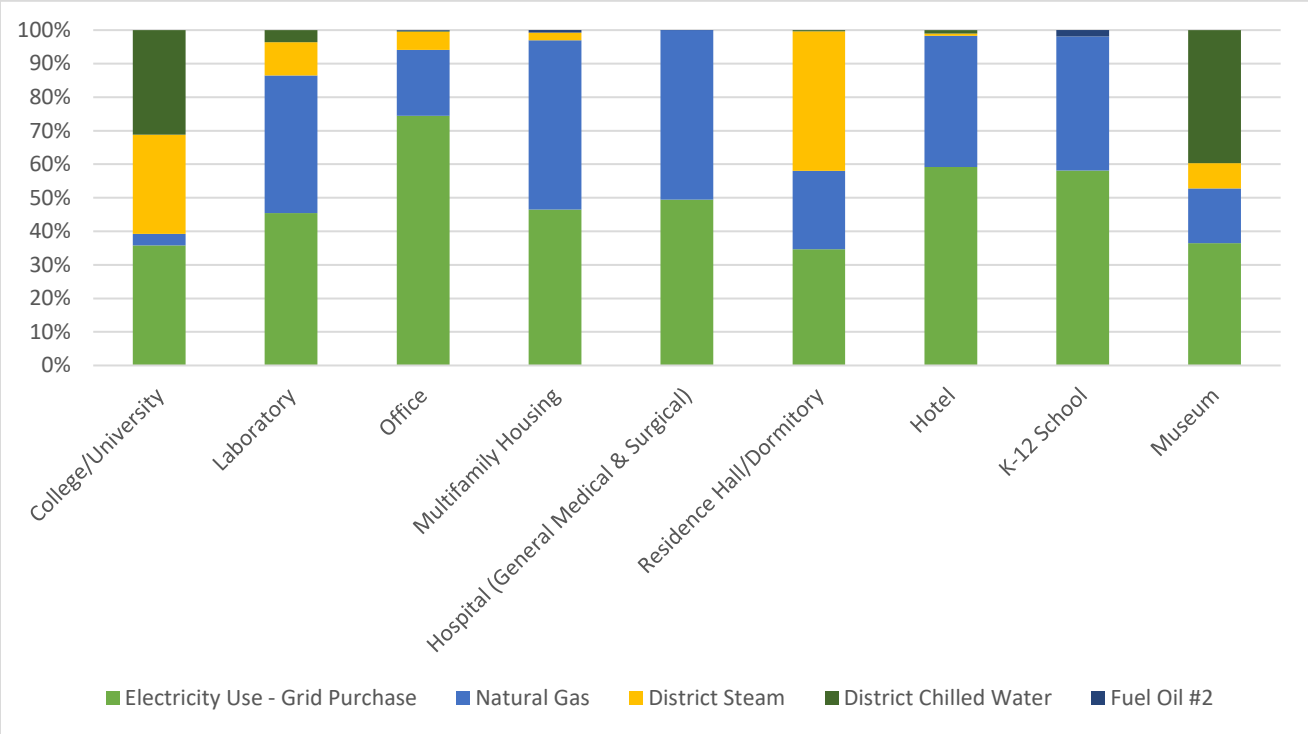
Total Greenhouse Gas Emissions (Thousand Metric Tons, CO2e) by Property Type in 2017 BEUDO Analysis



Total Energy Use and GHG Emissions by Fuel Type

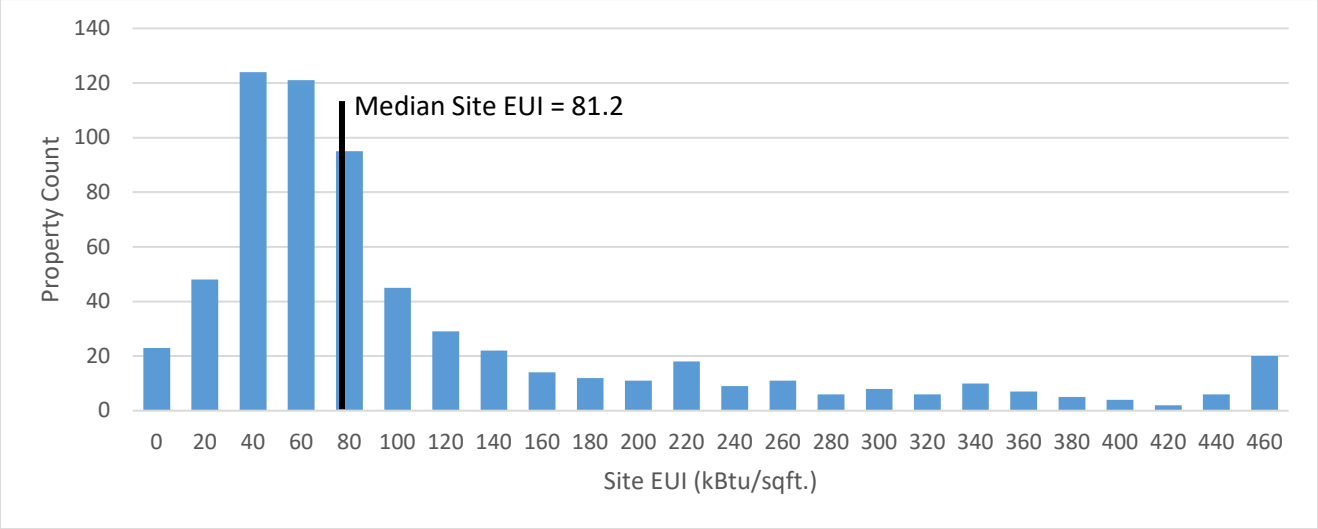


Fuel Mix by Property Type



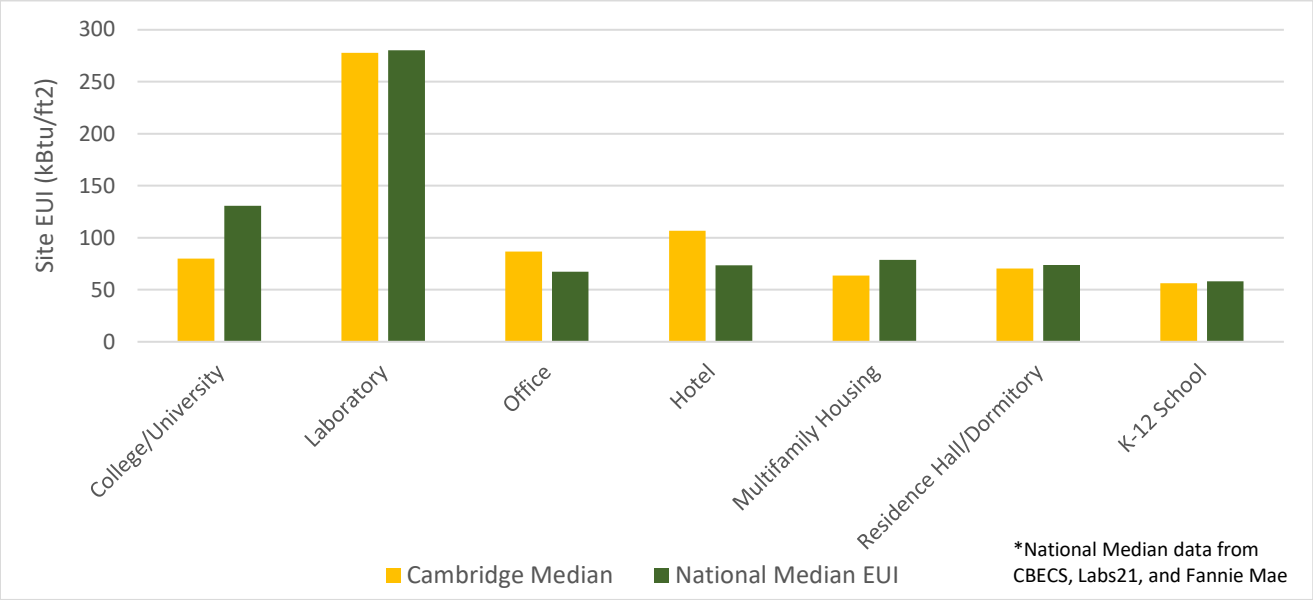
The energy use intensity, or EUI, of buildings is a helpful metric to normalize energy use across buildings of different sizes, much like an MPG sticker on a car. As illustrated in the graph below, most buildings reporting to BEUDO have an EUI below 100 kBtu/ft^2, with a handful of buildings consuming much more energy (i.e. energy dense buildings like laboratories).

Site EUI Distribution



In order to contextualize the results of the Cambridge analysis, median energy use intensities for various property types included in the Cambridge data are compared to the national median energy use. The national median EUI data primarily comes from the Commercial Building Energy Consumption Survey (CBECS). Differences in median EUI may be due to more intensive activities, different climate and weather patterns, or differences in energy performance. Overall, BEUDO reporter site EUIs are quite close to the national medians.

Cambridge Median Site EUI versus National Median by Property Type

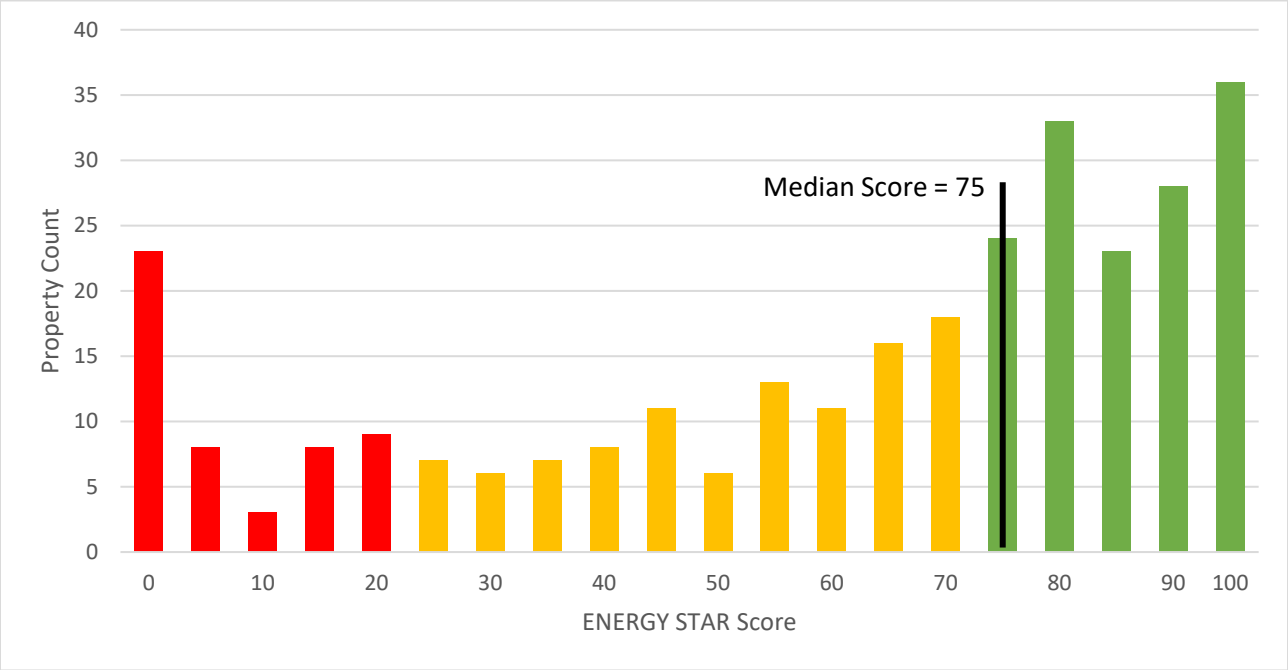


An additional comparison mechanism is the 1 – 100 ENERGY STAR score screening tool that helps property owners and managers assess how a building is performing. A score of 50 is the median; a score of 75 or higher means the buildings performs in the top quartile and may be eligible for ENERGY STAR certification.[36]

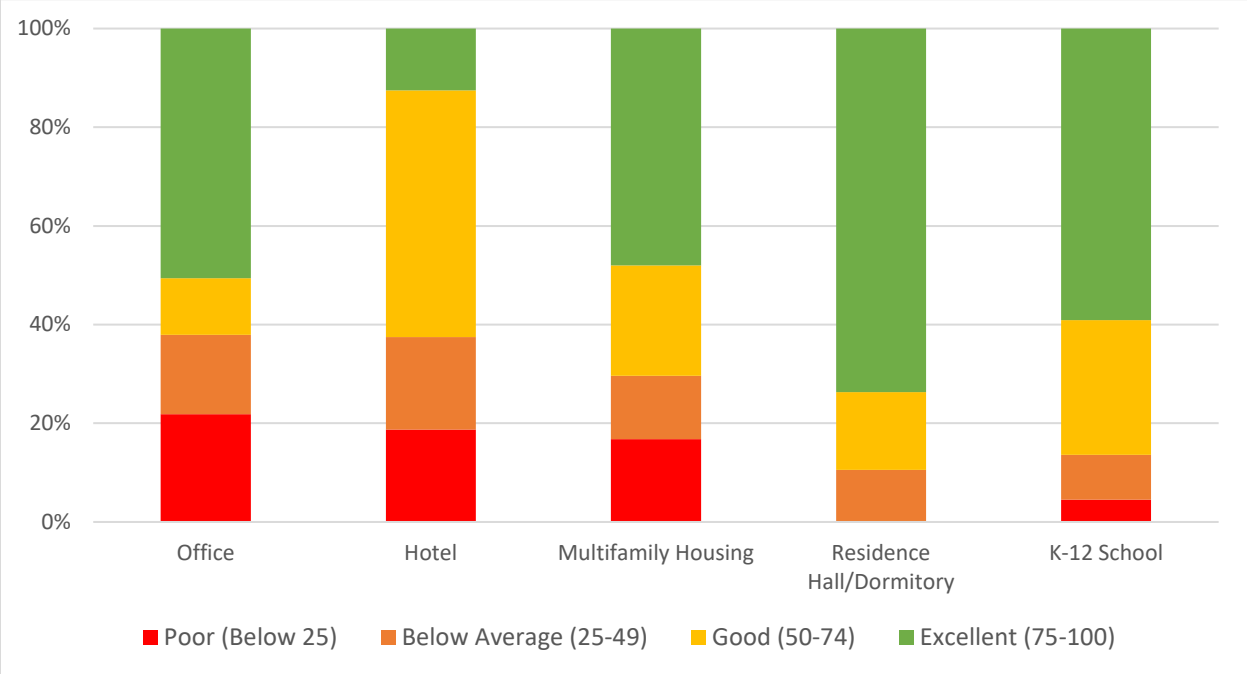
Out of the 668 reports included in the 2017 BEUDO data set, a subset of building categories are eligible for an ENERGY STAR score. The graph below shows the distribution of ENERGY STAR scores for these 305 properties. Across all eligible properties, Cambridge buildings tend to perform better than their peers, with an average score of 64 and a median score of 75. The graph also shows a significant amount of properties with an ENERGY STAR score of zero, which may be due to incomplete information or a mixed use (such as a laboratory in an office building). The second graph shows the ENERGY STAR score by property type.

[36] Note that Energy Star changed the baseline for Energy Start scores in 2018, which will lead to lower scores for most building types in their 2018 reports.

Distribution of Energy Star Scores



ENERGY STAR Score Distribution by Property Type



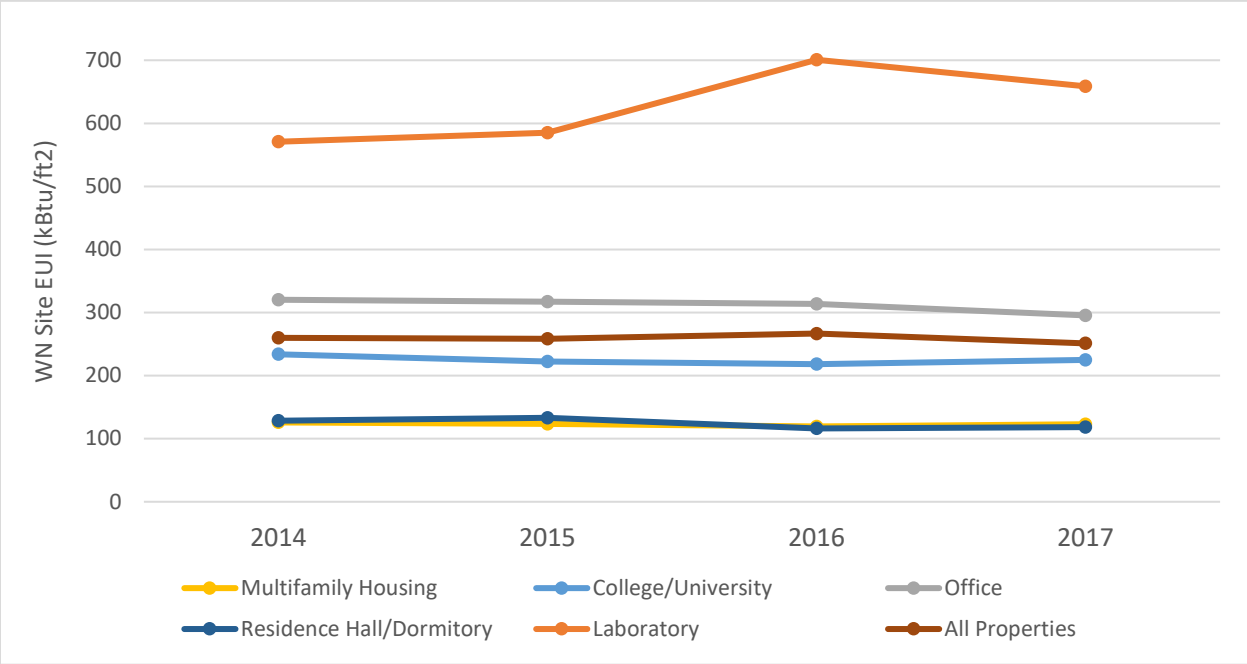
Based on the data in the BEUDO reports, many large building types in Cambridge are already on the way to efficient energy use, while others have a ways to go. Laboratories are clearly a key challenge based on their high EUI and significant proportion of total GHG emissions. It should

be noted that the unique uses of laboratories along with health and safety requirements has much to do with their high emissions, and not necessarily the construction of the buildings themselves. Hotels, while having a lower ENERGY STAR score, only contribute a small proportion of Cambridge's GHG emissions, so may be less of a priority. The higher GHG emission factor of electricity from the grid illustrates the important of decarbonizing the electricity sector in the short term, which will enable additional emissions reductions by fuel switching from natural gas to electricity in the medium to long term.

Annual BEUDO reports will serve as a key resource to tracking energy and GHG emission trends from large buildings in Cambridge and hopefully demonstrating the progress of the Net Zero Action Plan. Now that four years of BEUDO data have been reported, initial trends in the data over time can be observed in the graph below. Data from BEUDO properties reporting data in at least 3 years is included.[37] Most property types see a modest decrease in energy use intensity over the four years, with an average reduction of 1.1% per year.

The evaluation of additional requirements for BEUDO buildings (Action 1.1.2) will consider whether this rate of improvement is sufficient or if greater savings should be required, and how those saving might be achieved and measured.

Weather-Normalized Site EUI Over Time by Property Type



[37] If a property has fewer than 4 years of reported data, the fourth year value is interpolated by assuming a constant rate of change. Note that only 473 of the properties have 3 or more years of data, limiting the ability to accurately compare performance of all BEUDO properties over time.

APPENDIX 1: NET ZERO ACTION PLAN SCHEDULE

Cambridge Net Zero Action Plan - *April 29, 2015*

External Study | Internal Study | Program Pilot | Program Implementation | Policy Pilot | Policy Implementation | Net Zero/Positive Target | Regulation Implementation | Stakeholder-Based Program Wide Review

		2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Net Zero + Net Positive Targets						Net Zero Municipal		Net Zero Residential 1-3 Units			Net Zero Commercial Multi-Family Institutional					Net Zero Labs					Net + Municipal
Action 1 - Energy Efficiency in Existing Buildings																					
1.1.1 Custom Retrofit Program	Residential	Feasibility	Multi-Family Pilot		Review	Potential Multi-Family Program				Review	Potential Multi-Family Program										
	All					Feasibility	Custom Retrofit Pilot		Review		Custom Retrofit Program				Review	Custom Retrofit Program					
1.1.2 Additional BEUDO Requirements	Comm. + MF		Design		New Building Energy Use Disclosure Ordinance Req's					Review	Version 2 Potential T.O.S/R. Requirements				Review	Version 2 Potential T.O.S/R. Requirements					
1.1.3 Upgrades at Time of Renovation or Sale	All			Feasibility		Potential T.O.S/R. Requirements				Review											
1.1.4 O+M Plan Requirement	Comm. + MF (New Const.)			Design	Required O+M Plan				Review	Required O+M Plan				Review	Required O+M Plan				Review	Required O+M Plan	
Action 2 - Net Zero New Construction																					
2.2.1 Market Based Incentive Program	Residential	Feasibility	Pilot Residential		Review	Pot. Net0 Incentive Program		Review	Potential Net+ Incentive Program		Review	Potential Net+ Incentive Program				Review	Potential Net+ Incentive Program				
	Comm. + MF			Feasibility	Pilot Commercial			Review	Potential Net0 Incentive Program		Review	Potential Net+ Incentive Program				Review	Potential Net+ Incentive Program				
	Labs					Pilot Labs		Review	Potential Net0 Incentive Program		Review	Potential Net0 Incentive Program				Review	Potential Net+ Incentive Program				
2.2.2 Height + FAR Bonus		Feasibility *	Potential H+FAR Incentive Program					Review	Potential H+FAR Incentive Program		Review	Potential H+FAR Incentive Program				Review	Potential H+FAR Incentive Program				
2.3 Increase Green Building Requirements in Cambridge Zoning Ordinance		Design	Stage 1 - New LEED Requirements			Review	Stage 2 - New LEED Requirements				Review	Stage 3 - New LEED Requirements				Review	Stage 4 - Potential New Green Building Requirements				
2.4.1 Net Zero Requirement for New Construction of Municipal Buildings		Design	Net Zero Ready			Review	Net Zero Required				Review	Net Positive Required				Review	Net Positive Required				
2.4.2 Renewal of Municipal Buildings		Design Action Plan		Pilots		Stage 1 - Building Renewal Strategy					Stage 2 - Building Renewal Strategy										
2.5 Removal of Barriers to Increased Insulation		Design	New Policy			Review	New Policy														
Action 3 - Energy Supply																					
3.1 Low Carbon Energy Supply Strategy		E.S.S. Study **	Implement Energy Supply Strategy																		
3.2 Rooftop Solar Ready Requirement		Design	Solar Ready Requirement		Study	Potential Solar Requirement Version 1					Potential Solar Requirement Version 2										
3.3 Develop a Memorandum of Understanding with Local Utilities		Develop MOU	Utility Collaboration					Review		Potential 2nd Utility Collaboration											
Action 4 - Local Carbon Fund																					
4 Investigate Local Carbon Fund			Feasibility		Establish Potential Co2 Fund																
Action 5 - Engagement and Capacity Building																					
5.1 Communication Strategy		Design	Implement Communication Strategy																		
5.3 Net Zero Lab Standards		Feasibility ***	Dev. Standard	Pilot Standard 1		Implement Potential Standard				Review	Pilot Standard 2				Implement Potential Standard					

* To occur as part of Cambridge Master Plan process

** To happen in conjunction with Kendall Square study

*** Externally Led