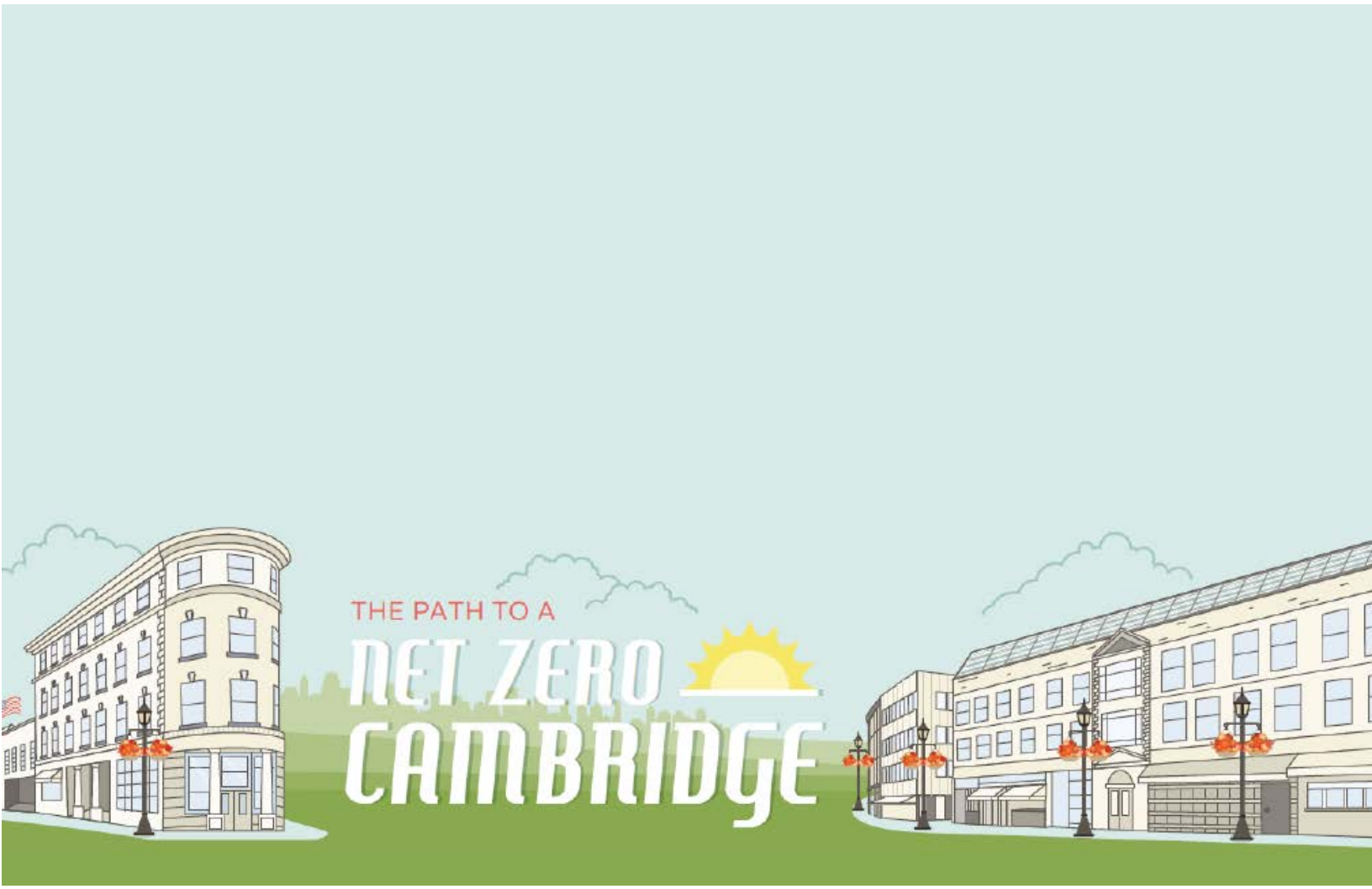
The Getting to Net Zero Framework

Prepared for the Cambridge Getting to Net Zero Task Force

April 29, 2015


THE PATH TO A
NET ZERO
CAMBRIDGE

Prepared by:

A Letter from the City Manager:

Why it is Cambridge's Imperative to Respond to Climate Change

Dear Reader,

I want to thank all the members of the Net Zero Task Force, the public and City staff as well as our local partners including institutions, businesses, and organizations who helped shape and support the recommendations in this Getting to Net Zero in Cambridge Report.

Climate change poses a growing set of risks and challenges to cities, and combatting it needs to start locally. We are fortunate in Cambridge to live and work in a city that has access to resources as well as a participatory, creative, and responsible community. Whether it is the intellectual capital and commitment of our universities, the innovation and research contributions from our industry and business leaders, the financial stability of our city government, or the social activism and drive of our residents, the city of Cambridge is at a clear advantage to address the complexities of climate change. Given these resources, there is an inherent understanding in our community that it is our responsibility to raise our level of effort and to demonstrate how to take effective action.

Over the course of the last 15 months, the Net Zero Task Force endeavored to respond to the need to reduce the carbon footprint of the built environment and map out an aggressive course to mitigate the effects of climate change. The result of this process is the development of a vetted 25-year action strategy that sets the foundation for ongoing governance and collaboration leading us to our climate goals. The significance of this plan is that it is comprehensive; it addresses both new and existing buildings and sets target dates for net zero new construction across all sectors. Furthermore, the recommendations are achievable, and at the same time bold in their vision.

This process was remarkable not only in that it can be a model for how to build consensus, but that it also produced a replicable framework that can be used by other communities. For these reasons, I anticipate that the work of this Task Force will continue to advance Cambridge's role as a regional and national leader in climate action.

I want to again thank all of those who have participated and assisted in this process – our resident activists who brought this issue to the forefront and our community partners—including local businesses, institutions and organizations who have long since been industry and institutional leaders in environmental sustainability. My sincerest gratitude to the Cambridge community and the collective responsiveness that ensued. Achieving a net zero Cambridge will only be possible with ongoing commitment, innovation, and collaboration. Let's continue to work together and point the way forward.

Sincerely,

Richard C. Rossi

City Manager

A Letter from the Members of the Compact for a Sustainable Future

Dear Cambridge Community,

The Cambridge City Government along with Cambridge-based universities, businesses and other organizations have long known the threat that climate change presents to our environmental, social, and economic sustainability. These groups have worked both individually and collectively on responses and shared solutions. These responses include decades of work to enhance the energy efficiency of buildings, to pursue renewable energy, and to reduce our collective carbon footprint. Cambridge's businesses and universities have a robust history of aggressively pursuing energy efficiency, and transitioning to the ambitious net zero goals Cambridge is considering.

These combined efforts have made Cambridge a global leader on addressing this issue. For instance, there are more LEED certified buildings in Cambridge than any other City in the United States including many Platinum-rated buildings. The following are a few highlights of Cambridge-based efforts across the spectrum of organizations that reside in the City:

* A non-profit, Homeowner's Rehab, has reduced its carbon footprint 21% for its portfolio of 73 buildings through retrofits and renewable energy systems. Deep energy retrofits have resulted in 67–70% reduction in natural gas consumption.

* A retail business, Whole Foods, has reduced energy use per square foot by 17.4% in the North Atlantic region through lighting retrofits and updated controls.

* A high-tech data center, The Massachusetts Green High Performance Computing Center (MGHPCC), a collaborative effort with several universities including MIT and Harvard and state, municipal and business partners - was awarded LEED Platinum - the highest rating level possible and a first for a university research data center.

* At Universities, Harvard, and MIT faculty and students are researching solutions and innovations to address global climate change and they have also worked to identify strategies for driving energy efficiency in city and campus buildings with applications beyond Cambridge. In addition to our research and teaching efforts, both institutions are committed to on-campus action:

* Harvard has reduced greenhouse gas emissions 21% from FY06–FY14 in response to its goal to reduce GHG emissions 30% by 2016, including growth (a 32% reduction without growth). All energy intensive space has been energy audited and over 1,400 energy conservation measures implemented. Green Building Standards, a Life Cycle Cost policy, and integration of energy planning into capital planning drive innovation and aggressive energy efficiency.

* MIT has undertaken aggressive energy efficiency programs across campus, and embraces high-performance building design. Efficiency Forward developed by MIT with NSTAR (now Eversource Energy) is a model program to drive energy efficiency adopted by many other large, energy intensive organizations.

* Commercial property owner Boston Properties pursues LEED Gold and Platinum certification for its properties, and its energy reduction initiatives have been recognized by the EPA, NAREIT, and the Global Real Estate Sustainability Benchmark for exemplary leadership.

* Research and development laboratory owner BioMed Realty has reduced energy use by employing a sub-metering strategy that informs tenants of their energy consumption trends, applying intelligent building automation controls that optimize mechanical heating and cooling demands, and by sharing best practices among its office and tenants within its 17 million sq. ft. portfolio.

* Life science commercial property owner Alexandria Real Estate Equities owns and operates one (1) Platinum and three (3) Gold certified buildings in Cambridge, including a recently completed building that draws power and steam from its own micro-grid. As a Platinum Member of the U.S. Green Building Council, has enacted an aggressive energy and carbon reduction program throughout its Cambridge portfolio of lab and office buildings and is committed to incorporating environmental best practices within its 18.5 million sq. ft. portfolio.

In addition to the efforts in sustainable design and operational efforts of building owners, Cambridge has a unique advantage in its ability to harness the research being conducted at its local universities. This research allows Cambridge to serve as a living lab for cutting edge efforts and it benefits from research projects such as solar mapping technology which can facilitate the installation of solar panels on appropriate buildings throughout the city, battery technology being adapted and tested in Cambridge, and numerous other examples.

The business and university community looks forward to working cooperatively to harness the community's capacities in research, innovation, entrepreneurship, social enterprise, and governance to meet the energy and climate goals being pursued by the City of Cambridge. The foundation of any effort to address the urgent challenges facing our community is collaboration and partnership. The significant and scalable solutions we need to transition to a cleaner energy future can and must be created through the innovations and ideas that we generate by working together.

About the Cambridge Compact for a Sustainable Future

MIT, Harvard University and the City of Cambridge developed a compact to work collaboratively to address issues related to sustainability and climate change on a local basis. The "Cambridge Compact for a Sustainable Future" lays out a framework for signatories to work in a more coordinated and robust fashion to tackle local sustainability challenges. The signatories also have recruited the participation of many major business partners, and this list of partners continues to grow. Open to eligible organizations and individuals, the Compact aims to leverage the different organizations' core skills and competencies in research, best practices and governance to generate new solutions in the areas of building energy efficiency, sustainable transportation, climate mitigation and adaptation, waste reduction, water management, renewable energy, urban natural resource management, and green tech incubation.

Contents

Credits

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Lisa Peterson, Deputy City Manager

City Council

David P. Maher, Mayor
Dennis A. Benzan, Vice Mayor
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Introduction

The Climate Imperative

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.

In November 2014, the United Nations issued its 5th Emission Gap report – an analysis of the gap in emissions reductions worldwide to limit global warming in this century to the two degrees Celsius increase deemed necessary to avoid the worst impacts of global climate change. The report concludes that to stay within the 2-degree limit, global carbon neutrality will need to be achieved sometime between 2055 and 2070.

Addressing the Built Environment: Cambridge's Key to Carbon Neutrality

Though our actions in Cambridge only have a small effect on global climate change, it is still our responsibility to take care of our share of the problem and to work to develop solutions that others can implement. Our buildings are both the problem and the solution for addressing climate change. In Cambridge, close to 80% of our greenhouse gas emissions results from building operations and, as a sign of our thriving economy, new buildings seem to be sprouting up every day. If the city can get to net zero in the building sector, we will have made major progress towards achieving the U.N.'s goal of carbon neutrality in our cities.

Key Municipal Initiatives

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 emissions. At that time, we set a goal to reduce emissions by 80% by 2050. 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. Below are some of the City's key initiatives:

Green Communities Act— the city has been officially designated as a "Green Community" by the Commonwealth of Massachusetts. As a designee, the City adopted the Stretch Energy Code and met the goal of reducing municipal energy consumption by 20% below an FY08 baseline in FY13 among other steps is on the path to meeting a goal of generating 5% of municipal electricity consumption by 2020 from on-site solar photovoltaic systems

Net Zero aspirations for recent school projects –attempts to reduce energy use through optimized building design and incorporating on-site renewable energy.

Adopted the Building Energy Use Disclosure Ordinance in 2014 – a foundational strategy that provides a means to provide building energy performance information to the marketplace and enhance local energy planning

Created the Cambridge Energy Alliance—a City-sponsored program aimed at helping Cambridge residents and businesses identify and arrange financing for energy efficiency improvements is currently conducting a climate change vulnerability assessment, which will form the technical foundation for a climate change preparedness plan. The key focus of the plan is making buildings more resilient to storm damage and extreme heat

Collaborations with Our Community Partners

In addition, the City has worked extensively with key community partners including our local institutions, businesses, and organizations to harness the community capabilities in research, innovation, entrepreneurship, social enterprise and governance. The following are two of these driving forces:

> **Compact for a Sustainable Future:** In what is considered a first agreement of its time, the City along with Harvard University and MIT signed the Compact for a Sustainable Future, the aim of which is to work collaboratively to address issues related to sustainability and climate change on a local basis. The signatories also have recruited the participation of many major business partners, and this list of partners continues to grow.
>
> **Kendall Square EcoDistrict:** A stakeholder-driven process including representatives from local businesses, property owners, the City, MIT, the Kendall Square Association, and the Cambridge Redevelopment Authority collaborating to set goals for and implement projects to improve Kendall Square's sustainability

Together these initiatives are the foundational tools, policies, and organizations that are utilized to advance our goals towards aggressively reducing energy consumption and promoting the expansion of renewable energy opportunities in Cambridge.

The Impetus for the Net Zero Task Force

2013 marked a time of significant construction activity in the city of Cambridge. There was growing concern in the community that any new development would make the goal of reducing greenhouse gas emissions harder, unless new developments were built to be net zero greenhouse gas emissions. Out of this concern, a group of Cambridge residents filed a zoning petition (the Connolly Petition) requiring that all new buildings over 25,000 square feet be net zero or annual offsets would be required.

The petition was met with considerable apprehension. The main objections were that the types of buildings constructed in Cambridge cannot physically achieve a net zero performance on site and that the requirements would drastically increase development costs, and thereby drive business out of Cambridge and stifle the local economy. While the Connolly petition was met with concern, it was the catalyst in bringing the issue of greenhouse gas emissions from buildings to the forefront.

In response, 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. To ensure a collaborative process, the City appointed representatives across sectors to study the technical aspects in greater detail and develop comprehensive, actionable, long and short term recommendations.

Channeling Community Ambition & Leveraging Community Assets

From the start, the Net Zero Task Force aimed to channel the community ambition while at the same time leverage the community's resources to deliver a strategy that balances responsibility across sectors. The group agreed that bold strategies were needed, and that current best practices would not be enough. 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. The following document is an overview of this effort.

Executive Summary

For the purpose of this document, the term '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).

The Task Force produced high level recommendations that are summarized under five key areas to get to net zero. The impacts of the recommended actions were modeled at the community level and are projected to achieve a 70% reduction in annual emissions from the Cambridge building stock over a 25-year time horizon. The recommendations are summarized below.

1. Energy Efficiency in Existing Buildings
    - 1.1.1 Custom Retrofit Program
    - 1.1.2 Additional BEUDO Requirements
    - 1.1.3 Upgrades at Time of Renovation or Sale
    - 1.1.4 Operations and Maintenance Plan Requirement for New Construction
2. Net Zero New Construction
    - 2.1 Create Net Zero Targets for New Construction
    - 2.2 Net Zero Incentives
        - 2.2.1 Market-based Incentive Programs
        - 2.2.2 Height + FAR Bonus
    - 2.3 Increase Green Building Requirements in the Cambridge Zoning Ordinance
    - 2.4 Net Zero Requirement for New Construction + Deep Retrofits of Municipal Buildings
        - 2.4.1 Net Zero Requirement for New Construction
        - 2.4.2 Deep Retrofits of Municipal Buildings
    - 2.5 Removal of Barriers to Increased Insulation
3. Energy Supply
    - 3.1 Low Carbon Energy Supply Strategy
    - 3.2 Rooftop Solar Ready Requirement
    - 3.3 Develop a Memorandum of Understanding with Local Utilities
4. Local Carbon Fund
    - Investigate Local Carbon Fund
5. Engagement & Capacity Building
    - 5.1 Communication Strategy
    - 5.2 Develop Ongoing Capacity to Manage Getting to Net Zero Project
    - 5.3 Net Zero Lab Standards and Maintenance Plan Requirement for New Construction

Specific Requests from Council

- Endorse the recommended set of actions
- Endorse the recommended process that engages stakeholders over time

The set of recommendations is intended to form a framework by which deep emissions reductions can be achieved. The framework is designed to strike a balance between articulation of a clear long term direction and the setting of targets while also maintaining the flexibility to manage the project in such a way that it can adapt to the evolving market, changes in energy prices and advances in technology. To achieve this, targets are set to provide direction for the project and a transparent governance structure is proposed, providing oversight so that the plan can be reviewed and renewed periodically based on up to date financial analysis and technical feasibility. Ongoing engagement of key stakeholders will be required throughout the duration of the initiative as will detailed analysis of each of the proposed strategies.

This set of recommendations, developed by the Task Force and working groups, was reviewed by local stakeholders from the Chamber of Commerce, the Cambridge Compact for a Sustainable Future, the Climate Protection Action Committee and Massachusetts Biotech Council (MassBio) as well as the general public. The recommendations were refined based on the feedback of these groups and an iterative process with the Task Force including public comment over the course of a year. The recommendations are comprehensive and work together to address all building types in a manner that is balanced and will accelerate action.

The Task Force recognizes that charting a 25-year course of action intended to transform the local built environment will not be a one-time exercise and recommends that the action plan be reviewed every five years to ensure it remains an effective plan and reflects both the evolving state of technology and the Cambridge economy. Finally the majority of recommendations require further study and stakeholder input at the design phase and many require council action.

Introduction

Background

In October 2013 a group of residents brought a petition to Cambridge City Council requesting an amendment to the Zoning Ordinance that would require all new construction in Cambridge to achieve net zero annual greenhouse gas emissions. With signatures from over 500 Cambridge residents, the "Connolly Petition," proposed a focus on energy efficient design and renewable energy production and, if necessary regional renewable energy credits (RECs).

City Council and the Planning Board supported the net zero objective, but noted that the proposed requirements for new construction could significantly impact the real estate development and overall economy of Cambridge. To address these concerns, City Council called for the creation of a "Getting to Net Zero Task Force," with the mandate to define a measured and strategic path to net zero. Task Force members included residents, community advocates, subject matter experts, business and property owners, developers, and two major universities1. The Task Force was to investigate and determine a pathway for Cambridge to become a "net zero community" addressing both new and existing buildings and developing recommendations for how to achieve this objective.

[1] See "Credits" on page 6 for list of Task Force members.

Purpose of report

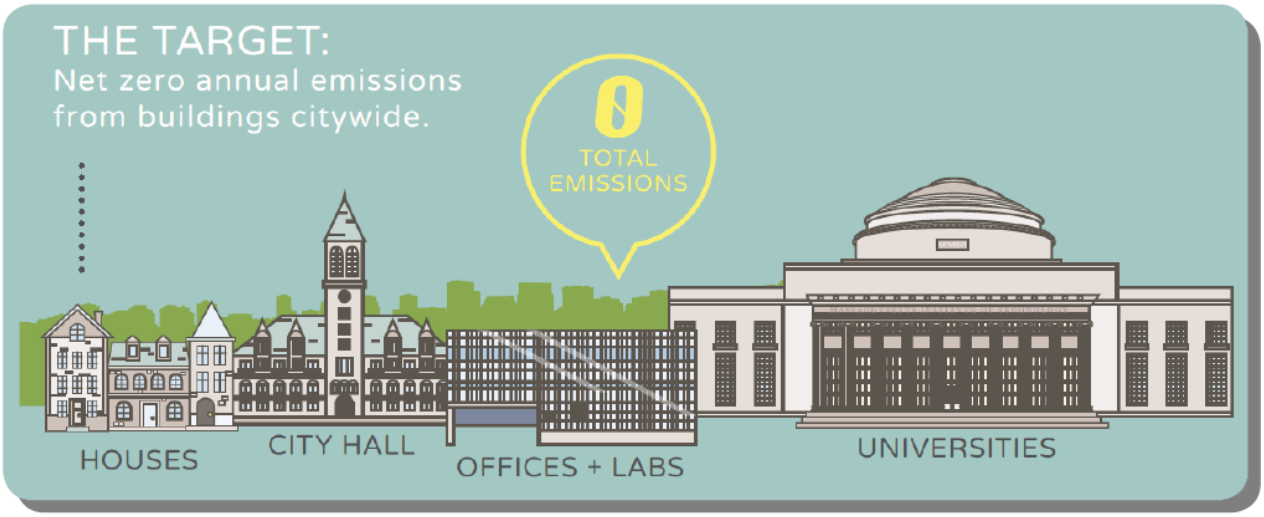
The purpose of this report is threefold:

- It summarizes the process undertaken beginning January 2014 to develop recommendations, primarily driven by the Getting to Net Zero Task Force (the Task Force), the associated working groups, and the Community Development Department (CDD).
- It comprises high-level ideas and recommendations and an initial action plan for how to achieve the net zero objective. This includes a pathway to net zero emissions in new construction and strategies to achieve significant community scale emissions reductions for both new and existing buildings.
- It recommends an approach to implementation and ongoing governance of the plan over its projected 25-year scope.

1 Defining Net Zero

The Task Force defines net zero with respect to the city as a whole as:
A community of buildings for which, on an annual basis, all greenhouse gas emissions produced through 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).

The target includes Scope 1 and Scope 2 greenhouse gas (GHG) emissions sources as defined by the Greenhouse Gas Protocol.[2] This protocol calculates emissions related to all ongoing operations of a facility, including on-site combustion and purchased energy. The net zero target does not include embodied emissions generated from the manufacture of building materials, building construction activities, occupant transportation or waste.



[2] http://www.ghgprotocol.org

Getting to Net Zero

Targets

The Getting to Net Zero Action Plan includes a variety of strategies to achieve a net zero community:

- Highly energy efficient buildings (new + existing)
- The use of onsite renewables
- The use of offsite renewables
- The use of offsets and potentially renewable energy credits (RECs)[3] (as a temporary measure to achieve net zero).

To develop a strategy to meet the net zero objective as defined above, the Task Force developed policy targets for new construction and for existing buildings. A brief explanation for this approach is as follows:

- With new construction, developers and designers can design projects to meet energy efficiency and renewable energy targets. The City of Cambridge can use tools such as the Zoning Ordinance to require incremental improvements in energy efficiency in new buildings.
- Existing buildings vary in terms of their energy performance, and require a variety of strategies to significantly reduce greenhouse gas emissions from their operations. As such, the approach to improving efficiency in existing buildings requires a broader variety of tools including both incentives and regulations.

The target of achieving community-wide net zero emissions in Cambridge is ambitious. Actions supporting the achievement of this goal need to be balanced with other City priorities including continued economic growth, housing affordability, improved climate resiliency, historic preservation, and planning and urban design objectives. To this end, the approach to achieving net zero does not solely rely on exemplary performance in any one sector. The set of targets for net zero new construction for each sector (see Table 1) addresses these complexities and competing priorities.

A series of proposed actions to be implemented between 2015–2040 are detailed in this report. The projected greenhouse gas (GHG) impacts of these actions were modeled based on proposed actions being implemented beginning in 2015 through to 2040, and are projected to reduce emissions by 70% by that time. This will position Cambridge to achieve its 2007 target of reducing community GHG emissions by 80% reduction by 2050[4]. Further, it will set a trajectory to achieve continued GHG reductions until net zero has been achieved, while accommodating growth of the community and local economy.

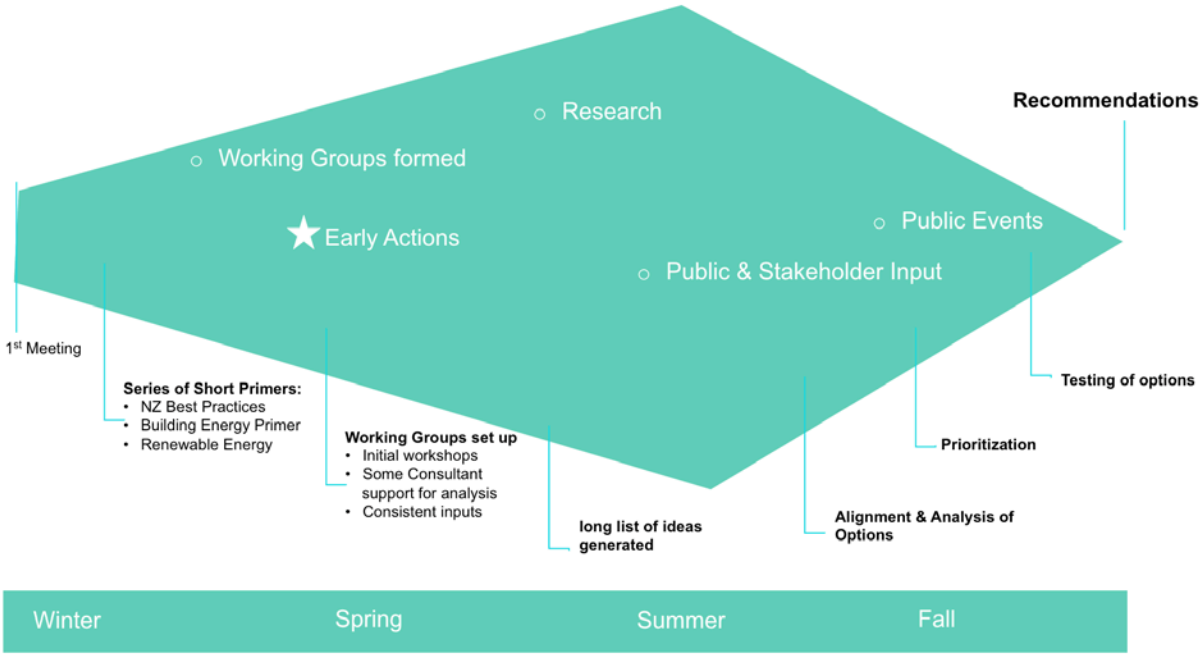
Approach to the Work

The Task Force held 13 meetings between January 2014 and April 2015 with the goal of developing and building consensus around a list of recommended actions by early 2015. Figure 1 illustrates the chronology of the work undertaken by the Task Force over the duration of its tenure.

[3] RECs can only be used to offset electricity.

[4] Cambridge adopted a target to reduce emission by 80% by 2050 in 2007. The net zero action plan modeled 70% reduction over 25 years based on 2014 emissions data.

Figure 1 - Task Force Work Plan



To support the development of a roadmap to net zero, the following research was provided to Task Force members:

- Policy Best Practices in Energy Efficiency: a summary of best practices from other jurisdictions that have introduced leading energy efficiency and green building programs (see Appendix A)
- Cambridge Building Energy Primer: an analysis of the building stock in Cambridge including energy sources and energy consumption by building type and sector (see Appendix B)
- Low Carbon Energy Primer: an overview of what renewable energy technologies and low carbon energy applications could be deployed in Cambridge in various contexts (see Appendix C).
- The Solar Potential in Cambridge: A report prepared by Task Force member Paul Lyons on physical and market potential of Solar Energy deployment in Cambridge. (see Appendix F)

Working Groups

Working groups were established early on in the process. The mandate of the working groups was to study action areas in more detail and develop a list of ideas that would support the target. Four working groups were created to focus on:

- Engagement and behavior change
- Incentives and financing tools
- Regulation and planning approaches
- Energy supply and offsets

The working groups met regularly between May and September 2014. Each produced a report [5] identifying a long list of actions to be explored or integrated into the final recommendations for the Task Force. In addition to the long list of actions that should be explored, the task force recommended that three actions be prioritized immediately for action they were:

- Adopt the Building Energy Use Disclosure Ordinance – **Complete**
- Provide comments to the State on requesting an update of the stretch code in support of Net Zero objectives – **Complete**
- Amend the LEED Requirements in the Zoning Ordinance – **Detailed design complete, and recommended approach is part of final Task Force recommendations**.

Modeling Impacts

A model was developed to measure the projected GHG reductions[6] associated with each of the proposed actions. The purpose of modeling emissions and potential reductions was to help the Task Force prioritize actions to be included in the recommendations, based on the relative impact of each. In designing the model, the following variables were taken into account:

- Growth in building square-footage by sector over time
- Transitions to natural gas as a replacement for coal
- Improvements in energy efficiency based on market adoption of new technology
- Continued growth in the supply of green power in accordance with the Massachusetts Renewable Portfolio Standard (RPS).

The following variables were identified as having potential impact on GHG emissions reduction potential. However, these variables were excluded from the model as the degree of their impact is not well understood at this time:

- Changing heating and cooling loads resulting from climate change
- The effect of advancements in renewable energy technology
- Continued price volatility in the energy sector.

For a more detailed methodology on how GHG emissions were calculated see Appendix H.

Communications and Engagement

To keep Cambridge stakeholders informed and engaged throughout the process of developing the recommendations, the Engagement and Behavior Change working group began by mapping all of the stakeholders that would potentially be impacted by this process.

The following engagement activities were initiated throughout 2014-2015:

- All working group and Task Force meetings were open to the public
- Meeting materials and minutes were posted on the Community Development Department's webpage

[5] See Appendix D to review Working Group Summaries

[6] The model was created as a resource to help guide the decisions of the Task Force. It is not intended to be used as a precise tracking or measurement tool.

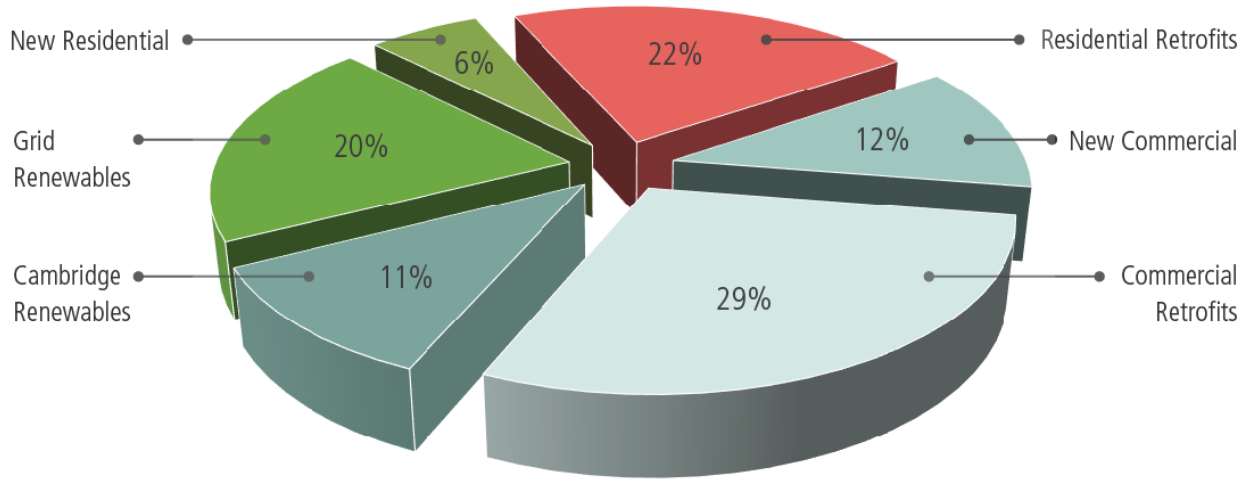
- A mid-year report was published and circulated publically
- A public forum featuring an external pane of net zero experts and offering the audience an opportunity to review and discuss preliminary Task Force recommendations.
- Meetings with key stakeholders such as:
  - Massachusetts Biotech Council
  - Cambridge Sustainability Compact Steering Committee
  - Climate Protection Action Committee
  - Cambridge Chamber of Commerce
  - Cambridge Historical Commission Staff
  - Cambridge Department of Public Works
- A final Public Forum where the Task Force presented the final recommendations and discussed their potential implementation with the public.

Net Zero Action Plan

Overview

The intent of this plan is to introduce an approach that is balanced not only among sectors but also among new buildings, existing buildings, and renewable energy supply. Figure 2 presents a breakdown of the proportion of GHG reductions projected from each sector.

Figure 2 – Projected Greenhouse Gas Reductions by Sector



Key Actions

The proposed actions to meet the net zero objective are categorized into five key areas:

1. **Energy Efficiency in Existing Buildings**
2. **Net Zero New Construction**
3. **Energy Supply (low carbon and renewable energy)**
4. **Local Carbon Fund**
5. **Engagement & Capacity Building (communication and resources)**

These five areas and their associated actions are summarized below and described in further detail in Appendix G of this report.

1. Energy Efficiency in Existing Buildings

The goal of this category is to ensure that existing buildings are operating optimally and, where necessary, are retrofitted to maximize efficiency. Building energy data collected by way of the Building Energy Use and Disclosure Ordinance (BEUDO) will be a key tool to catalyze these actions. In 2015, the City will be in possession of the first year of benchmarking data. This data will lay the groundwork to support a targeted approach to building improvements. For building types that will not be subject to the BEUDO, other tools and approaches such as mandatory upgrades at time of renovation or sale will be explored.

The recommendations[7] for existing buildings are as follows:

1.1.1 Custom Retrofit Program

Explore and develop retrofit incentive programs

Continue to work with the utilities to adapt current incentive programs to take a performance-based approach, where the incentive amount is determined by the relative GHG reductions associated with a given retrofit project. There are currently incentive programs offered by the utility that are well utilized but different approaches could yield better results. City staff are currently in discussions with Eversource regarding a retrofit pilot program for multi-family buildings that could potentially serve as a pilot for this performance-based approach.

1.1.2 Additional Building Energy Use Disclosure Ordinance Requirements (BEUDO)

Require owners of buildings covered under BEUDO to submit energy management plans and to undertake retro-commissioning where appropriate.

The intent of requiring management plans for energy in new construction and major renovations is similar to Cambridge's current practice of requiring transportation demand management plans. Compelling owners to consider how they and their tenants operate their buildings will save energy and set them on a trajectory of continuous savings. Institutional level plans should be accepted for companies or institutions with a clear institution-wide GHG emissions or energy reduction goal. The operation and maintenance (O+M) plans would be similar to retro-commissioning plans in that they would identify opportunities to optimize the operations of the building over time.

1.1.3 Upgrades at Time of Renovation or Sale

Explore a requirement for energy efficiency upgrades at time of renovation and/or sale

This action is to introduce a requirement for building energy upgrades at the time of permitting and/or sale. An initial step will be to undertake a review of how best to implement new retrofit requirements, including whether upgrades should be required at time of renovation or property sale, or both. The tradeoffs associated with each path are to be reviewed in detail and in consultation with industry during the program design phase. Energy efficiency retrofit requirements for buildings subject to BEUDO (i.e. greater than 25,000 square feet) will be

[7] For detailed recommendations, see Appendix G.

based on BEUDO data findings in order to target the least efficient buildings (as compared to their peers) for upgrades.

1.1.4 Operations and Maintenance Plan Requirement for New Construction

Require submission of operation and maintenance plans as a condition of permitting

As a condition of occupancy, developers will be required to submit an operations and maintenance plan for the building. The plan will follow a simple template and ensure that the building has a plan to ensure it is operated to its maximum level of energy efficiency. While the requirement would apply to new construction, its objective is to ensure future existing buildings are operated optimally.

2. Net Zero New Construction

The recommendations for new construction are as follows[8]:

2.1. Create Net Zero Targets for New Construction

Set targets for net zero new construction in Cambridge by building type/sector.

Table 1 includes a preliminary set of target dates for different building types to achieve net zero. These target dates are proposed as policy goals for both industry and Cambridge staff to work towards. It is recommended that regular meetings be held with stakeholders to evaluate the evolving state of technology and construction practices as they relate to targets dates identified below. Specifically, Cambridge staff will consult with industry and other key stakeholders at least two years in advance of proposing regulations requiring buildings to be net zero. The factors that will be reviewed as part of this assessment and consultation are as follows:

- The number of existing net zero buildings of that building type in Cambridge and Northeast
- Technical feasibility/industry capacity
- Access to renewable energy supply on-site or in the region
- Economics including a 'net present value' analysis
- Contribution to other goals such as resiliency

The variation in target years reflects the varying degree of complexity associated with achieving net zero in different building sectors and specifically recognizes the challenges faced by lab buildings in meeting these aggressive targets.

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

[8] For detailed recommendations, see Appendix G

2.2 Net Zero Incentives

Provide a compelling incentive package to encourage private developers to exceed energy efficiency requirements.

In order to ensure that the most effective incentives are being utilized, Harvard and MIT have offered to collaborate with the city of Cambridge on a study of the most effective incentive strategies for the Cambridge context. While this study will look at all available tools, the following incentives to catalyze transformation of the market to net zero construction were specifically recommended for further exploration by the task force:

- Market-based incentive program
- Floor area ratio (FAR) bonuses
- Height relaxation

It is recommended that a study be undertaken to assess the feasibility of a performance fee and rebate program. If it proves feasible, the next step would be to initiate a pilot program in the residential sector to test its practicality and effectiveness. Additionally, a wider review of other market-based solutions that help developers overcome first costs and encourage innovation in green building design and construction is also recommended.

FAR bonuses and height relaxation should be explored in the context of the Cambridge citywide planning process and within the full spectrum of other programs such as affordable housing that currently use these as tools.

2.3 Increase Green Building Requirements in Cambridge Zoning Ordinance

Increase minimum green building requirements on a regular basis starting in 2015

The Task Force recommends the incremental scaling up of green building requirements, benchmarked with real-world examples and cost benefit analysis, over time leading up to the specific net zero target dates identified for each building type. The green building requirements in the Cambridge Zoning Ordinance currently apply to buildings 25,000 square feet or larger. Requiring incremental improvements in advance of the net zero targets sets industry on a trajectory to realize deep energy efficiency savings and better equips them to achieve the referenced targets. For more specific information on how green building requirements are proposed to be amended see Appendix G.

2.4 Net Zero Requirement for New Construction + Energy Performance Improvements to Existing Municipal Buildings

Introduce bold targets for new construction and energy performance improvements for existing municipal buildings.

To demonstrate leadership, establish a policy that new construction of municipal buildings target net zero in the near term. This policy would also be applicable to gut renovations where a building is being completely renovated with new electrical, mechanical, interior, and envelope systems. For all other existing municipal buildings, the Task Force recommends introducing greenhouse gas reductions as a key component throughout the municipal improvement strategy and integrating it with other priorities, such as life safety, and accessibility.

2.5 Removal of Barriers to Increased Insulation

Resolve policy barriers to improving insulation of buildings.

Develop an approach to remove barriers in the Zoning Ordinance to enable the addition of exterior insulation and improve the efficiency in renovations to residential buildings. The approach will have to be sensitive to both historic preservation and fire and life safety.

3. Energy Supply

Achieving net zero and improving community resiliency will require a significant shift in the supply of energy to Cambridge buildings away from fossil fuel based sources and toward low- or zero-carbon distributed sources. This will include realizing a significant portion of the city's solar potential (both PV and thermal), taking advantage of opportunities to harvest waste heat from large commercial or industrial facilities, and expanding and "greening" the city's district energy capacity.

To meaningfully address energy supply the Task Force developed three recommendations:

3.1 Low Carbon Energy Supply Strategy

The objective of this strategy is to define how the City will support the broad implementation and development of renewable and low carbon energy in Cambridge. This includes identifying what role(s) Cambridge can play in generation, distribution, and storage.

Additionally, the City will review what role(s) it can play in the procurement of additional green power supply through lobbying the State to increase the Renewable Portfolio Standard (RPS)9, and by reviewing the potential for customer aggregation as a tool to further increase the supply of renewables to meet Cambridge municipal and residential needs, potentially in combination with non-profit or commercial energy users. The desired result is to achieve measurably more new renewable energy in Cambridge over the life of the strategy.

3.2 Rooftop Solar Ready Requirement

Develop "solar ready" requirements and explore renewable energy requirements.

Recognizing that during construction is the most economically efficient time to prepare a roof to support solar energy, the Task Force recommends that Cambridge design a solar ready ordinance that considers structural design, building and roof orientation and impact on landscape or vegetation objectives. The ordinance has to recognize that some roofs will be unsuitable for solar energy, due to overshadowing, orientation, roof top mechanical requirements etc. and should therefore be excused from the requirements.

Further the Task Force recommends that over the medium term, the City explore requiring that some portion of renewable energy be generated on site for new buildings. This is similar to what some local governments in the United Kingdom have enacted over the last decade.

[9] The Massachusetts Renewable Energy Portfolio Standard (RPS) is a statutory obligation that suppliers of electricity obtain a minimum percentage of their electricity from renewable sources. The regulation began in 2003 and started at 1% of total demand. It was legislated to grow by .5% per year until 2008, after which it has since grown by 1% per year.

3.3 Develop an Memorandum of Understanding with Local Utilities

This recommendation recognizes that the success of this initiative is greatly impacted by how well the City and stakeholders can work constructively with the utilities to be more efficient and switch to lower carbon forms of fuel and also address cost considerations.

4. Investigate Local Carbon Fund

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, a recommended alternative approach is to develop a locally managed carbon fund[10]. The carbon fund would be a voluntary mechanism available as an alternative path to achieving net zero at the building level.

A carbon fund would introduce the option, as an alternative to achieving net zero, to make a payment to offset a project's emissions. The fund could further be used by local institutions that have established sustainability goals that could be addressed through the purchase of offsets. 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.

The objective of the fund should be to create a vehicle that is easy to use as a method to achieve net zero emissions over the short and medium term. Administrative costs should be kept to a minimum to ensure the maximum proportion of the fund is invested directly into emission reduction project development. The offsets need not be "gold level" certified, but the accreditation methodology should be robust. For example, a program with defined parameters could qualify once but be used to offset emissions from several buildings. Further, 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.

5. Engagement and Capacity Building

The Task Force strongly recommends that a comprehensive long-term communications strategy around the Cambridge Net Zero objective be developed. 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.

To meaningfully address engagement and capacity building the Task Force has three recommendations:

[10] Note that the proposed carbon fund should not be confused with what is typically called a 'carbon tax,' which is a different tool both in structure and how the funds are used. The carbon fund will not interfere, nor will there be overlap with the proposed state level carbon tax (Massachusetts House Bill 2532), which proposes to charge customers $5 per ton for carbon-based fuel.

5.1 Develop a Communication Strategy.
5.2 Develop ongoing capacity to manage getting to net zero project.
5.3 Develop Net Zero Standards for Laboratories.

The strategy will examine how the City can leverage tools such as community based social marketing, citizen challenges, and recognition programs to promote action on net zero and make it common practice. There is already significant leadership being demonstrated by the building industry locally with regard to developing highly efficient commercial office and laboratory buildings. Harvard and MIT have also shown significant leadership on GHG emissions and energy reductions. Any successful communications strategy will have to build on and celebrate these successes.

The Task Force recommends that the City conduct a thorough policy analysis and stakeholder engagement review for all of the key regulatory ideas suggested in this report.

A working group should be convened to work on building energy efficiency operations within labs. The purpose of this group would be to work with lab tenants to explore ways in which research work can be optimized to be more energy efficient. The Cambridge research community is uniquely suited to take a leadership role on this issue and create ‘made in Cambridge’ solutions.

A. Ongoing Operational Requirements and City Investment

These goals and actions that are being proposed come at a time of great change in the green building sector: energy prices are increasing, renewable energy costs are decreasing, and there is great volatility in commodity prices globally. While there is a need to demonstrate bold leadership and set goals today, there is also a need for ongoing management of this initiative to ensure that the targets remain relevant and achievable for industry.

To this end, the Task Force has proposed that the whole suite of recommendations be reviewed every five years throughout implementation. These reviews will allow for the overall strategy to adjust based on changing economics, technology and stakeholder needs. The review process will be similar to the initial work of the Task Force in that it will be supported by staff and be informed by a similar group of stakeholders.

The Task Force recommends that the City continue to invest staff time and resources into identifying resources, tools, innovative ideas, training opportunities, grants and other resources to support residents and commercial property owners in working toward this aggressive goal.

Program Governance

As noted above, the net zero framework will require regular program wide reviews of the overall strategy every five years and specific stakeholder review and consultation for each of the actions as they are implemented. In order to ensure that the framework evolves in the desired manner, the Task Force recommends that the implementation of the framework adhere to the following principles:

- Supports long range healthy economic strategies as well as climate goals
- Uses market based and data driven analysis and decision making
- Commitment to identifying and testing the best available policies, practices, and technologies, and support an openness to new ideas when circumstances change
- Commitment to allowing the principle of offsets as long as it can be demonstrated that the offset produces actual GHG reductions whether in the form of an energy efficiency or renewable energy activity
- Commitment to measuring and monitoring impact over time that leads to course corrections where required
- Ensure consultation is comprehensive and engages affected stakeholders, the general public and subject matter experts
- Commitment to developing informative and replicable models that will be shared with others

The Task Force also recommends that Climate Protection Action Committee be charged with ensuring that an annual report is issued by the City, documenting what actions have been taken to implement the Net Zero Action Plan and the trends in greenhouse gas emissions from building operations.

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Measurement & Program Review

The ongoing management and reporting on the City's progress toward net zero will be become easier by way of the collection and analysis of BEUDO data. This effort will also be aided by a closer working relationship with the utilities and major institutions to help understand data for buildings that are currently not included in the BEUDO.

The data and accomplishments communicated in the proposed annual reporting on this project should be informed by the communications strategy. There was strong consensus on the Task Force that a concerted effort to make emissions more understandable to the general public and key stakeholders is vital to keeping the community engaged on this topic.

Key Partnerships

Cambridge staff will continue to work through the Cambridge Sustainability Compact to ensure that the institutions, and development community in Cambridge are not only consulted, but also central to the evolution of the project over time. Specifically the work that Harvard and MIT are currently undertaking to develop and execute plans to lower their emissions will be central to this initiative being successful, given the size of their campuses.

Training and Capacity Building

Building a workforce and a professional services community that is capable of delivering net zero buildings will have to be a regional initiative. Working with neighboring communities that are also targeting deep emissions reductions to bring training and knowledge to the greater metropolitan area will help to accelerate the development of net zero emissions buildings.

The Task Force also recommends that the City develop a detailed staffing and resource plan for how they will support the community in this effort, how they will efficiently and effectively execute on the proposed ideas in this report, and provide resources and support to the residential and business community around implementation.

B. Concurrent and Supportive City Initiatives

The achievement of net zero interfaces with a number of other City objectives and concurrent planning initiatives:

- Citywide plan – will both inform and be informed by the recommended actions noted above. Specifically the energy supply strategy should be done concurrently in order to ensure that land use and density is also informed by renewable energy availability. The citywide plan will further inform the feasibility of providing height and density bonuses as incentives.
- EcoDistricts – The Kendall Square EcoDistrict energy study will serve to inform the broader citywide energy study as well as serve as powerful platform for the City of Cambridge, land owners, and tenants and utilities to cooperate on building energy retrofits and exploration of microgrids.
- Climate change vulnerability assessment/preparedness plan – While the proposed framework generally supports resiliency objectives including more efficient buildings, local renewable energy and microgrids, there is a need to review potential conflicts such as whether solar panels have any adverse impact on the urban heat island effect.
- Cambridge Compact for a Sustainable Future – As noted above, the Sustainability Compact will be a key stakeholder group that will help to guide and support the implementation of these recommendations.
- Climate Protection Action Committee (CPAC) – CDD staff will ensure that annual progress updates proceed and are reviewed by CPAC to ensure accountability and transparency.

Appendices

To open the appendices, double click on the file icon.

Appendix A – Policy Best Practices Report

Cambridge Best Practice Policy Guide I

Appendix B – Cambridge Building Energy Primer

Cambridge_BuildingEnergyPrimer_Final

Appendix C – Energy Supply Primer

Energy Supply Primer_Final

Appendix D – Working Group Output: Long list of actions

Summary of Net Zero Task Force Working G

Appendix E – Greenhouse Gas Reduction Model

Cambridge GHG Reduction Model

Appendix F – Cambridge Solar Potential Report

Cambridge Solar PV Potential_Final

Appendix G –Summary of Proposed Actions

Summary of Proposed Actions_Fina

Appendix H – List of Members of Working Groups

Working Group members

Appendix I – Cambridge Net Zero Action Plan Gantt Chart

Cambridge Net Zero Gantt_Final