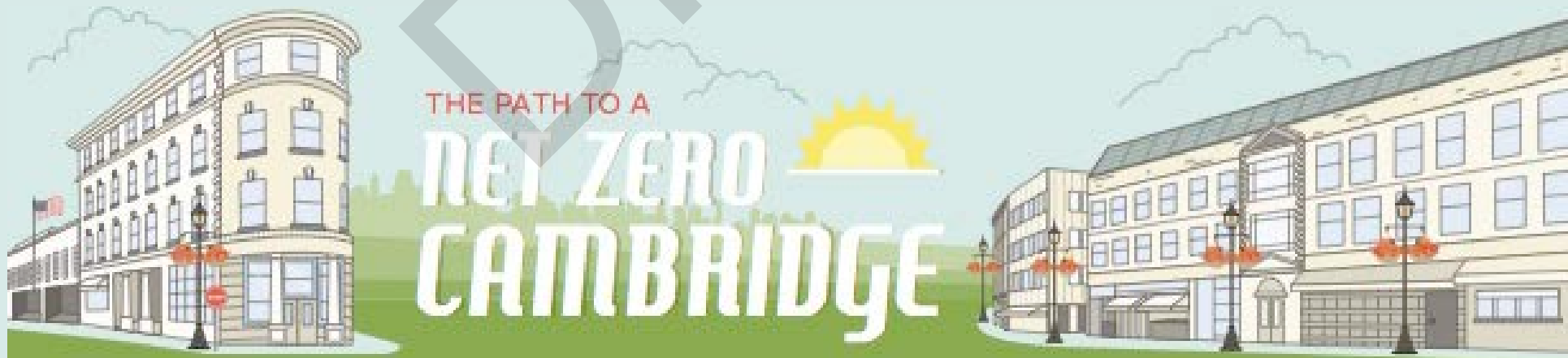


# City of Cambridge

## Net Zero Action Plan – 2021 Update

### Executive Summary

October, 2021



## Topics covered by executive summary slides

1. **5-year Review Background**
2. **Net Zero Task Force Process**
3. **Recent GHG Emissions Trends and NZAP Impacts To-Date**
4. **2021 NZAP Actions**
5. **2021 NZAP Implementation**
6. **Estimated Impacts of Adjusted Actions**



# 5-Year Review Background

1

## THE CLIMATE IMPERATIVE

Climate change poses a growing set of risks and challenges to cities.



Combating climate change needs to **start locally**



Buildings generate over 80% of Cambridge's total greenhouse gas emissions.

That is why it is Cambridge's aim to achieve

# NET ZERO EMISSIONS

from buildings.

Residents, universities, businesses and the City are collaborating to address the immediacy of the climate imperative.

## DEFINITION OF NET ZERO

Net Zero Emissions are defined in the Net Zero Action Plan as a community of buildings for which annually all greenhouse gas emissions produced through building operations are offset by carbon-free energy.

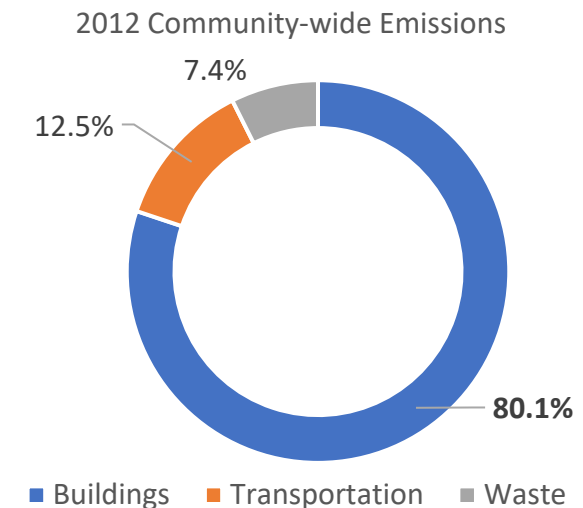


## Net Zero Action Plan 5-Year Review

- The Net Zero Action Plan (NZAP) was adopted by the City Council in 2015 following an 18-month stakeholder process to identify a phased set of actions to reduce greenhouse gas emissions from new and existing buildings and develop a renewable energy supply strategy for Cambridge buildings.
- As part of the original NZAP, the Task Force proposed that the whole suite of actions be reviewed every five years to allow for the overall strategy to adjust based on changing economics, technology, and stakeholder needs.

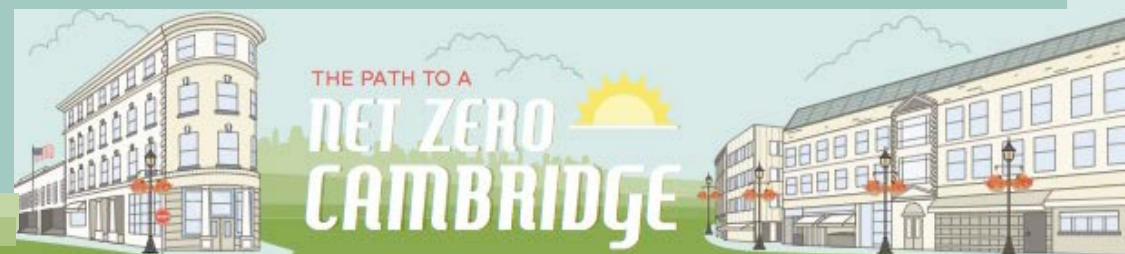
### Why Net Zero Buildings?

- 80% of greenhouse gas emissions in Cambridge are from building construction and operations. Since the original NZAP was issued in 2015, more than 8 million square feet of buildings have been added. If the city can get to net zero in the building sector, we will have made major progress toward achieving our carbon neutral commitment.



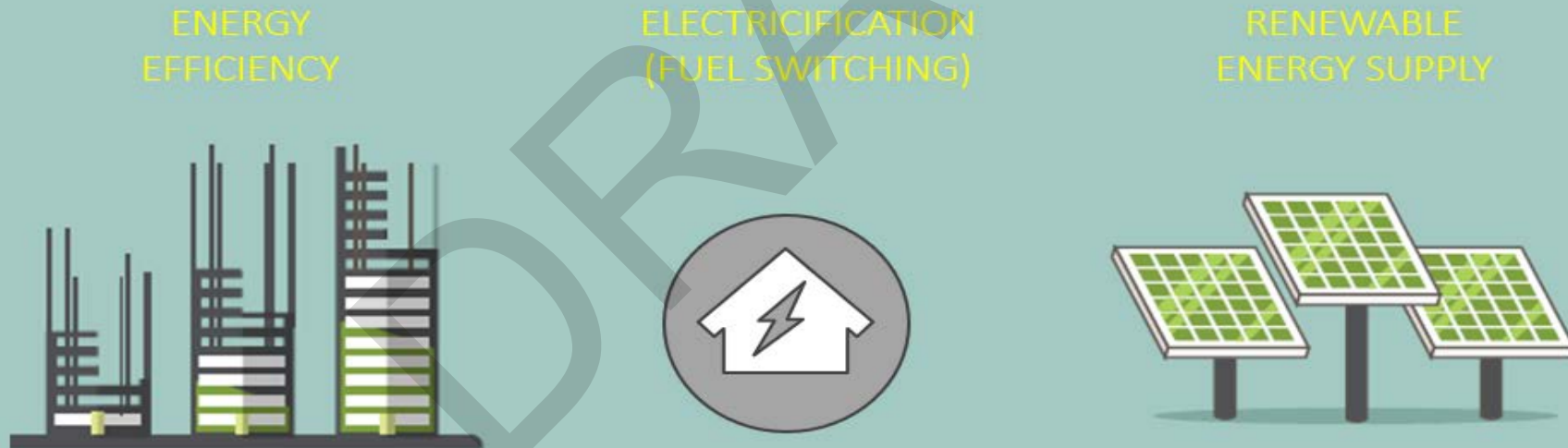
## NZAP 5-Year Review Objectives

- Conduct a comprehensive review of the 2015 NZAP in its current form and all related data to assess the impacts to date
- Set the foundation for identifying adjustments to the 2015 NZAP and, with stakeholder input, develop recommendations for adjustments to the NZAP
- Update the implementation plan that serves as the guiding document for driving the activities associated with the NZAP moving forward
- Assess and incorporate equity as a key aspect of program implementation to ensure an equitable transition to net zero



## Net Zero Action Plan Review Frameworks:

1. **NZAP Principles**
2. **Science, Technology, Policy, and Equity Review**
3. **Co-benefits Assessment**
4. **Reflection upon the Three Pillars of Decarbonization**



Three Pillars of Decarbonization – the three key strategies to decarbonize energy systems that align with the United Nation’s Sustainable Development Goals (SDGs)



# 1 Net Zero Action Plan Principles:

- Supports **climate goals** and **healthy economic** strategies
- Uses **science, market, and data-driven** analysis to inform decision making
- Support an openness **to new ideas** when circumstances change
- Commitment to allowing the principle of **offsets**
- Commitment to **measuring and monitoring** impact over time
- Ensures consultation is comprehensive and **engages affected stakeholders**
- Commitment to developing informative and **replicable models**
- **NEW:** Commitment to implementing the Net Zero Action Plan through a **racial equity and social justice lens**



## Science, Technology, Policy and Equity Lens:

### Science



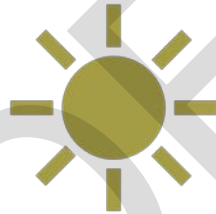
What science-based GHG reductions must be achieved to mitigate the impacts of climate change and maintain a healthy environment for Cambridge residents

### Policy



What Federal, State and Local Policies have changed that support our effort to reach the goals (e.g. building energy codes)

### Technology



What enabling technologies have emerged since the 2015 NZAP efforts that may affect our strategy

### Equity



We must recognize the social equity implications of policy choices and use an equity assessment framework to help guide our process

# Science

- Since the adoption of the Net Zero Action Plan in June 2015, the International Panel on Climate Change (IPCC), the body responsible for assessing the science related to climate change, has issued special reports on the impacts of global warming.
- The latest gap report indicates that to keep to within 1.5 deg C above pre-industrial levels, **emissions need to be reduced 50% below 2010 levels by 2030** and 100% by 2050 maintain the ability to reach this target<sup>1</sup>.
- With every passing year, there is more urgency in the scientific imperative, the years since 2015 have been the hottest on record



# Policy

- **At the Federal Government Level:**
  - A slowdown in federal policy under the Trump administration for energy efficiency, especially for plug loads created a gap in behavioral energy use reductions
  - Federal pollution regulations and tax credits will play a role in clean energy procurement for the City
  - National building codes such as the 2021 IECC set the baseline for state code updates
  - Whether policy objectives under the Biden administration are realized could have a large impact on GHG emissions, though they may have less of a direct impact on local building sector emissions



# Policy (continued)

- **At the State Level:**
  - The current Three-Year Energy Efficiency Plan for gas and electric utilities expires in 2021 and may shift to focus more on GHG emissions. Although the Plan is implemented at the state level, the City can advocate for alignment with local objectives and advance programs for hard-to-reach sectors like multifamily buildings.
  - Recent State Legislation:
    - An Act Setting Next Generation Climate Policy (S.2477) sets statewide net-zero emissions limit for the year 2050: It also sets sub-limits for specific sectors
    - An Act Relative to Energy Savings Efficiency (S.2478) that enacts appliance efficiency standards



# Policy (continued)

- **At the Local Level:**
  - Cambridge has now committed to achieving carbon neutrality by 2050. The faster Cambridge can reduce emissions within its borders, the more the **City can lead** by example in the global effort to combat climate change
  - Cambridge voted on the **proposed changes to the IECC** in December 2019 that would advance EE in new construction.
  - The City will **continue to advocate for a net zero stretch code** at the state level
  - A fossil fuel ban was considered, however, Brookline's effort to **ban on fossil fuel was struck down** by the State Attorney General. Still other pathways are open for consideration.



# Technology

- There are many enabling technologies that have emerged since the 2015 NZAP efforts
- Energy and Efficiency Technologies
  - Cold-climate Heat Pumps
  - Electric Vehicles (connected load to buildings)
  - Battery Energy Storage
  - Microgrids
  - Lighting and Controls
  - Efficiency Gains/Cost Reduction of Renewable Technology



# Technology Assessment

Tech Category	NZAP Enabling Technologies	Energy Efficiency in Existing Buildings		Net Zero New Construction		Energy Supply		Relative Impact on Overall Future Cambridge Emissions
		Economic	Technical	Economic	Technical	Economic	Technical	
Thermal Tech	<b>Air / Water Source Heat Pumps</b>	■	↑	↑	↑	n/a	n/a	+++
	Ground Source Heat Pumps	■	↑	■	↑	n/a	n/a	++
DER	<b>Rooftop PV</b>	↑	↑	↑	↑	n/a	n/a	+++
	Solar Thermal	■	■	■	■	n/a	n/a	+
	Fuel Cells	■	↑	■	↑	n/a	n/a	+
Energy Efficiency	Lighting Systems	↑	↑	↑	↑	n/a	n/a	++
	<b>Demand Flexibility</b>	■	↑	↑	↑	n/a	n/a	+++
Materials	PCM / Thermal Storage	●	■	■	↑	n/a	n/a	+
	Cement Alternatives	●	●	■	↑	n/a	n/a	++
	Glass	●	●	■	↑	n/a	n/a	++
Thermal Energy Supply	Electrolysis / Hydrogen Blending	n/a	n/a	n/a	n/a	■	■	++
	Geothermal Districts	n/a	n/a	n/a	n/a	■	■	++
Grid-scale Renewables	<b>Wind</b>	n/a	n/a	n/a	n/a	↑	↑	+++
	Microgrids	n/a	n/a	n/a	n/a	■	■	++
	<b>Off-site RE Procurement</b>	n/a	n/a	n/a	n/a	↑	↑	+++

Estimated Level of Feasibility:

● Low ■ Moderate ↑ Strong

Scale of Estimated Potential Impact on Overall Future Emissions:

+ Minor ++ Moderate +++ Significant



# Equity

- New lens for our current work
- Cambridge recognizes the social equity implications of such consequential policy choices.



**Equity  
Checklist**



**Dimensions**



**Pitfalls**

- We will be using Applied Economics Clinic's equity assessment framework helps guide our process



# Equity (continued)

- The proposed Net Zero Actions entail potential equity benefits and pitfalls and, in some cases, are equity neutral.
- Potential **equity benefits** include:
  - Improved indoor comfort and air quality,
  - Lower energy bills,
  - Increased access to financing and funding,
  - Enhanced energy reliability, and
  - Increased resident engagement, awareness, and participation.
- Potential **equity pitfalls** include:
  - Housing cost and rental cost increases,
  - Energy cost increases,
  - Inequitable program participation, and
  - Inequitable distribution of benefits and burdens.
- Potential **equity pitfalls can be avoided** by incorporating specific policy language that targets equity and builds in flexibility so that policies can be adjusted if inequitable impacts arise.

## Equity Assessment Framework



### Equity Checklist

The checklist provides a method to ensure a robust treatment of climate and social equity.



### Dimensions

Social equity cuts across many dimensions, each of which requires consideration.



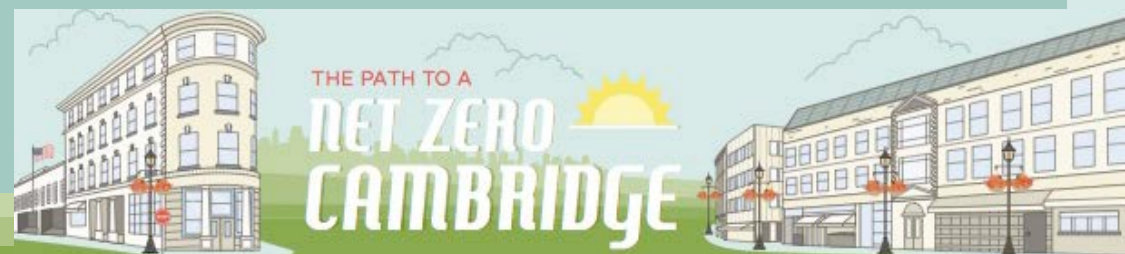
### Pitfalls

Each equity dimension has common equity pitfalls that should be acknowledged, addressed, and intentionally mitigated should they arise.

# 3

## Community Co-benefits Considered

Government and Policy Development	Economic	Environmental
<ul style="list-style-type: none"> <li>• Leadership by example</li> <li>• Promotes Collaboration</li> <li>• Facilitates Public Participation</li> <li>• Enhances Policy Evaluation</li> <li>• Enhanced data availability and access</li> </ul>	<ul style="list-style-type: none"> <li>• Employment Growth</li> <li>• Enhanced Economic Competitiveness</li> <li>• Reduction in Operation Costs</li> <li>• Reduction in Cost of Public Infrastructure</li> <li>• Decreased Energy Costs</li> </ul>	<ul style="list-style-type: none"> <li>• Reduction in Water Use</li> <li>• Less Materials Use Impacts</li> <li>• Reduction in Waste</li> <li>• Lowers air pollution from generation assets</li> <li>• Life-cycle Carbon Emissions Reductions</li> </ul>
Health and Wellbeing	Climate Resilience	Access and Engagement
<ul style="list-style-type: none"> <li>• Promotes Healthy Lifestyle for Residents</li> <li>• Lowers Combustible Gases in Buildings</li> <li>• Improves Community Aesthetics</li> <li>• Improved Building Comfort/IAQ</li> </ul>	<ul style="list-style-type: none"> <li>• Increased Energy Security</li> <li>• Provides opp. for hardening infrastructure</li> <li>• Provides opp. for improved building resilience</li> <li>• Reduces Risk for Vulnerable Populations</li> </ul>	<ul style="list-style-type: none"> <li>• Improved Access to Public Space</li> <li>• Improved Access to Public Transit</li> <li>• Improved Access to Employment /Training</li> <li>• Engagement of Local Women/Minority Owned Businesses</li> </ul>



# Net Zero Task Force Process

## Net Zero Task Force

- A key element ensuring the continued forward-thinking of the Net Zero Action Plan (NZAP) is the plan's mandate that a detailed review of the whole suite of actions by a stakeholder Task Force. For this review, Task Force members included eight Residents/Advocates, eight Institutions/Property Owners/Developers, and nine Subject Matter Experts – a total of 25 Task Force members

### Residents

**David Adamian,**  
CEO of Greener U  
**Gaurab Basu,**  
Physician  
**Peter Crawley,**  
CPAC Representative  
**Margery Davies,**  
Mother Out Front Representative  
**Henrietta Davis,**  
Former Mayor of Cambridge  
**Jan Devereux,**  
Former Vice Mayor/Representative of Green  
Cambridge  
**Adam Gould,**  
Representative of Youth Climate Activists  
**Kolin Loveless,**  
Representative from Neighborhood Nine

### Institutions, Property Owners and Developers

**Jane Carbone,**  
Director of Development for Homeowners Rehab  
**Deborah Donovan,**  
VP of Env., Health and Safety at Takeda  
**Tom Evans,**  
Executive Director, Cambridge Redevelopment Authority  
**Heather Henriksen,**  
Managing Director of the Harvard Univ. Office of  
Sustainability  
**Eli Herman,**  
Construction Manager for Akelius Real Estate  
**Rick Malmstrom,**  
Executive Director of Sustainable Operations for Alexandria  
Real Estate  
**Ben Myers,**  
VP of Sustainability for Boston Properties  
**Julie Newman,**  
Director of the MIT Office for Sustainability

### Subject Matter Experts

**Lauren Baumann,**  
VP of New Ecology  
**David Bisson,**  
Business Development Manager for Resonant Energy  
**Andrea Love,**  
Resident and Green Building Design Expert with Payette  
Architects  
**Chris Leary,**  
VP at Jacobs Architects  
**Paul Lyons,**  
Resident and CEO of Zapotec Energy  
**Steve Miller,**  
Energy Efficiency Consultant for Eversource  
**Gabe Shapiro,**  
Co-founder All-in-Energy  
**Tom Sieniewicz,**  
Resident and member of Planning Board  
**Jen Stevenson Zepeda,**  
Director of Research and Operations for Climable

## Net Zero Task Force Meetings

The Task Force was convened via Zoom webinar for a total of five full-group Task Force Meetings and six Working-group Meetings. The Taskforce Meetings were designed to cover:

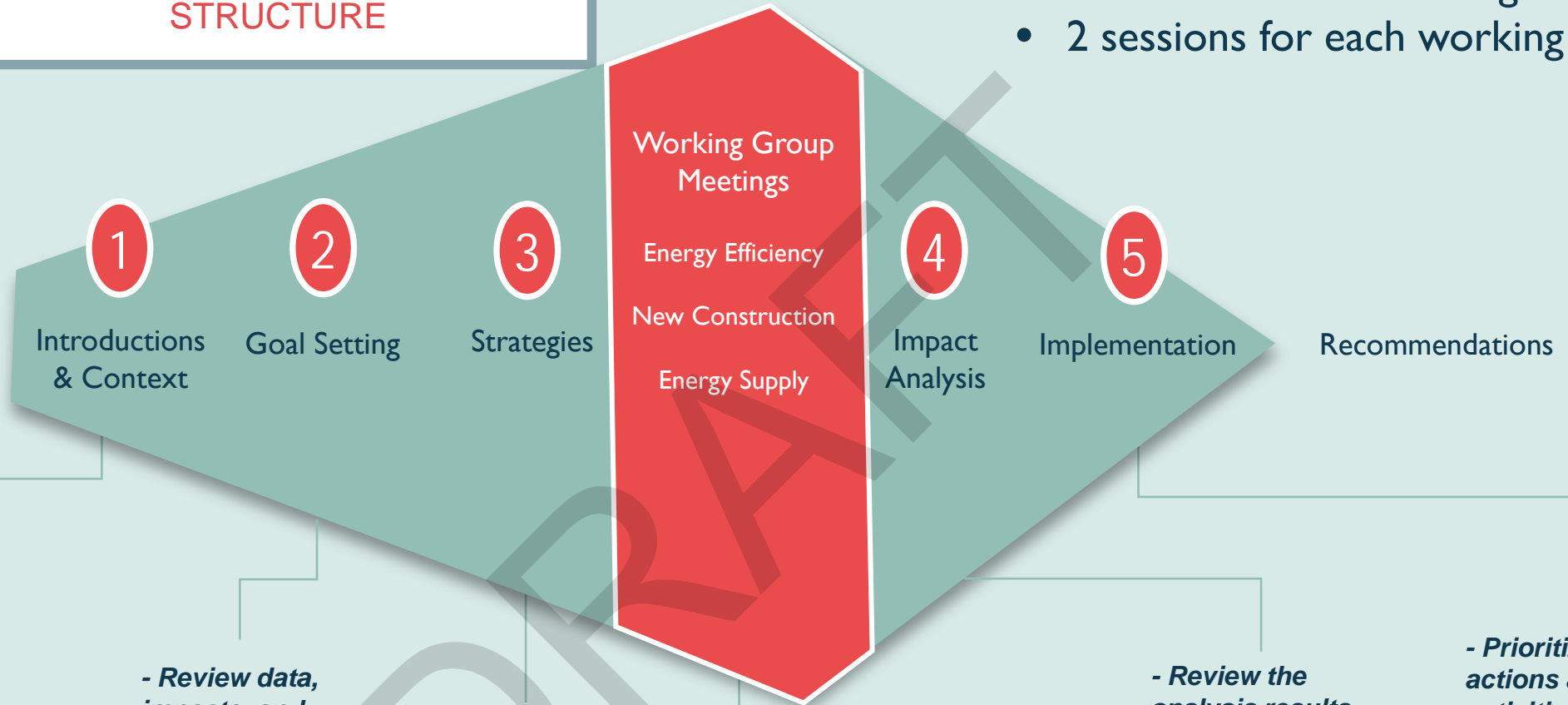
- a) NZAP review context and goal-setting
- b) Existing data sources and program evaluation approaches
- c) NZAP strategy and action update recommendations
- d) Equity assessment and updated implementation plan

## TASK FORCE OBJECTIVES

- Explore and update strategy as appropriate including actions, targets, and timeline for achieving net zero emissions.
- Provide recommendations outlining short-term (1-2 years), medium-term (3-5 years) and longer-term actions (6-10 years).
- Provide input on design and implementation for each action including regulations to consider, planning measures, incentives, and initiatives.
- Provide feedback on the projected impacts of each action.
- Agree on an ongoing communication, reporting and accountability strategy.

## TASK FORCE MEETING STRUCTURE

- 5 Full Task Force Meetings held
- 2 sessions for each working group



- GHG Emissions Overview  
- Equity Review  
- Historical Recap

- Review data, impacts, and frameworks

- Level-setting, brainstorming potential adjustments

- Generate and confirm proposed adjustments

- Review the analysis results and timelines

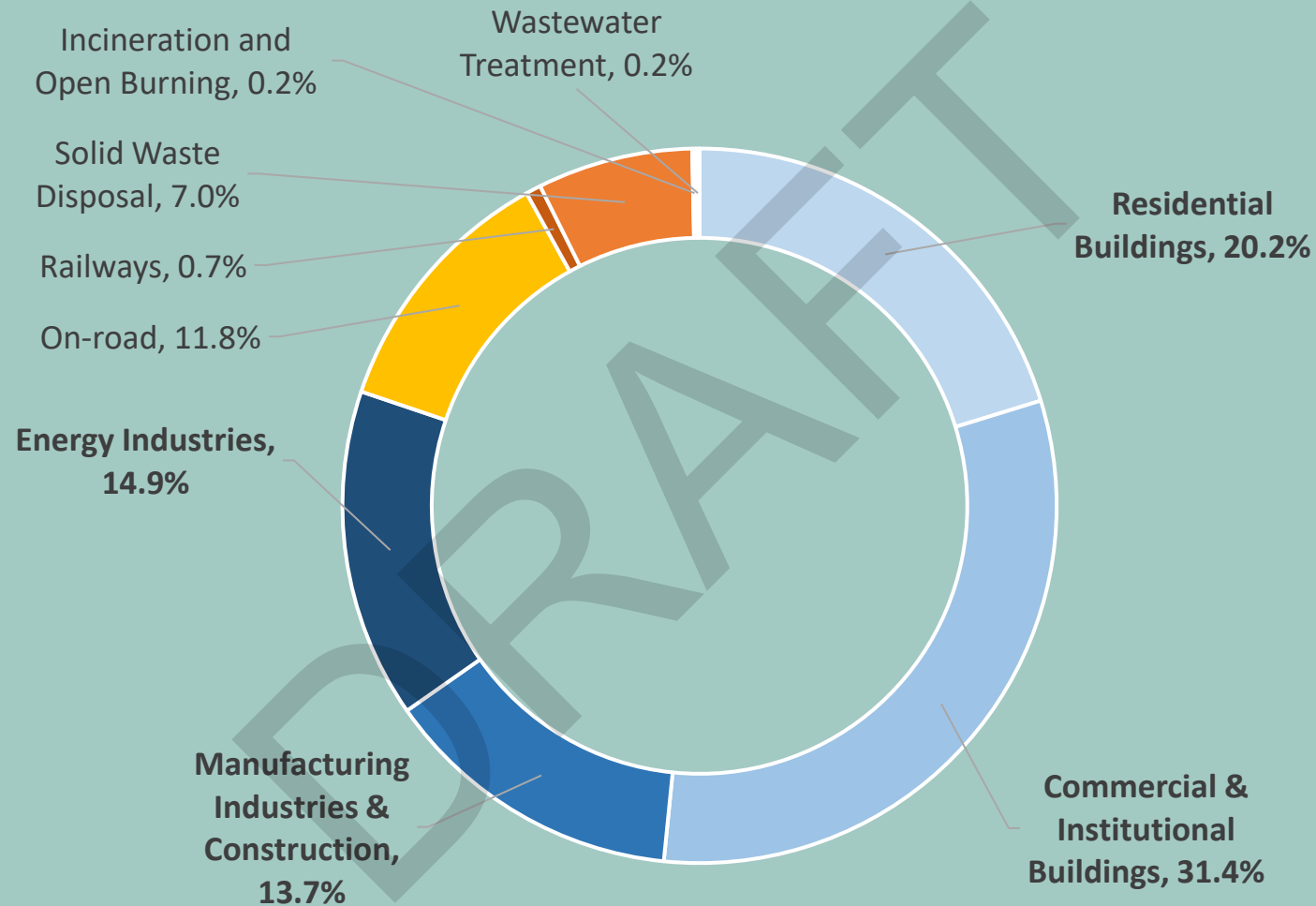
- Prioritization of actions and activities





# Recent GHG Emissions Trends and NZAP Impacts to Date

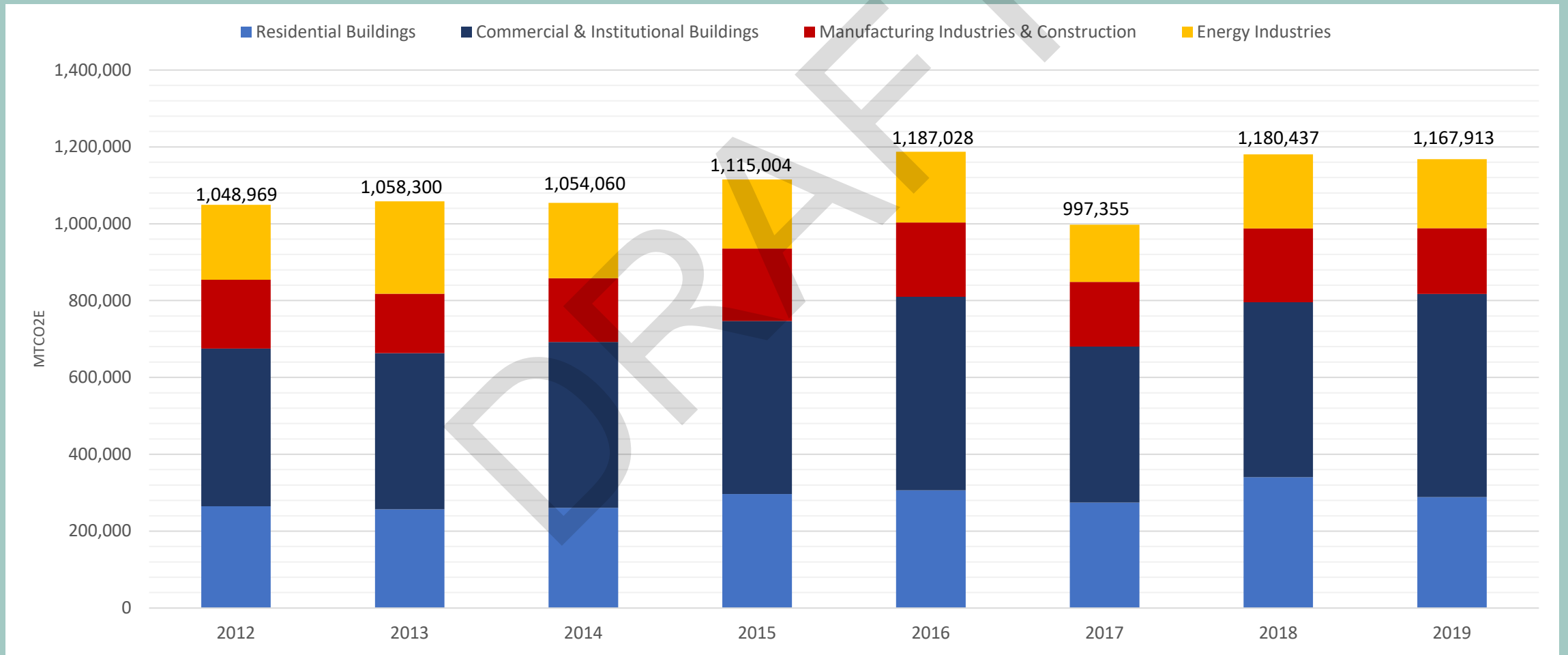
# Cambridge Community GHG Inventory



**Cambridge Community-wide Emissions  
by sub-sector (2012)**

# Net Zero Action Impacts To-date

## Building Sector Emissions Trends 2012 - 2019



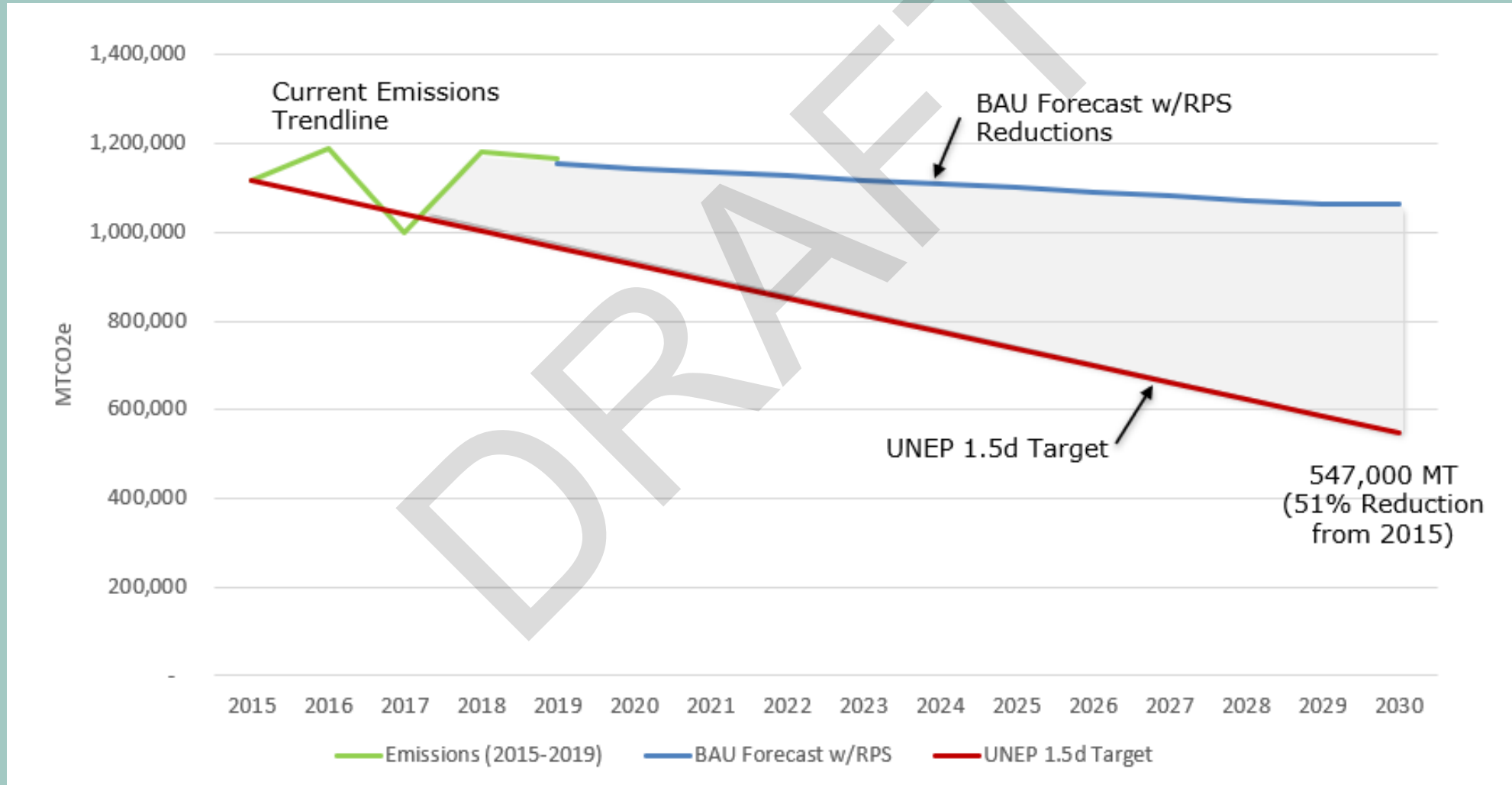
## Analysis of GHG Emissions Trends

The inventory data shows that although emissions fluctuate year to year, the general building sector emissions trend has remained relatively flat since 2012. A regression analysis of possible contributing factors was performed by DNV which considered degree day data, policies enacted during this time, and commercial and residential floor area data and found that overall:

- The commercial sector has twice the impact on emissions trends as the residential sector.
- More cooling degree days (an amount of time during the year when cooling is in demand in buildings) correlates with higher GHG emissions.
- Floor area added within the City from new construction projects was statistically associated with changes in total emissions, as as emission increases from new buildings were balanced out by decreases from the existing building stock.

## Net Zero Action Impacts To-date

### Comparison of Recent Trends to the 2030 UNEP Aligned Emissions Target



## Net Zero Action Impacts To-date

The impact assessment involved a review of community-wide emissions trends in recent years in relation to future goals as well as a bottom-up assessment of the NZAP actions adopted in 2015. The combination of these two approaches helped determine the overall impacts of the NZAP since 2015. The review of the original NZAP actions found that:

- **The 2015 NZAP has laid the groundwork to reduce emissions** from the City of Cambridge building stock with quantifiable impacts from five strategies aimed at increasing the energy efficiency of buildings, improving the performance of new construction, and providing more renewables in the energy supply.
- **Nearly 1,100 buildings in the City now report their energy and water usage** to the City annually through the Building Energy Use Disclosure Ordinance (BEUDO), providing valuable information for planning and with future performance requirements currently being planned.
- Of the five NZAP Actions that were identified as contributing to measurable results to-date; there are **improvements needed in data collection and program tracking**. The emissions savings could only be calculated for four of those actions based on availability of data, representing only 1% of the of the total buildings sector emissions in 2015.

## Measurable Results

- **1,450 units** in the Custom Retrofit Program (Action 1.1.1)
- **54 projects** completed under Article 22, Green Building Requirements representing over **8 million SF** (Action 2.3)
- **78 projects** completed as part of the Renewal of Municipal Buildings Action **saving 4 million kWh** of electricity (Action 2.4.2)
- **445 Rooftop PV systems** installed under the Cambridge Solar programs, **~5 MW of capacity**
- **12,592 MTCO<sub>2</sub>e** estimated emissions reduced from these actions

## Other Notable Results

**Action 2.4.1, Net Zero Requirement for New Construction of Municipal Buildings:** Has influenced the standards for design for new municipal buildings. Projects that align with these standards include:

- The King Open School (2019) – Fossil fuel free
- 859 Mass Ave (2017) – Deep energy retrofit with GSHPs
- Martin Luther King School (2016) – 69% energy performance improvement

### **Building Energy Use Disclosure Ordinance (BEUDO)**




- Enacted in 2016 has led to nearly 1,100 buildings in the city that now report their energy and water usage to the city annually
- While no emissions savings are currently attributed at this time, we anticipate that the addition of the performance improvement requirement will result in significant impacts in the coming years







# Status of NZAP Actions

## Action 1 – Energy Efficiency in Buildings





Legend:

-  - In progress
-  - Behind Schedule
-  - Parked

Action No.	Action	Description	Stage	Impact	Status as of 2020
1.1.1	Custom Retrofit Program	Multi-Family Energy Pilot in implementation. Custom Retrofit Program for BEUDO* buildings in implementation	Implementation	Medium	
1.1.2	Additional BEUDO Requirements	Amendment proposal is ready to move forward but behind original schedule	Regulatory	High	
1.1.3	Upgrades at Time of Renovation or Sale	Time of Renovation or Sale requirement feasibility assessment completed through Zero Cities project	Feasibility	High	
1.1.4	O&M Plan Requirement	BEUDO process included the creation of O&M plan template	N/A	Low	




# Status of NZAP Actions

## Action 2 – Net Zero New Construction

Action No.	Action	Description	Stage	Impact	Status as of 2020
2.1	Net Zero New Construction	Technical and economic feasibility study for net zero small residential buildings (1-3 units) completed	Feasibility	Low	
2.2.1	Market Based Incentive Program	Completed feasibility study of market incentives for new buildings	N/A	Low	
2.2.2	Height and FAR Bonus	Determined not to be desirable as standalone policy given upcoming requirements	N/A	Low	
2.3	Article 22 Green Building Requirements	Previously delayed requirements have been adopted	Implementation	Medium	




# Status of NZAP Actions

## Action 2 – Net Zero New Construction (cont.)

Action No.	Action	Description	Stage	Impact	Status as of 2020
2.4.1	Net Zero Requirement for New Const. of Municipal Buildings	New municipal buildings being designed to achieve net zero emissions	Implementation	Low	
2.4.2	Renewal of Municipal Building	Continued implementation of Municipal Facilities Improvement Plan	Implementation	Low	
2.5	Removal of Barriers to Increased Insulation	Previously delayed requirements have been adopted	Regulatory	Low	


# Status of NZAP Actions

## Action 3 – Energy Supply

Action No.	Action	Description	Stage	Impact	Status as of 2020
3.1	Low Carbon Energy Supply	Implementation of multiple study recommendations in progress	Implementation	High	
3.2	Rooftop Solar Ready Requirements	Solar installation requirement technical analysis completed	Feasibility	Medium	
3.3	Develop a Memorandum of Understanding with Local Utilities	Pursue project-specific collaboration in place of overarching MOU	N/A	Supporting Action	

# Status of NZAP Actions




## Action 4 – Low Carbon Fund

Action No.	Action	Description	Stage	Impact	Status as of 2020
4	Investigate Local Carbon Fund	Virtual pilot complete but behind implementation schedule	Design	High	

DRAFT

# Status of NZAP Actions

## Action 5 – Engagement and Capacity Building

Action No.	Action	Description	Stage	Impact	Status as of 2020
5.1	Communications Strategy	Implementation of multi-faceted communication strategy ongoing	Implementation	Supporting Action	
5.2	Develop Ongoing Capacity to Manage Getting to Net Zero Project	Program Wide Review delayed due to COVID-19	Implementation	Supporting Action	
5.3	Net Zero Labs Standards	In progress through Compact for a Sustainable Future workplan	Design	Medium	

# 2021 NZAP Actions

## Recommended NZAP Adjustments to Actions

- The adjustments to the 2015 NZAP actions were a result of a lengthy stakeholder engagement process and a robust technical analysis of the possible impacts of the actions in the coming decades.
- The adjustments made provide the city with a set of actions more focused on activities that the city has control over while also taking into consideration activities at the state level and of the local utilities



## Recommended NZAP Adjustments to Actions

2015 NZAP	Recommended Adjustments for the 2021 NZAP Update
Action 1 Energy Efficiency	Action Area 1: Energy Efficiency in Existing Buildings
1.1.1 Custom Retrofit Program	Action 1.1 Custom Retrofit Program for Residential (up to 50 units) and Small Commercial
1.1.2 Additional BEUDO Requirements	Action 1.2 BEUDO Requirements
1.1.3 Upgrades at Time of Renovation	Action 1.2.1 BEUDO Performance Requirements
1.1.4 Operation and Maintenance Plans for New Const.	Action 1.2.2 BEUDO Resource Hub
Action 2 Net Zero New Construction	Action 1.3 Upgrades at Transaction Points
2.1 Net Zero New Construction	Action Area 2: Net Zero New Construction
2.2 Net Zero Incentives	Action 2.1 Net Zero Requirements for New Construction
2.2.1 Market-based Incentives	Action 2.2 Address Embodied Carbon through Green Building Requirements *NEW*
2.2.2 Height and FAR Bonus	Action 2.3 Net Zero Requirements for Municipal Buildings
2.3 Increase Green Building Requirements	Action Area 3: Low Carbon Energy Supply
2.4 Net Zero New Construction for Municipal Buildings	Action 3.1 Carbon Free Thermal Energy
2.5 Removal of Barriers to Increased Insulation	Action 3.2 On-site Renewable Electricity Access
Action 3 Energy Supply	3.2.1 Rooftop Solar Requirement
3.1 Low Carbon Energy Supply	3.2.2 Community Solar Access *NEW*
3.2 Rooftop Solar Ready Requirement	Action 3.3 Off-site Renewable Electricity Access *NEW*
3.3 Develop a MOU with Local Utilities	Action Area 4: Financing and Capacity Building
Action 4 Investigate Local Carbon Fund	Action 4.1 Local Carbon Fund and Community Aggregation
Action 5 Engagement and Capacity Building	
5.1 Communications Strategy	
5.2 Develop Ongoing Capacity to Manage the NZAP	
5.3 Net Zero Lab Standards	

# Updated net zero action plan

## **Action Area 1: Energy Efficiency in Existing Buildings**

- Action 1.1: Custom Retrofit Program for Residential and Small Commercial Buildings
- Action 1.2: BEUDO Performance Requirements
- Action 1.3: Upgrades at Transaction Points

## **Action Area 2: Net Zero New Construction**

- Action 2.1: Net Zero Requirements for New Construction
- Action 2.2: Address Embodied Carbon through Green Building Requirements \*NEW\*
- Action 2.3: Net Zero Requirements for Municipal Buildings

## **Action Area 3: Low Carbon Energy Supply**

- Action 3.1: Carbon Free Thermal Energy
- Action 3.2: On-Site Renewable Energy Access
- Action 3.3: Off-Site Renewable Energy Access \*NEW\*

## **Action Area 4: Financing and Capacity Building**

- Action 4.1: Investigate Creation of Local Carbon Fund (Enhanced Aggregation)

# Action Area 1 – Energy Efficiency in Existing Buildings

## 2015 Structure:

- Action 1.1.1 Custom Retrofit Program
- Action 1.1.2 Additional BEUDO Requirements
- Action 1.1.3 Upgrades at Time of Renovation
- NEW Financing Access Action
- Action 1.1.4 Operations and Maintenance (being addressed under BEUDO)

## 2021 Updated Structure:

- Action 1.1 Custom Retrofit Program for Residential (up to 50 units) and Small Commercial
- Action 1.2 BEUDO Requirements
  - Action 1.2.1 BUEDO Performance Requirements
  - Action 1.2.2 BEUDO Resource Hub
- Action 1.3 Upgrades at Transaction Points

# 1.1 Custom Retrofit Program for Residential (up to 50 units) and Small Commercial

## Overview

The intent of this action is to ensure that small-med residential and small commercial buildings are operating optimally and, where possible, are retrofitted to maximize efficiency and GHG reductions. In addition to these requirements, other tools and policies will be directed broadly across all building types, where appropriate, in order to achieve the necessary emissions savings.

This Action will have 3 areas of focus:

- Multifamily Custom Retrofit
- LMI Multifamily Engagement
- Small Commercial Custom Retrofit

## Contribution to Net Zero Objective

The custom retrofit programs are instrumental for engaging residents and small business owners in the implementation of the NZAP. They align well with the principles of the NZAP, in particular: engaging affected stakeholders; developing informative and replicable models; and demonstrating commitment to equity and social justice.

## Estimated Cumulative Emissions Reductions by 2050



## Key Activities

### Short Term (1-2 Years)

1. Evaluate pilot programs to gauge impacts and identify strategies and adjustments that may be made to maximize participation
2. Determine program adjustments to:
  - Coordinate with MassSave program offerings
  - Identify a path for more adequately engaging LMI households
  - Continue to establish the CEA as a resource hub for energy management information for homes and small businesses
3. Advocate for strengthening and alignment of state energy efficiency program with Cambridge needs
4. Integrate resilience and electrification with energy efficiency offerings

### Medium Term (3-5 Years)

5. Identify means of access to project financing
6. Increase transparency in program implementation

### Long Term (5+ Years)

7. Integrate with Enhanced Community Aggregation Program

## Equity: Positive

This Action aims to enable retrofitting of existing homes and businesses in Cambridge to achieve more efficient operations and energy savings. It has positive equity impacts because more energy efficient homes and businesses improve indoor comfort and air quality and lower energy bills, with particular benefits for vulnerable populations.

## Cross-cutting Issues

**Renewable Thermal Systems:** Retrofits present an opportunity for replacement of fuel-based systems with electric systems

**Climate Change Preparedness / Resilience:** consider incorporating resilience improvement assessments as part of any audit or EE improvement

**Electric Transport:** Consider access to charging stations and implications for buildings electrical equipment

**Capacity / Local Carbon Fund:** Consider designing carbon fund to supplement costs of improvements for LMI families; provide owners greater access to capital

# 1.2 BEUDO Requirements

## Overview

The Building Energy Use Disclosure Ordinance covers commercial buildings >25,000sf and residential buildings >50 units. While a small proportion of the total number of buildings in Cambridge, these largest buildings account for over 50% of the square footage and approximately 80% of building-generated GHG emissions in Cambridge. By targeting these buildings for improvement, Cambridge will see significant progress in GHG emission reductions. This Action has two tracks:

1.2.1 Performance Requirements

1.2.2 BEUDO Resource Hub

## Contribution to Net Zero Objective

1.2.1 – Performance Requirements: The BEUDO Performance Requirement is essential for meeting the City’s net zero emissions goal. By adopting performance standards, owners (or real estate managers) of buildings that make up the largest source of emissions in the City will be required to find ways to reduce their emissions to net zero over time.

Estimated Cumulative Emissions Reductions by 2050



## Key Activities: 1.2.1 Performance Requirements

### Short Term (1-2 years)

1. Enact Performance Requirements
2. Establish stakeholder advisory committee as appropriate to oversee implementation and inform regulations

### Medium Term (3-5 years)

3. Monitor building performance and support compliance

## Equity: Flag

While this action places the greatest amount of responsibility on the largest emitters in the City to assist in the transition to a net zero emissions city, it must be noted that the costs of building upgrades may get passed on to tenants and for large multi-family buildings subject to BEUDO increase housing costs, creating a potential equity pitfall for vulnerable residents and businesses. The current BEUDO performance requirement proposal would give increased flexibility to affordable housing and allow affordable housing developers to access financial support to meet their upgrade requirements.

## Cross-cutting Issues

**Renewable Thermal Systems:** To comply with BEUDO building performance standards, building owners will need to electrify thermal systems and decrease fossil fuel use

**Climate Change Preparedness / Resilience:** Consider incorporating resilience improvement assessments as part of any building improvement project

**Electric Transport:** Consider access to charging stations and implications for buildings electrical equipment

**Capacity / Local Carbon Fund:** Pursue sharing of best practices through the Cambridge Climate Leaders Initiative

# 1.2 BEUDO Requirements

## Overview

The Building Energy Use Disclosure Ordinance covers commercial buildings >25,000sf and residential buildings >50 units. While a small proportion of the total number of buildings in Cambridge, these largest buildings account for over 50% of the square footage and approximately 70% of the GHG emissions in Cambridge. By targeting these buildings for improvement, Cambridge will see significant progress in GHG emission reductions. This Action will have two tracks:

1.2.1 Performance Requirements

1.2.2 BEUDO Resource Hub

## Contribution to Net Zero Objective

1.2.2 BEUDO Resource Hub: The intention of the BEUDO Resource Hub is to arm building owners with the knowledge and the tools to identify areas of improvement, take action, and achieve net zero emissions in their own buildings. Key issues the resource hub should seek to address are electrification, fossil fuel free district energy, and renewable energy procurement options, including solicitation, contracting, and pricing resources.

## Anticipated Annual GHG Reductions by 2050

This is an emissions reduction enabling action intended to help facilitate the requirements of 1.2.1 (BEUDO Performance)

## Key Activities: 1.2.2 BEUDO Retrofit Support

### Short Term (1-2 Years)

1. Continue and expand Building Energy Retrofit Program and Resource Hub to support BEUDO buildings to achieve performance requirement goals, including assistance with energy efficiency, electrification, and renewable electricity as well as project finance options

### Medium Term (3-5 Years)

2. Evaluate Resource Hub Impacts

### Long Term (5+ Years)

3. Integrate with Enhanced Community Aggregation Program

## Equity: Neutral

This action targets building owners only and there is no direct impact on Cambridge's vulnerable residents. That said, this action entails potential equity benefits in the same way BEUDO requirements do: building upgrades will result in more energy efficient homes and businesses.

## Cross-cutting Issues

**Renewable Thermal Systems:** To comply with BEUDO building performance standards, building owners will need to electrify thermal systems and decrease fossil fuel use

**Climate Change Preparedness / Resilience:** Consider incorporating resilience improvement assessments as part of any building improvement project

**Electric Transport:** Consider access to charging stations and implications for buildings electrical equipment

**Capacity / Local Carbon Fund:** Pursue sharing of best practices through the Cambridge Climate Leaders Initiative

# 1.3 Upgrades at Transaction Points

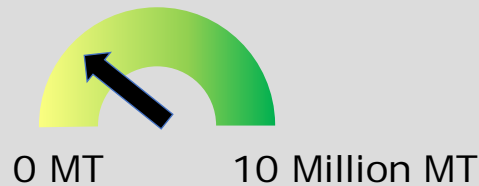
## Overview

Studies commissioned by Cambridge on this topic have projected that by 2050, all building area will be sold and/or touched by a renovation permit, with many being sold or renovated multiple times over that period. The intent of this Action is to ensure that transaction points in building life-cycles are leveraged to achieve energy improvements.

## Contribution to Net Zero Objective

This action is key to both increasing the energy efficiency of Cambridge's existing building stock and replacing fossil fuel-based equipment with renewable thermal systems.

Estimated Cumulative Emissions Reductions by 2050



## Key Activities:

### Short Term (1-2 Years)

1. Complete program design, including:
  - Determine means for tracking triggering events
  - Studying options for time-of-lease requirements
  - Studying financial options tied to transaction points
  - Address condominiums
2. Develop toolkits/templates for use at transaction points
3. Implement contractor education program

### Medium Term (3-5 Years)

4. Formally adopt upgrade requirements at transaction points (sale, lease, renovation, replacement) based on short term lessons learned
5. Establish a resource hub to provide technical and economic support to building owners to achieve upgrades
6. Implement transaction requirements and monitor performance and impacts

### Long Term (5+ Years)

7. Assess feasibility of increasing the transaction performance improvement requirements to achieve net zero emissions.

## Equity: Flag

A potential equity pitfall would occur if the costs of building retrofits at the point of transaction get passed on to the next building owner/tenant without a commensurate reduction in building operational costs, thereby increasing housing costs. At the same time, transaction points may provide access to financing, such as mortgages, which can make energy upgrades more accessible to building owners.

Upgrades at the time of building transaction points also have the potential for equity benefits. Building upgrades will result in more energy efficient homes and businesses, which improve indoor comfort and air quality, and lower energy bills.

## Cross-cutting Issues

**Renewable Thermal Systems:** require that upgrades at time of renovation include the replacement of fuel-based systems with electric systems

**Climate Change Preparedness / Resilience:** Consider incorporating resilience improvement assessments as part of any audit or EE improvement

**Electric Transport:** Consider access to charging stations and implications for buildings electrical equipment

**Capacity / Local Carbon Fund:** Design with a mechanism to offset losses incurred by landlords while units are unoccupied

# Action 2 – Net Zero New Construction

## 2015 Structure:

- Action 2.1 Net Zero Targets for New Construction
- Action 2.2 Net Zero Incentives
  - 2.2.1 Market-based Incentive Programs
  - 2.2.2 Height + FAR Bonus
- Action 2.3 Increase Green Building Requirements
- Action 2.4 Net Zero Requirements for Municipal Buildings
  - 2.4.1 Net Zero Requirement for New Construction
  - 2.4.4 Deep Retrofits of Municipal Buildings
- Action 2.5 Removal of Barriers to Increased Insulation

## 2021 Updated Structure:

- Action 2.1 Net Zero Requirements for New Construction
- Action 2.2 Address Embodied Carbon through Green Building Requirements
- Action 2.3 Net Zero Requirements for Municipal Buildings



# 2.1 Net Zero Requirements for New Construction

## Overview

The initial net zero new construction targets developed for the NZAP are considered outdated and require alignment with current standards practices, state-level code initiatives, and the urgency of addressing climate impacts from new construction activities. These original targets can be used as a reference point but should be adjusted as more information becomes available.

## Contribution to Net Zero Objective

The originally recommended targets were intended to show leadership and create an environment of innovation, yet regardless of how the state stretch code for net zero new construction affects the target years, this action is anticipated to contribute to the net zero goals by avoiding emissions that would otherwise be added by new buildings.

Estimated Cumulative Emissions Reductions by 2050



## Key Activities

### Short Term (1-2 Years)

1. Advocate for a state-level net zero stretch code approach that aligns with Cambridge’s net zero emissions priorities
2. Compile net zero resources and templates for the building community to achieve net zero standards by construction type
3. Adopt state net zero stretch code
4. Monitor and assess opportunities to avoid fossil fuel use in new construction

### Medium Term (3-5 Years)

5. Revisit and assess timeline for net zero new construction by building type based on state code structure

### Long Term (5+ Years)

6. Monitor performance of new construction and assess needs for additional adjustments

## Equity: Flag

Although recent experience shows that the cost of constructing net zero roughly aligns with the cost of traditional construction for many building types, in adopting the new code, the City must consider any incremental cost of net zero buildings – that is, costs above and beyond non-net zero buildings – that may be passed on in the form of increased housing or rental costs, creating a potential equity pitfall.

Net zero buildings also entail potential equity benefits. Net zero buildings are more energy efficient, improve indoor comfort and air quality, and can lower building operational costs.

## Cross-cutting Issues

**Renewable Thermal:** Fossil fuel free new construction should be considered as part of net zero design

**Climate Change Preparedness / Resilience:** Ensure that NZE aligns with all-electric construction with resilient design strategies. Consider requiring a resilience narrative as a part of permit process

**Electric Transport:** Consider requiring charging station access or charging station ready design

**Capacity / Local Carbon Fund:** For any building unable to achieve ZNE, contributions should be made to the carbon fund; will need to determine what those contributions are and when the fund/CCA will be able to accept payments

## 2.2 Address Embodied Carbon through Green Building Requirements

### Overview

The Zoning Ordinance is a regulatory tool that Cambridge can use to incrementally require higher standards of green building and energy efficiency for large commercial projects. Large buildings, subject to Special Permit requirements, are currently required to design to a certain LEED or other similar green building standard. As a result, project developers are delivering buildings that are higher quality. This action also provides the opportunity for the City to address another not previously considered but highly impactful source of carbon emissions: embodied carbon

### Contribution to Net Zero Objective

This regulatory approach is a strong tool to demonstrate the City's commitment and leadership on sustainable new construction. Going forward, Net Zero projects should consider the impact of both embodied carbon and operational carbon. Including embodied carbon neutrality in the NZAP is an important step in the pathway to achieve a net zero carbon future.

### Estimated Cumulative Emissions Reductions by 2050

*Measurement methodology not yet established*

### Key Activities

#### Short Term (1-2 Years)

1. Adopt embodied carbon narrative for new construction.
2. **Implement LEED alternative pathways**
3. Design and develop policy to prioritize re-use
4. Design carbon intensity targets
5. Develop toolkit / templates
6. Perform technical assessment of carbon impacts
7. Participate in peer learning sessions with other cities

#### Medium Term (3-5 Years)

8. Adopt Life Cycle Analysis/carbon reduction requirements
9. Assess zero carbon certification
10. Implement and monitor performance

#### Long Term (5+ Years)

11. Adopt enhanced LCA/carbon reduction requirements

### Equity: Flag

A potential equity pitfall would occur if the incremental costs of either the green building requirements or materials with lower embodied carbon content are passed on to tenants and increase housing or rental costs.

Lower embodied carbon buildings may also provide benefits beyond emissions, including site sustainability, indoor environmental quality, non-toxic building materials, reductions in waste generation and water use, and increasing access to alternative transportation

### Cross-cutting Issues

**Renewable Thermal:** While green building design is still the focus, a focus will remain on all-electric design as part of the new construction standards

**Climate Change Preparedness / Resilience:** Align green buildings requirements with recommendations from Climate Resilient Zoning Task Force

**Electric Transport:** For green buildings, electric vehicle charging access in the design of new buildings will continue to be pursued

**Capacity / Local Carbon Fund:** This action presents an opportunity for sharing information and education the market on the issue of embodied carbon

## 2.3 Net Zero Requirement for New Construction + Deep Retrofits of Municipal Buildings

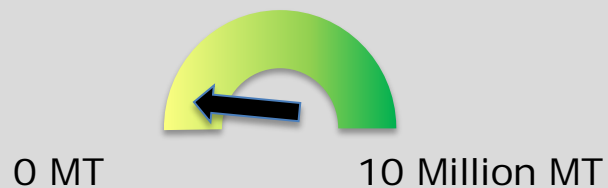
### Overview

To demonstrate leadership, the City has for several years been designing and constructing new municipal buildings to be fossil fuel free and, since 2020, required to be net zero. This also applies to “gut renovations” where a building is being completely renovated with new electrical, mechanical, interior, and envelope systems. This commitment to the net zero and renewable thermal objectives will become a formal policy and provide a showcase for others for new technologies

### Contribution to Net Zero Objective

There is significant benefit to the City demonstrating leadership by committing to achieving net zero emissions in its own building stock. This shows the City’s commitment, demonstrates that net zero is achievable, will generate savings and chart a path to net zero for private industry.

### Estimated Cumulative Emissions Reductions by 2050



### Key Actions:

#### Short Term (1-2 Years)

- 2.4.1 Net Zero Requirement for New Construction of Municipal Buildings** Continue policy that new construction of municipal buildings will achieve net zero and be fossil fuel-free.
- 2.4.2. Renewal of Municipal Buildings** Continue policy that (1) greenhouse gas reduction is a priority when constructing facility improvement projects and (2) operational improvements will be implemented to achieve targets established and tracked by the City.
- City of Cambridge to prioritize evaluation of Embodied Carbon

#### Medium Term (3-5 Years)

- 2.4.2. Renewal of Municipal Buildings** Continue to implement municipal building improvement strategy piloting new technologies and emerging practices, and track improvements (GHG reduction) annually.

#### Long Term (5+ Years)

- 2.4.1. Consider additional objectives for newly constructed municipal buildings**
- 2.4.2. Renewal of Municipal Buildings** Continue to implement municipal building improvement strategy

### Equity: Neutral

The action targets municipal buildings only, and there is no direct impact on Cambridge’s vulnerable residents. That said, this Action entails potential indirect and conditional equity benefits. Net Zero municipal buildings have benefits beyond energy, by promoting healthy indoor environments, the use of more environmentally friendly materials, and waste reduction.

### Cross-cutting Issues

**Renewable Thermal:** All new municipal buildings should be designed to be fossil fuel-free

**Climate Change Preparedness / Resilience:** Municipal building should remain in operation and serve as a resource to the community during emergency events

**Electric Transport:** The city may demonstrate leadership by installed EV charging station at municipal buildings

**Capacity / Local Carbon Fund:** This action builds capacity through demonstrated leadership and piloting new technology

# Actions 3 – Energy Supply

## 2015 Structure:

- Action 3.1 Low Carbon Energy Supply Strategy
- Action 3.2 Rooftop Solar Ready Requirement
- Action 3.3 Develop a MOU with Local Utilities

## 2021 Updated Structure:

- Action 3.1 Carbon-Free Energy Supply
- Action 3.2 On-site Renewable Electricity Access
  - Action 3.2.1 Rooftop Solar Requirements
  - Action 3.2.2 Community Solar Access
- Action 3.3 Off-site Renewable Electricity Access

# 3.1 Carbon-free Energy Supply

## Overview

Achieving net zero emissions and improving climate resiliency will require a significant shift from fossil fuel-based heating and hot water to low-carbon, renewable thermal systems. Specifically, this action will include continuing to support the electrification of individual buildings' heating and hot water systems, as well as enabling low-carbon district energy systems where suitable. In addition, the transition to renewable thermal will translate to changes in grid infrastructure and the gas network, and Cambridge should engage and lead on planning for an equitable, effective transition to renewable thermal energy supply.

## Contribution to Net Zero Objective

About half of the emissions attributed to the building sector are from fossil fuel use. Accordingly, transitioning buildings to renewable thermal systems will be an important part of achieving progress on Cambridge's Net Zero goals. Electrification, using heat pumps and heat pump water heaters, enables buildings to eliminate fossil fuel use, instead using electric systems that can be powered by renewable electricity. District energy will continue to play an important role in commercial and institutional hubs.

## Estimated Cumulative Emissions Reductions by 2050



## Key Activities

### Short Term (1-2 Years)

1. Continue to build the Cambridge Clean Heat Program and expand targeted outreach efforts
2. Expand support for multifamily building electrification
3. Engage with development teams and partner organizations on district energy
4. Engage the electric utility and building owners on deploying grid-interactive technologies
5. Identify possible demonstration projects for low-carbon microgrids

### Medium Term (3-5 Years)

6. Create a program to facilitate local district energy connections
7. Examine ways to ensure the uptake of low-carbon district energy by new buildings where feasible
8. Lead engagement with utility and state partners to understand infrastructure needs
9. Focus on Workforce Development
10. Engage building owners in expanding building to grid or grid interactive tech

### Long Term (5+ Years)

11. Use Community Choice Aggregation to provide new mechanisms for renewable thermal deployment
12. Ensure inclusion of renewable thermal in any rental or transaction-point renovation
13. Work with district energy system operators and legacy utilities to plan for decarbonized transition

## Equity: Flag

The City must take into account that the cost of district energy and renewable thermal energy systems may get passed on to consumers in the form of increased energy costs, creating a potential equity pitfall for the most vulnerable residents. There might also be inequities in access to renewable thermal technologies.

Equity benefits could come from lower or more stable energy costs. The City also has the potential to take advantage of positive equity impacts because district energy systems enhance localized, more reliable energy resources, which is of the greatest benefit to vulnerable households.

## Cross-cutting Issues

**Renewable Thermal Systems:** This action would be supportive of and have direct influence over the expansion of renewable thermal systems in the city

**Climate Change Preparedness / Resilience:** opportunity to move equipment out of flood-prone basements, these systems provide needed cooling during times of extreme heat.

**Electric Transport:** Limited

**Capacity / Local Carbon Fund:** Limited

## 3.2 On-site Renewable Electricity Access (Part 1)

### Overview

On-site renewable energy access is intended to promote on-site renewable energy systems and provide support to building owners who may install these types of systems. This may include rooftop photovoltaics (PV), solar thermal, battery storage or fuel cells – systems capable of supplying renewable electricity to the host building. This Action will have two tracks:

3.2.1 Rooftop Solar Requirements

3.2.2 Community Solar Access

### Contribution to Net Zero Objective

3.2.1 Rooftop Solar Requirements - The purpose of this requirement is to ensure that all new buildings, and in the future, existing buildings have access to on-site solar generation or could easily be retrofitted at a later date where feasible.

### Anticipated Annual GHG Reductions by 2050

While the installation of renewable electricity systems such as rooftop photovoltaic (PV) panels produces emissions-free electricity, emissions reductions from such projects are not included as contributing to the goals of the NZAP, as the RECs from these systems are likely to be traded and counted as emissions reductions elsewhere.

### Key Activities

#### Short Term (1-2 Years)

1. Study the potential to integrate a solar installation requirement with existing green roof requirements in collaboration with universities

#### Medium Term (3-5 Years)

2. Adopt a solar PV or solar thermal installation requirement for new buildings based on the feasibility study
3. Consider expanding solar ready requirement to existing buildings by applying the requirements for solar ready to major roof replacements.

#### Long Term (5+ Years)

4. Enhanced solar requirement: Determine means to increase on-site renewable generation requirements on existing buildings.

### Equity: Flag

The City must take into account that the costs of rooftop solar energy sources could get passed on in the form of increased energy and/or housing costs, creating one or more potential equity pitfalls.

The operational costs of renewable electricity are very low and can result in energy cost savings for vulnerable Cambridge residents, depending on the ultimate distribution of program costs and benefits. When paired with energy storage, rooftop solar is also more reliable.

### Cross-cutting Issues

**Renewable Thermal Systems:** Improved the costs-effectiveness of renewable thermal options

**Climate Change Preparedness / Resilience:** Strong overlap, enables greater access to on-site back-up power supply for when larger grid is down

**Electric Transport:** On-site renewables may serve as a source of energy for charging electric vehicles

**Capacity / Local Carbon Fund:** Carbon fund may be used to offset costs of solar installations.

## 3.2 On-site Renewable Electricity Access (Part 2)

### Overview

Community Solar Access: building off the solar initiatives undertaken to-date, Cambridge should pursue implementing a third-party administered on-site solar action initiative. The primary aim of this program will be to enable the installation of solar on underutilized existing roofs and to give more residents access to the economic and resilience aspects of solar electricity.

### Contribution to Net Zero Objective

3.2.2 Community Solar Access- The purpose of this action is to use market forces to add solar photovoltaics to existing buildings connecting developers to consumers who cannot add solar themselves.

### Anticipated Annual GHG Reductions by 2050

While the installation of community solar projects produces emissions-free electricity, emissions reductions from such projects are not considered to be contributing to the emissions reductions goals because it is uncertain where ownership of the RECs will lie.

### Short Term (1-2 Years)

1. Further design of solar administrator program, including function, structure, and funding
2. Implement community solar program based on program design

### Medium Term (3-5 Years)

3. Continue to expand access to on-site solar for all populations
4. Integrate program with Virtual Microgrid concepts

### Long Term (5+ Years)

5. Integrate with the enhanced community aggregation program

### Equity: Positive

The City has the potential to take advantage of positive equity impacts because community solar programs have the potential to reduce energy costs for participants who are unable to install solar on their own homes, and the customer receives a bill credit for the energy generated by their share. Access to community solar projects should be prioritized for vulnerable populations.

### Cross-cutting Issues

**Renewable Thermal Systems:** Improved the cost-effectiveness of renewable thermal options

**Climate Change Preparedness / Resilience:** Strong overlap, enables greater access to on-site back-up power supply for when larger grid is down

**Electric Transport:** On-site renewables may serve as a source of energy for charging electric vehicles

**Capacity / Local Carbon Fund:** Carbon fund may be used to offset costs of solar installations.

## 3.3 Off-site Renewable Electricity Access

### Overview

While energy efficiency and on-site renewable generation will contribute to buildings achieving net zero emissions, they are not enough on their own to achieve the net zero goals of the City. The dense urban context in Cambridge requires that off-site renewable electricity access be a part of the mix. Not all off-site renewable contracts have the same impact, however. When seeking to procure off-site renewables, it is necessary to adhere to certain criteria to have a positive impact. Under this action, criteria will be adopted more formally so that corporate entities and others have the guidance they need to enter into renewable power purchase agreements.

### Contribution to Net Zero Objective

This action is considered enabling and is designed to facilitate access to renewable energy resources when demand reduction, on-site renewables, and improvements to the state electricity grid are not adequate for meeting NZE performance targets.

### Estimated Cumulative Emissions Reductions by 2050



### Key Activities

#### Short Term (1-3 Years)

1. Formalize and adopt off-site RE criteria
2. Develop dual pathways for building owners to choose as a compliance option; City sponsored aggregation and VPPA pathway for corporate entities
3. Create a central repository of informational resources and technical support to address the questions and information needs of building owners and property managers.

#### Medium Term (3-5 Years)

4. Implement City-sponsored aggregation pathway for residences and small businesses

#### Long Term (5+ Years)

5. Integrate with Enhanced Community Aggregation Program

### Equity: Neutral

The City should be mindful that the cost of off-site renewable energy sources (if those resources turn out to be more costly) are likely to get passed on in the form of increased energy costs, creating a potential equity pitfall.

Alternatively, the low operational costs of renewable electricity can result in energy cost savings and less price volatility for vulnerable Cambridge residents. As the state-wide, region-wide, and nation-wide share of renewable energy grows, there is less need for existing or new fossil fuel resources which often disproportionately impact vulnerable populations.

### Cross-cutting Issues

**Renewable Thermal Systems:** Provides renewable electricity to electric-based equipment

**Climate Change Preparedness / Resilience:** Limited

**Electric Transport:** Helps reduce emissions by providing renewable electricity for charging vehicles

**Capacity / Local Carbon Fund:** Community aggregation may be a key vehicle for delivering off-site renewable electricity.



## Actions 4 – Financing and Capacity Building

### 2015 Structure:

- Action 4 Investigate Local Carbon Fund

### 2021 Updated Structure:

- Action 4.1 Local Carbon Fund (Enhanced Community Aggregation)

# 4.1: Local Carbon Fund (Enhanced Community Choice Aggregation)

## Overview

For Cambridge to become a net zero community, it will require an annual emissions balance across the entirety of the City's building stock. The primary goal of this action is to create a single point from which financial and technical resources may be deployed in order to support the emissions reductions in the other actions, thereby creating greater flexibility and coordination of compliance with those actions. The new approach to Community Choice Aggregation recommended here, also known as Aggregation 3.0, moves away from the boilerplate green energy business products of deregulated energy retailers and utilities towards a local ownership pathway allowing for widespread local deployment of DERs, and energy improvements including efficiency improvements and electrification.

## Contribution to Net Zero Objective

This action is considered essential for increasing the number of energy efficiency and electrification projects completed. To date the City, CEA, and Energy Advisor programs have had good results in engaging building owners in energy efficiency programs, but few projects have moved forward through completion. This action provides a mechanism by which projects, companies and individuals can achieve net zero emissions through having better access to energy efficiency and electrification resources and be able to participate in renewable energy purchasing programs.

## Anticipated Annual GHG Reductions by 2050

This action is considered an enabling action. By implementing this action and providing access to financing as well as capacity for building owners to take action on energy improvement projects, emissions reductions will be realized in Action 1.1, Action 1.2, Action 1.3, Action 2.1, and Action 3.3.

## Key Activities

### Short Term (1-2 Years)

1. Enhance CEA Support and Function
2. Generate list of financing options
3. Identify a pathway for establishing revolving loan fund
4. Program design - CCA 3.0 model development: clearly define responsibilities of the CEA, CCA, Solar Advisor with respect to financing/funding access and capacity building as well as level of interaction between the administrators.
5. Investigate acquiring State energy efficiency funds

### Medium Term (3-5 Years)

1. Reassess and develop the operational model for the CCA 3.0
2. Link relevant activities from other Actions

### Long Term (5+ Years)

1. Implement the CCA3.0 and establish the program as the primary vehicle for facilitating NZE for homeowners, renters and business owners by providing them access resources for demand reduction and electrification projects and accessing renewable energy resources

## Equity: Positive

The City has the potential to take advantage of positive equity impacts including:

- More energy efficient homes and businesses improve indoor comfort and air quality and lower energy bills
- More financing and funding for efficiency and electrification upgrades
- Energy aggregation purchasing programs enhance customer engagement
- Energy aggregation purchasing programs enhance customer investment and ownership structures
- Energy aggregation purchasing programs enhance flexibility

## Cross-cutting Issues

**Renewable Thermal Systems:** Encourage electrification as part of the energy efficiency programs

**Climate Change Preparedness / Resilience:** May be used to promote local on-site RE generation that could serve as backup power

**Electric Transport:** May be used to encourage the installation of charging infrastructure

**Capacity / Local Carbon Fund:** Building capacity is the primary purpose of this action

# 2021 NZAP Implementation

# Net Zero Task Force Priorities by Action

Cambridge Net Zero Action Plan

Adjusted Actions Ratings by Various Metrics of Interest

Action number	Type	Action	**GHG Impacts Rating	**Resilience Rating	**Other Co-benefits Rating	Summed Benefits Rating	*Avg Score (Consider.it)	***Equity Rating	TF Adjusted Ranking
1.2		Action 1.2 BEUDO Requirements	3	2	2	7	80	Flagged	1
4.1	Enabling	Action 4 Local Carbon Fund (Aggregation 3.0)	N/A	3	3	6	64	Positive	2
3.3	New	Action 3.3 Off-site Renewable Energy Access	3	1	2	6	62	Flagged	3
2.1		Action 2.1 Net Zero Requirements for New Construction	2	3	2	7	71	Flagged	4
2.2	New	Action 2.2 Address Embodied Carbon through Green Building	1	2	1	4	30	Neutral	5
1.3		Action 1.3 Upgrades at Transaction Points	2	3	3	8	39	Flagged	6
1.1		Action 1.1 Custom Retrofit Program	1	3	3	7	6	Positive	7
3.1		Action 3.1 Low Carbon Energy Supply	N/A	3	1	4	47	Positive	8
3.2		Action 3.2 On-site Renewable Energy Access	N/A	3	3	6	70	Neutral	9
3.2.1		Action 3.2.1 Rooftop Solar Requirement	1	3	3	7	49	Flagged	10

Notes:

\*Avg. Score (Consider.it Poll): Average priority score given in Consider.it by TF members

\*\*GHG Impact, Resilience and Other Co-benefits rated 1-3 with 3 having the highest positive impact, and 1 having lowest impact

\*\*\*Equity ratings: Positive > Action having a positive impact, Neutral > Actions that have neither positive or negative impact, Flagged > Should be designed to address equity concerns/opportunities

"N/A" indicates that that Action is enabling or supporting emissions reductions in another Action

# Key Partnerships

- City staff cannot achieve the Net Zero Emissions goals alone. The City will continue to work with the Net Zero Task Force members, City Council, and other stakeholders to ensure that the residents, institutions, and development community in Cambridge are not only consulted, but central to the implementation and evolution of the project over time. Other Key Partnerships include:
  - **Climate Protection Action Committee (CPAC)** – CDD staff will ensure that annual progress updates proceed and are reviewed by CPAC to ensure accountability and transparency.
  - **Resilient Cambridge** – The climate adaptation plan resulting from the Climate Change Preparedness and Vulnerability Assessment with a range of recommendations for buildings in Cambridge, including energy resilience
  - **Envision Cambridge** – The citywide plan adopted in 2019 centered on the core values of livability, diversity and equity, economic opportunity, sustainability and resilience, community health and wellbeing, and learning, which includes goals, indicators, and targets for climate and environment
  - **City Council Climate Crisis Working Group** – A group of community advocates and local and state climate experts working over the course of fall 2021 to provide a prioritized list of specific actions the City can take to address the urgent challenge of climate change

# Key Partnerships

- The NZAP Actions should also be assessed in regard to City control and where there is reliance and regional and state actors to achieve the Action goals. Partnerships and advocacy should be established with the appropriate institutions to accomplish the activities of each Action.

For example:

- **Action 1.1: MassSave** provides financial support and technical services for energy efficiency building and infrastructure improvements to Massachusetts residents and businesses
- **Action 2.1: The state building code** regulates energy use in new construction and is established by the Board of Building Regulations and Standards, building off of the International Energy Conservation Code
- **Action 3.2: The Department of Energy Resources** regulates incentives such as the Solar Massachusetts Renewable Target based on the Renewable Portfolio Standard adopted by the state legislature
- **Action 3.3: The Renewable Portfolio Standard** adopted by the state legislature governs the amount of renewable electricity which must be purchased by competitive electricity suppliers

# Program Governance

- The review of the NZAP Action every five years will continue as it is an important piece of the implementation of the plan, especially as the scientific guidance behind climate change adjusts, technologies evolve, and impacts occur.
- The implementation framework will continue to adhere to the NZAP principles

## **NZAP Principles:**

- Supports long-range healthy economic strategies as well as climate goals
- Uses market-based and data-driven analysis and decision making
- Commits to identifying and testing the best available policies, practices, and technologies, and supports an openness to new ideas when circumstances change
- Commits 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
- Commits to measuring and monitoring impact over time that leads to course corrections where required
- Ensures consultation is comprehensive and engages affected stakeholders, the general public, and subject matter experts
- Commits to developing informative and replicable models that will be shared with other
- Commitment to implementing the Net Zero Action Plan through a racial equity and social justice lens

# Program Tracking and Metrics

- In order to track progress more efficiently, a more robust system for reporting and tracking project-level performance data from all actions will be needed for residents, businesses, and program implementers to access and monitor performance

## Example: BEUDO Performance Tracking Metrics

	Metric	Unit of Measurement
NZAP Action 1.2: BEUDO Performance Requirements	Buildings Disclosing Energy Use	Number
	Square Footage of Buildings Disclosing Energy Use	SF
	BEUDO Portfolio Electricity Consumption	kWh
	BEUDO Portfolio Gas Consumption	Therms
	BEUDO Portfolio Emissions	MT GHG
	Buildings Disclosing Energy Use (all years)	Number
	Square Footage of Buildings Disclosing Energy Use (all years)	SF
	BEUDO Portfolio Electricity Consumption (all years)	kWh
	BEUDO Portfolio Gas Consumption (all years)	Therms
	BEUDO Portfolio Emissions (all years)	MT GHG

\*See Appendix C of the 2021 NZAP Report for Tracking Metrics for all Actions



# Estimated Impacts of Adjusted Actions (DRAFT)

## NZAP Model

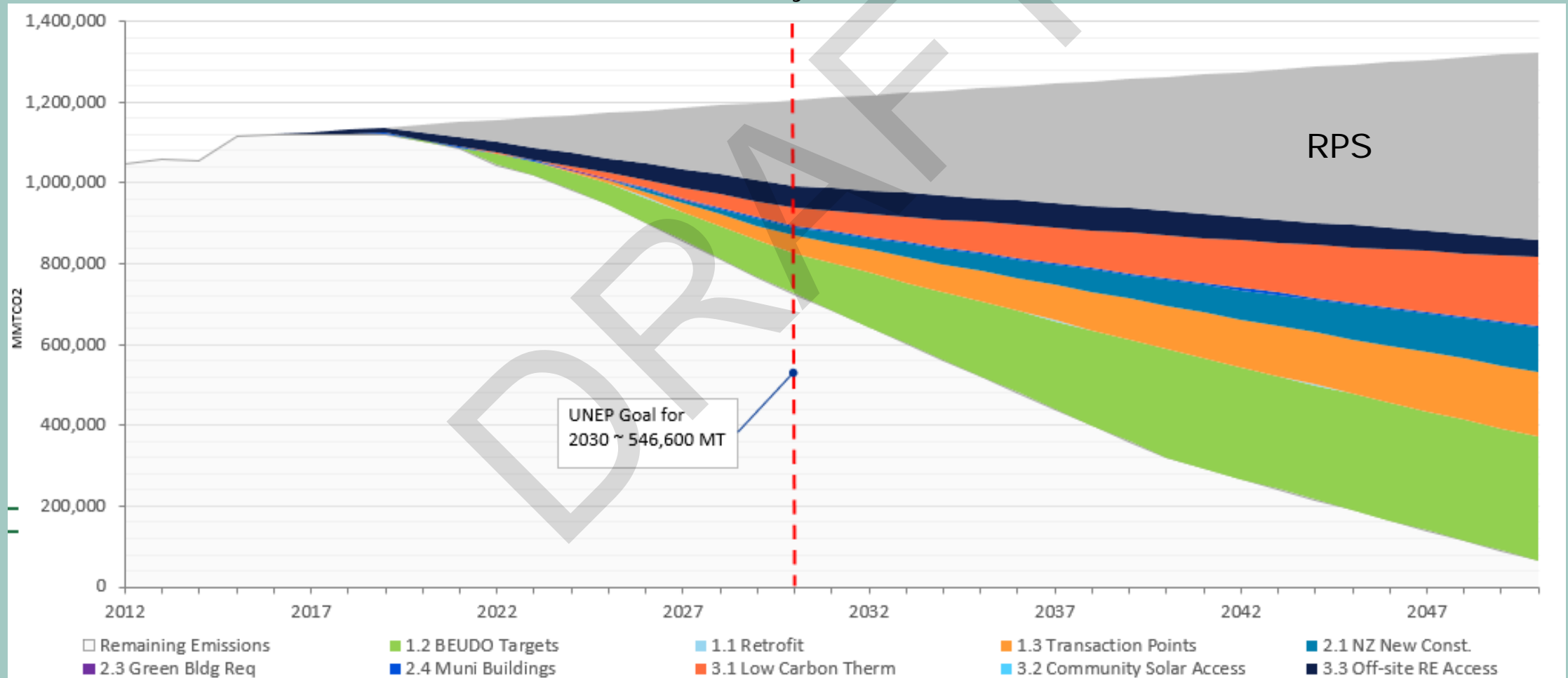
An Excel-based model was created to estimate the potential GHG reduction impacts of the NZAP Actions. The model uses the Community GHG inventory for buildings as a starting point, projects future increases due to population growth, and then models “wedge” reductions from that baseline based on a combination of state and local policies.

The model outputs can only be as accurate as the assumptions behind them, and the project team is still in the process of refining the model, so all results are currently in DRAFT form.

DRAFT

## Projected Emissions Reductions by Action: Baseline

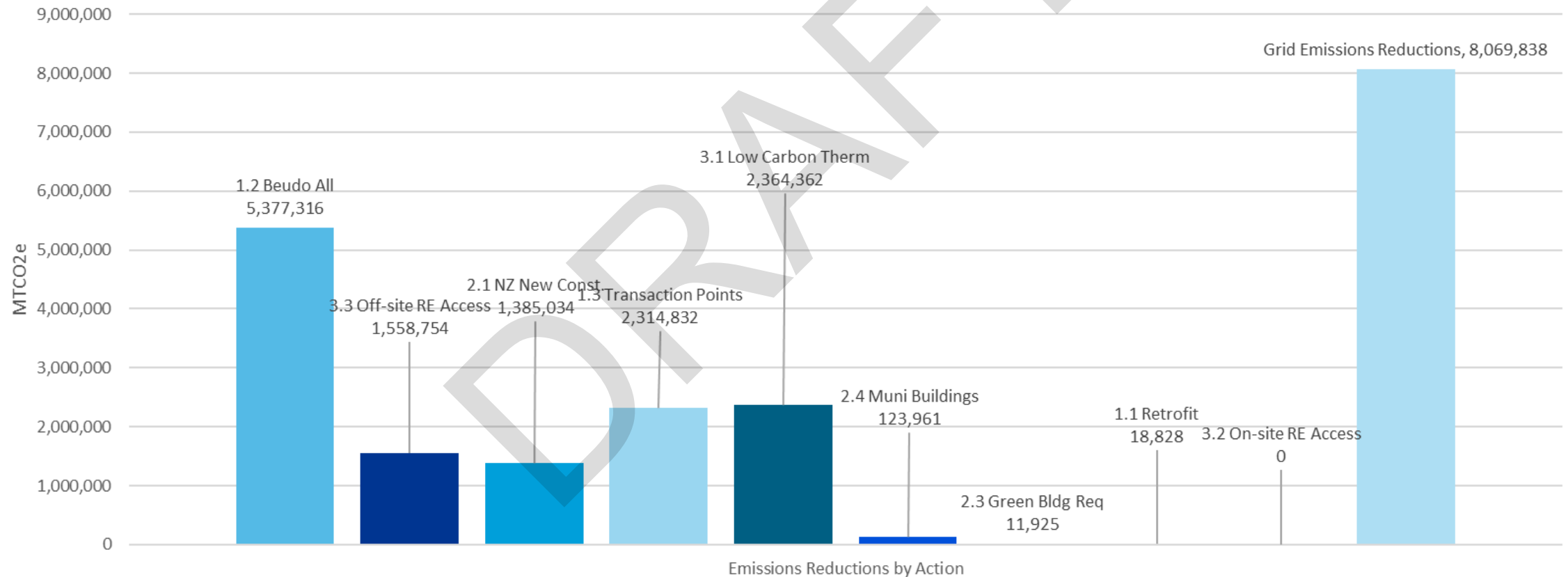
Under the baseline set of NZAP Actions, the largest emissions reductions come from the state RPS and BEUDO, and while the Net Zero Goal can be achieved by 2050 with this mix of Actions, the UNEP 1.5-degree Goal for 2030 will be missed unless emissions reductions are accelerated over the next 10 years



\*Gap in 2050 emissions is due to the way the inventory currently accounts for grid line losses and fugitive emissions, which would be eliminated by 2050

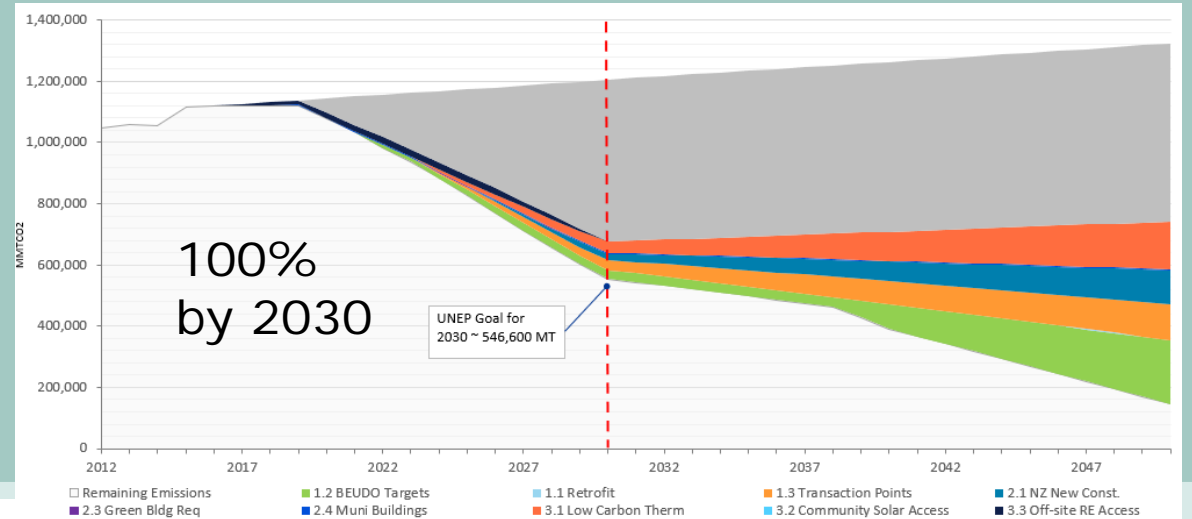
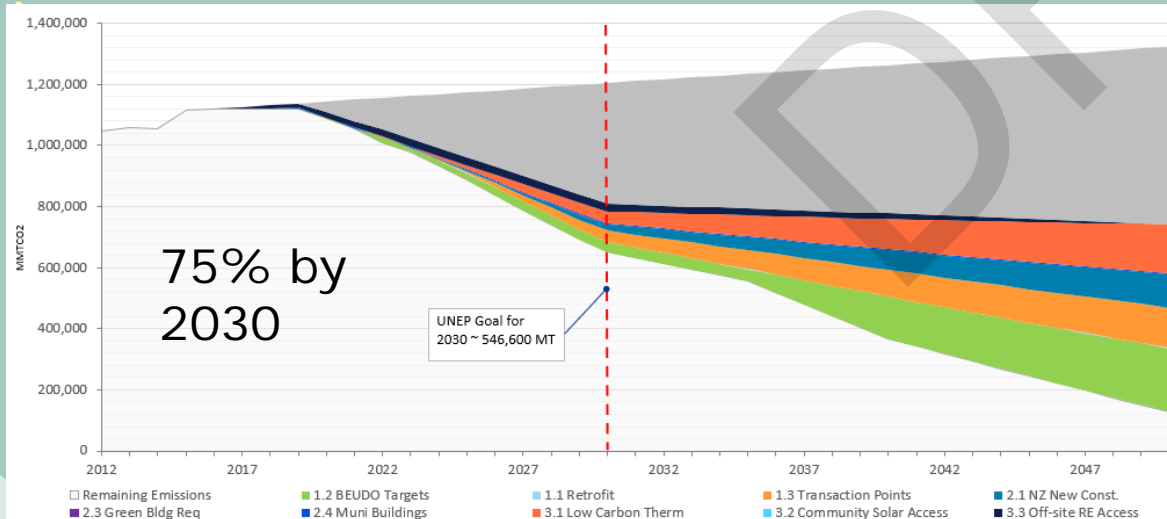
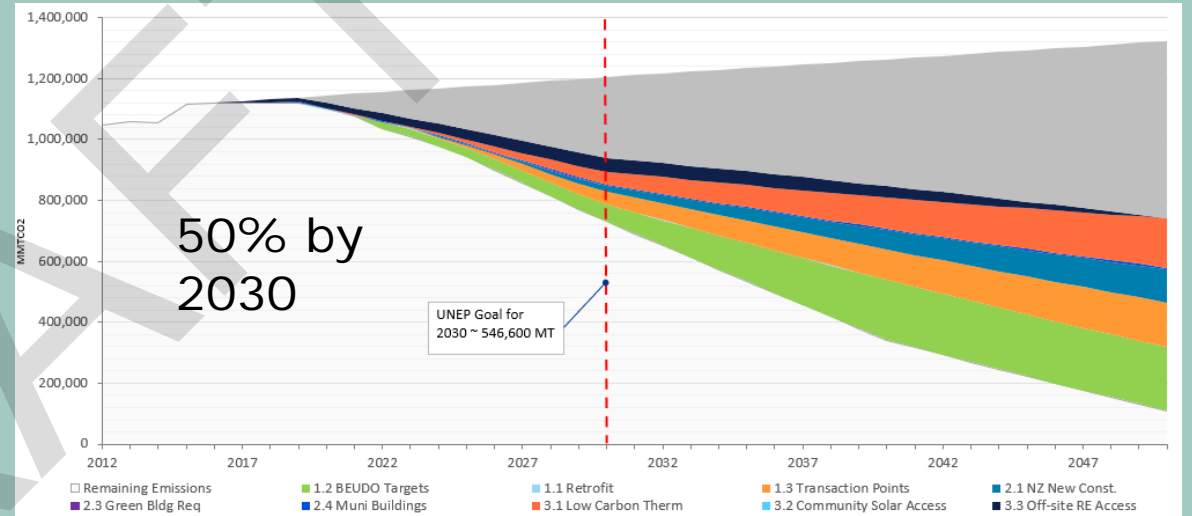
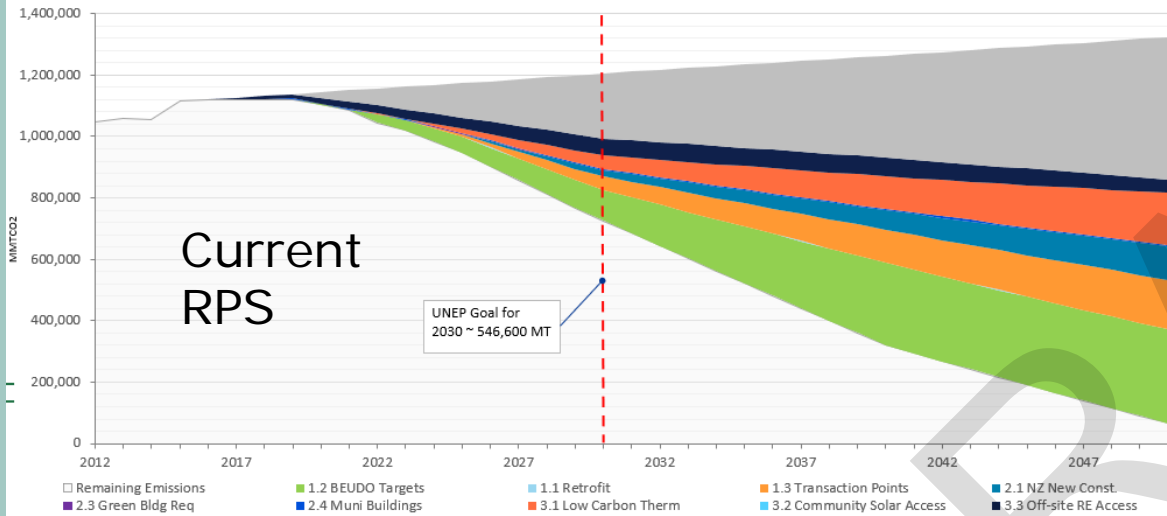
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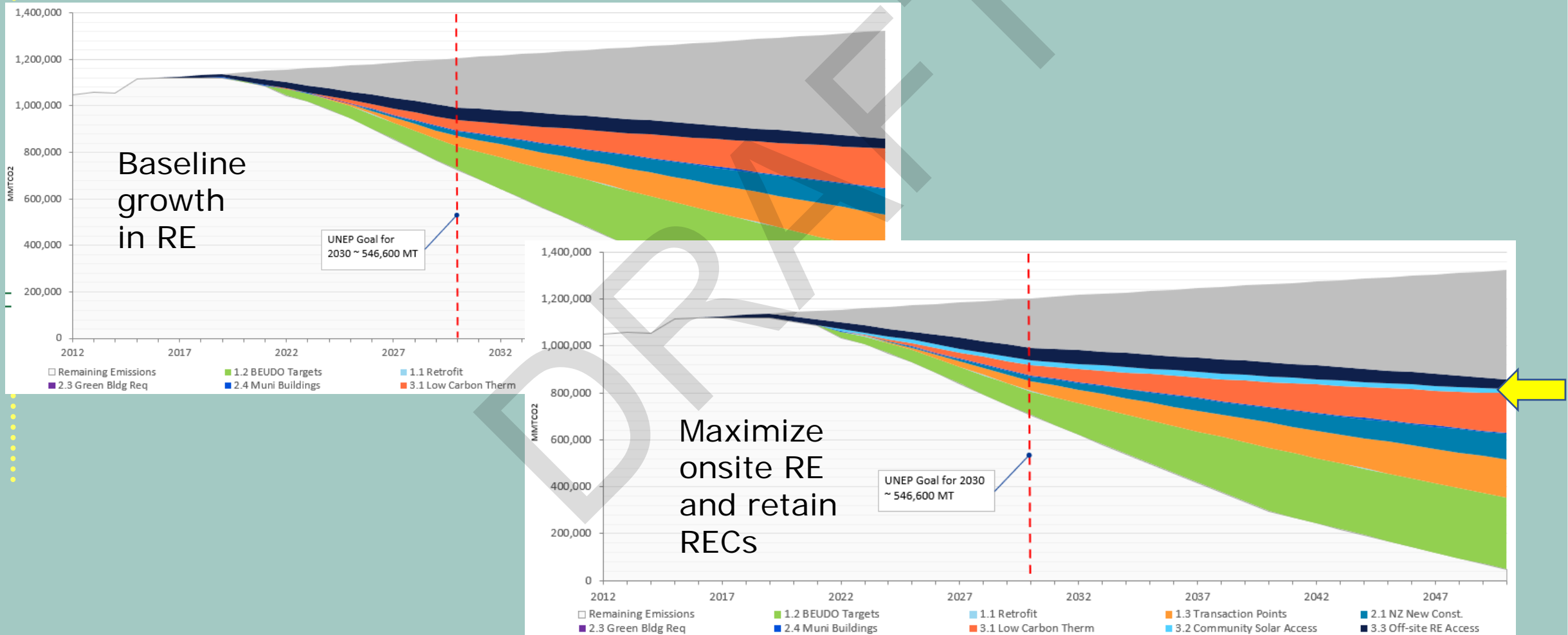
# Projected Emissions Reductions by Action: Alternatives

Increasing the pace of state-wide grid renewables initially cuts into BEUDO savings, but then drives increased reductions as it goes beyond BEUDO requirements. This outcome, however, is dependent on additional state action.



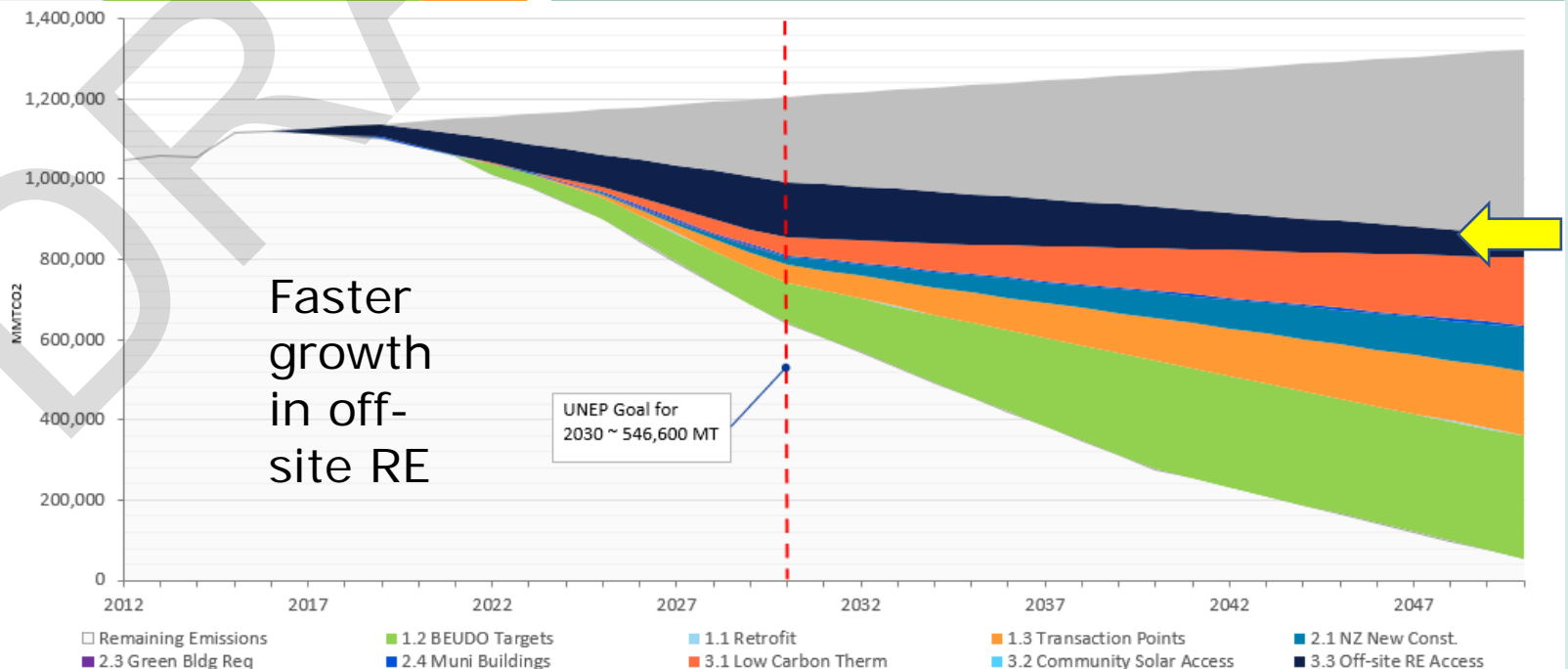
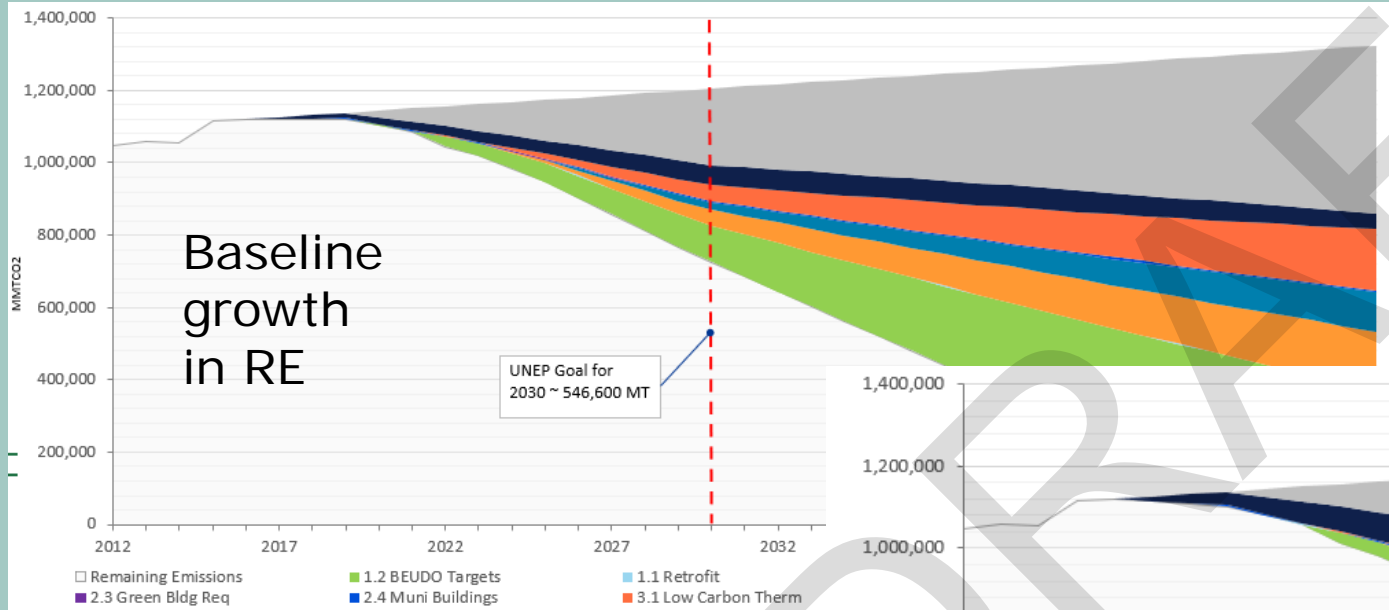
# Projected Emissions Reductions by Action: Alternatives

Given the limited roof space in Cambridge, even if on-site solar were maximized and a way to retain the RECs were devised, it would have a marginal impact on the emissions trajectory.



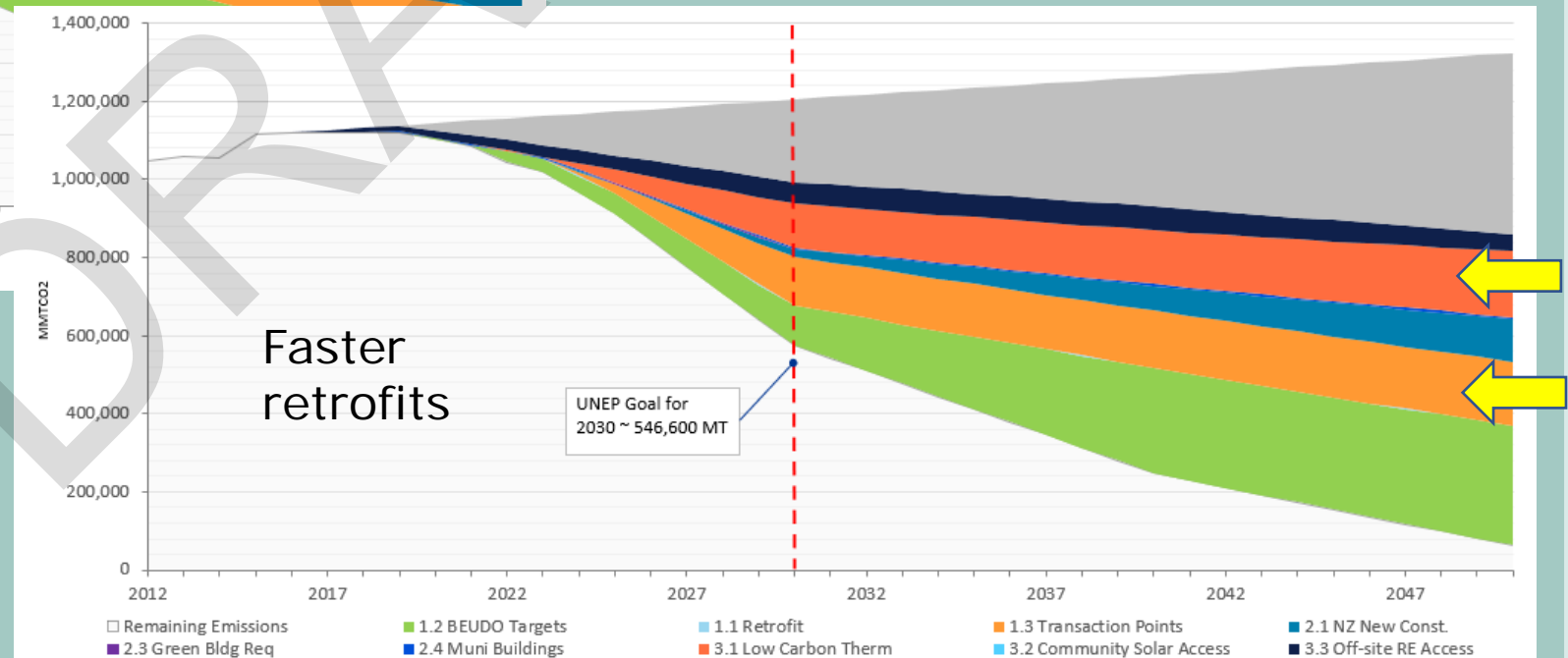
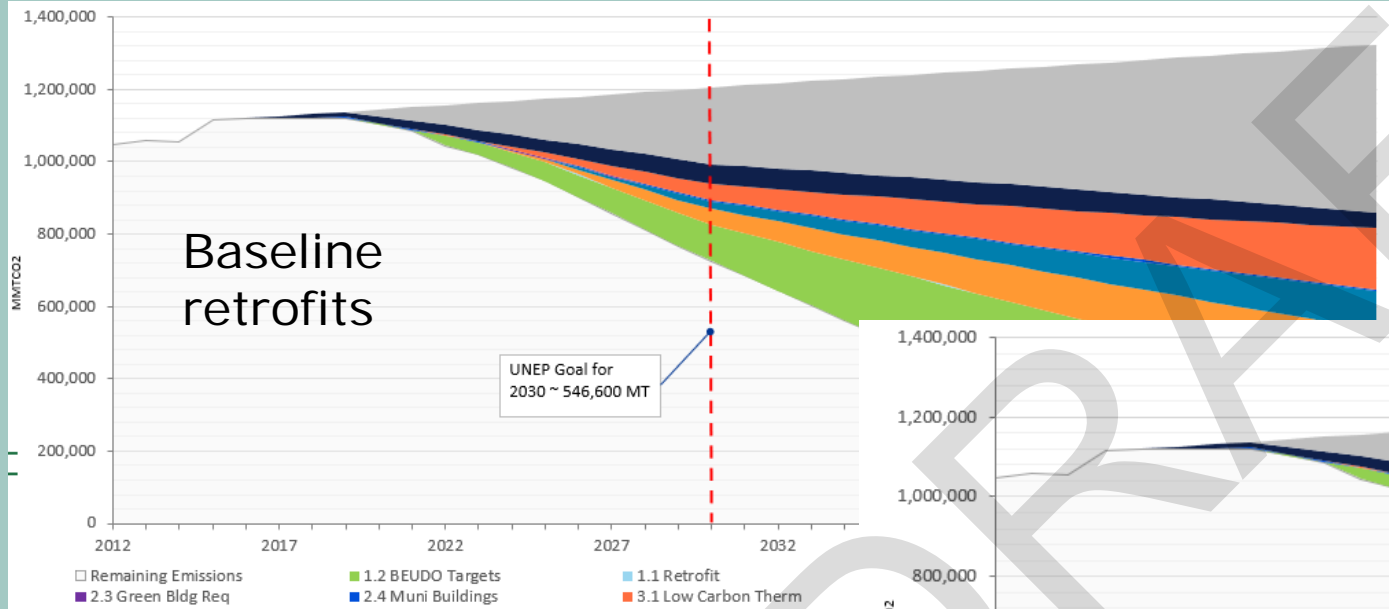
# Projected Emissions Reductions by Action: Alternatives

Procuring off-site RE faster than the state, however, has a notable impact by 2030. The wedge in the bottom chart represents the entire aggregation along with some large commercial accounts. The impact diminishes towards 2050 as the state RPS catches up.



# Projected Emissions Reductions by Action: Alternatives

Near-term savings could also be achieved by pursuing faster retrofits of residential and commercial non-BEUDO buildings through Actions 1.3 and 3.1, but the technical feasibility of this pace of retrofits is uncertain.







## Projected Emissions Reductions by Action: Alternatives

A combination of approaches may be the most likely means of meeting the 2030 target. This will require a coordinated effort to accelerate activity across multiple actions.

