



Thinking **BIG** & Small: **MULTI-BUILDING PLANNING FOR 2030**

THE CITY OF CAMBRIDGE MUNICIPAL FACILITIES IMPROVEMENT PLAN



LEARNING OUTCOMES

- Define achievable large and small-scale **energy, maintenance, and accessibility goals** encompassing large building portfolios.
- Establish **strategies for collaborative design process** and understand how to prioritize projects over a long-term planning time-frame.
- **Set project energy targets** and understand planning for net zero emissions, and the difference between net zero energy vs. emissions.
- Identify areas for **building standardization** to reduce maintenance costs and understand how to develop metrics to define success and track progress.

What do you do?

 Respond at PollEv.com/nedcollier051

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“The goal of the *Municipal Facilities Improvement Project* is to use **whole building thinking** to define a plan for the City of Cambridge to provide and maintain high-performance buildings for staff, occupants, the public and the environment.”

WHOLE BUILDING THINKING

The philosophy of looking at a **building as a series of interrelated systems** and buildings as part of an integrated portfolio.

A high performance building is low carbon and energy efficient, and also provides:

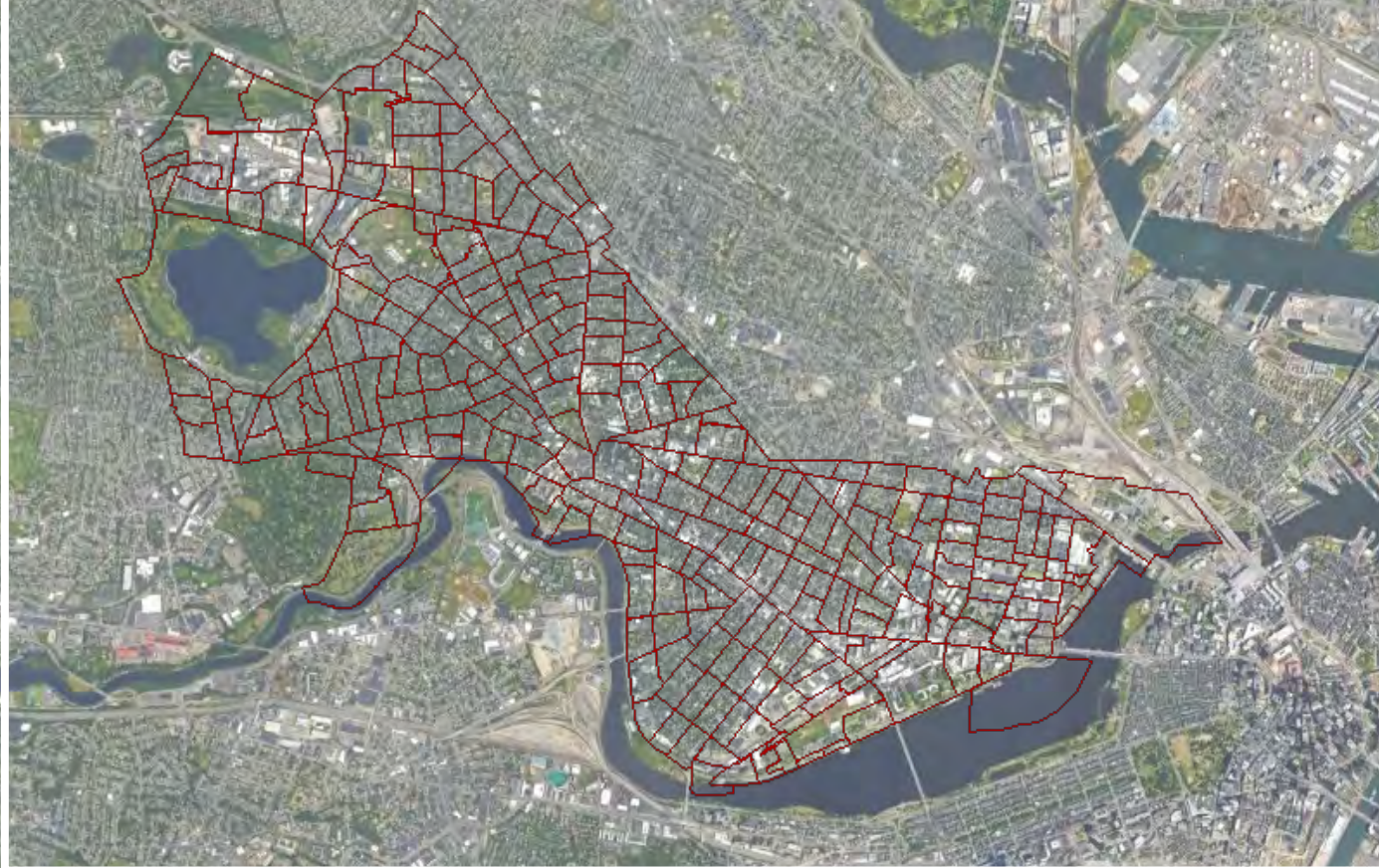
A comfortable, healthy indoor environment,

Resiliency,

Ease of maintenance, and is

Responsive to the larger community it serves.

CAMBRIDGE, MA



CAMBRIDGE GETTING TO NET ZERO TASK FORCE

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).*

Key Actions

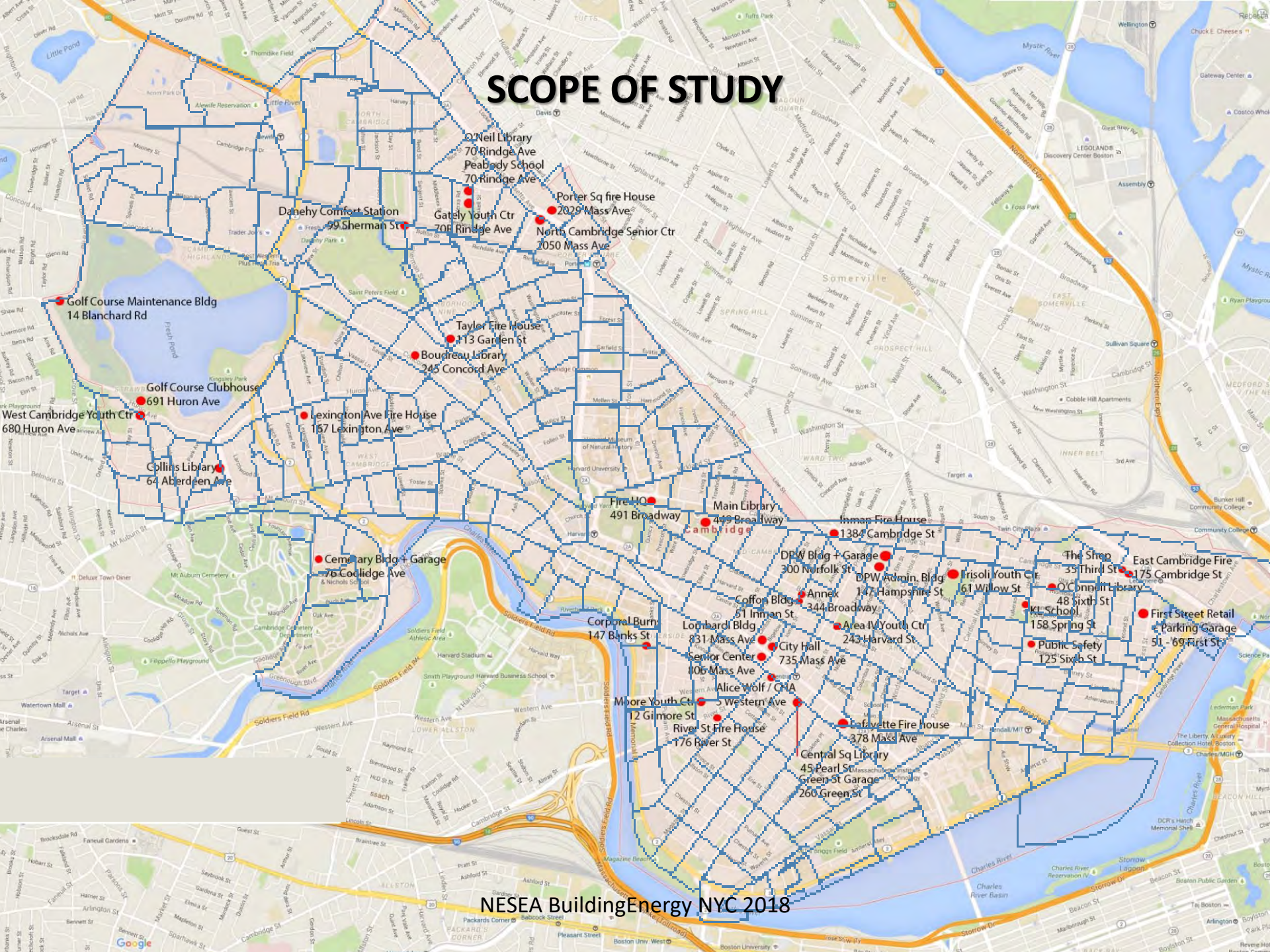
The proposed actions to meet the net zero objective are categorized into five key areas:

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)**

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



SCOPE OF STUDY



NESEA BuildingEnergy NYC 2018

MUNICIPAL FACILITIES FRAMEWORK + ASSESSMENT

Workshops

to articulate priorities, assessment criteria, goals and metrics to develop a holistic assessment framework.

Framework

scoring criteria and comprehensive building assessment form.

Assessment

of City municipal building portfolio through document review, preliminary site visits, occupant survey, benchmarking & energy analysis.

WORKSHOPS PHASE



Workshop 1: Visioning & Goal Setting



Workshop 2: Regulatory & Community



Workshop 3: Environmental



Workshop 4: Priorities



DETERMINING THE FRAMEWORK

ELEMENTS OF THE VISION

- LEAD IN LONG-TERM THINKING
 - EASY TO MAINTAIN/OPERATE
 - SIMPLICITY & PASSIVE DESIGN
 - CONSIDER LONG-TERM RESOURCE NEEDS
- COORDINATED APPROACH TO DESIGN
 - USE VISION TO LEARN
- MAINTAIN COMMUNICATION BETWEEN DESIGNERS, OPERATORS, TENANTS
 - CONSTRUCTING/OTHER TOOLS
- SET UP FRAMEWORK OF GOALS & BENCHMARKS
 - LONG-TERM STRATEGIC PLAN

VISION

COMMUNITY VALUES

- #2 ASSESS WHAT CITIZENS DESIRE IN THEIR MUNICIPAL BLDG.
- #1 ACCESSIBILITY IN ALL WEATHER
- #1 USER FRIENDLY
- #2 VIRTUAL KIOSK/INTERACTIVE BY 2018
- #2 PROXIMITY TO CITIZENS
- MULTIPLE USES IN FACILITIES (SCHOOLS, CC + PUBLIC RESOURCE)
 - 12 MONTH OCCUPANT RESILIENCY

VALUES

Operations & Maintenance

Good	Better	Best
Easy to request an item service and prompt response	Proactive maintenance in all areas	Advanced automated onsite reporting and dedicated onsite staff or resource
One bldg occupies a one-time survey	Repeat survey regularly and set goals based on occupant satisfaction	
Maintenance staff be trained in current technology	Continuing training	Maintenance staff be training for new technologies, codes, and standards
	Consistent equipment specifications and standards	Staff helpdesk, influence & implement specifications

OPERATIONS & MAINTENANCE

INDOOR ENVIRONMENTAL PERFORMANCE

- TEMP. HVAC
 - COMFORT IDEAL TEMPS
 - MOIST/SEPARATE ZONES FOR BETTER COMFORT
 - By 2024 - All buildings with good Commission 1000
 - TEMPERATURE 68-72 FRESH AIR VOLUME 15 CFM PER PERSON
- COMFORT
 - WARM SPACE / FRESH SPACE
 - INCREASED SENSORY AND SAFETY
- LIGHTING
 - By 2024 - All buildings with good Commission 1000
 - By 2024 - All buildings with good Commission 1000
 - By 2024 - All buildings with good Commission 1000
- ACOUSTICS
 - By 2024 - All buildings with good Commission 1000
 - By 2024 - All buildings with good Commission 1000
 - By 2024 - All buildings with good Commission 1000

INDOOR ENVIRONMENT

FIRE

- GOOD: All building occupants know exits
- BETTER: All building occupants have a plan & resources
 - Materials are safe for 10' Resurgers
- BEST

FIRE

- LIFE SAFETY
 - Healthy air, water, light, materials
 - Security Systems

LIFE SAFETY ACCESSIBILITY

- GOOD: Meet ADA code
- BETTER
- BEST: Universal design - all can use all buildings
 - Public should have easy access to info on IT & City procedures

CO₂/GHG REDUCTION

- 2010 - 2030 - 2050
- 2008 - 2015 8% ENERGY REDUCTION
- 25-30% ENERGY REDUCTION
- BEHAVIORAL CHANGES
 - UNPLUG/FOROFF
 - CONVEYANCE DESIGN
- 5% ENERGY REDUCTION

CO₂/GHG REDUCTION

- DATA FEEDBACK OPPORTUNITIES?
 - 30% LIGHTING LED/DIMMING SAVINGS (50%)
 - 15% DESIGN TO NEEDED LIGHT LEVELS
 - TASK LIGHTING Renewable Energy Supply
 - on site/off site
 - zero net energy: new
 - 40% HVAC
 - 5% ENERGY REDUCTION
 - FULL-ENVELOPE UPGRADES

RESILIENCE

- GOAL 1: Adequate emergency shelter
 - GOOD: 1 Shelter
 - BETTER: Strategically located shelters
 - BEST: All multi building/emergency shelter
- GOAL 2: Buildings withstand climate change + natural causes
 - GOOD: Disconnected buildings (cases to withstand flooding, power outage)
 - BETTER: Fuel cell backup generator
 - BEST: On-site power generation (fuel cells)
- GOAL 3: Changing needs of the City buildings
 - GOOD: Open Plan per building for change
 - BETTER: Minor alterations (flexible infrastructure included)
 - BEST: Changing one building's function to another

RESILIENCE

Historic GOALS

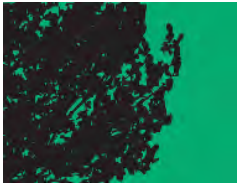
- #1 PRESERVE EXT CHARACTER
- #2 ACHIEVE HVAC COMFORT 40 CHANGE IN EXT
- #2 IMPROVE ENERGY EFFICIENCY
- #1 INCORPORATE INT. ARCH. FEATURES TO GREATEST EXT POSSIBLE
- #3 FUNCTIONALITY
- #1 INVENTORY OF BUILDINGS BY 2020
- #1 ESTABLISH STANDARDS OF MAINTENANCE FOR HISTORICAL FEATURES EXT + INT
- #2 SUSTAIN COMFORTABLE ENVIRONMENT

HISTORICAL GOALS

ASSESSMENT FRAMEWORK



Energy



GHG Emissions



Historic Preservation



Accessibility



Building Systems



IEQ



Fire & Life Safety

Any questions on the FRAMEWORK?

 Respond at PollEv.com/nedcollier051

Top

BUILDING ASSESSMENT PHASE



ALICE K. WOLF CENTER



AREA IV YOUTH CENTER



CITY HALL



CITY HALL ANNEX



COFFON BUILDING



DPW GARAGE



CENTRAL SQUARE BRANCH LIBRARY



GREEN STREET GARAGE



FIRE DEPARTMENT HEADQUARTERS



FRESH POND GOLF GARAGE



CITY HALL



FRESH POND GOLF CLUBHOUSE



HEALY PUBLIC SAFETY BUILDING



INMAN STREET FIREHOUSE



NORTH CAMBRIDGE SENIOR CENTER



PORTER SQUARE FIRE HOUSE



KENNEDY LONGFELLOW SCHOOL



LOMBARDI BUILDING



MAIN LIBRARY



WEST CAMBRIDGE YOUTH CENTER



FRISOLI YOUTH CENTER



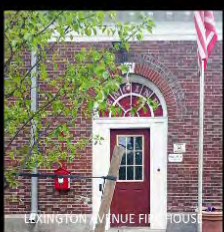
DPW ADMINISTRATION BUILDING



TAYLOR SQUARE FIRE HOUSE



BOULEVARD BRANCH LIBRARY



LEXINGTON AVENUE FIRE HOUSE



O'CONNELL BRANCH LIBRARY



MOORE YOUTH CENTER



RIVER STREET FIREHOUSE



DANEHY PARK COMFORT STATION



LAFAYETTE SQUARE FIREHOUSE



CEMETARY CHAPEL



CAMBRIDGE ELECTRICAL SHOP



CORPORAL BEANS BUILDING



PEABODY/RINGE AVE UPPER SCHOOLS



CITY YOUTH CENTER



FIRST STREET PARKING GARAGE



EAST CAMBRIDGE FIREHOUSE



CEMETARY ADMINISTRATION



O'NEILL BRANCH LIBRARY




CEMETARY GARAGE

SCORING SYSTEM

worst ← → best

Numerical Score:	-3	-2	-1	0	1	2	3
Energy Efficiency (kBtu/sf/yr) GHG emissions (m tCO ₂ e/sf)	Performing > 75% above MFIP portfolio	Performing 50-74% above MFIP portfolio	Performing 25-49% above MFIP portfolio	Performing at median of MFIP portfolio	Performing 25-49% MFIP portfolio	Performing > 50% below MFIP portfolio	Carbon Neutral in operation (site)
Historic Preservation	Historic features in poor repair and/or covered up/removed	X	Limited Historic features in poor repair and/or covered up/removed	N/A - not a historic building/no historic features	Limited Historic features in good condition	Extensive Historic features in good condition	Historic designation & extensive features in good condition
Accessibility	Conditions prevent access to building or program	X	Conditions allow access by nonstandard means	Conditions allow access but program not fully accessible	Building and programs fully accessible	Fully accessible with aspects of Universal Design present	Universal Design
Indoor Environmental Quality	Very Dissatisfied	Dissatisfied	Somewhat Dissatisfied	Neutral	Somewhat Satisfied	Satisfied	Very Satisfied
Building Systems	Immediate life safety risks or code compliance issues	High priority non-functional or immediate operational risks	Beyond design life, performance and/or system efficiency compromised	Operational and adequate for current use	Operational and adequate for current use; installed recently & in	Operational and functioning with efficiency and/or flexibility of use	Operating to the City's highest standards
Fire and Life Safety	Systems missing or hazardous condition in fire situation	Systems present but incomplete or non-functional	Systems present but not well maintained	Systems present and compliant	Systems present and maintained	Systems present and maintained + FP of emergency systems	Systems beyond what is required

ASSESSMENT FORM

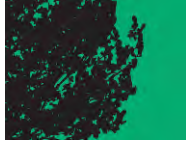
Cambridge Municipal Facilities Portfolio Assessment			
Building Data			
Global Building Data		Responses	
Building Name	Main Library		
Address	449 Broadway		
Facility Manager	Warren Pearson		
Building Image			
Year of original construction	1888		
Year of last major renovation	2006		
Area (gross square feet)	277,185		
Number of stories, total	4		
Number of stories, occupied	4		
Occupancy Category	Assembly		
Total occupants	78	current # of people	max # of people
Are there tenants other than government employees?	Yes	No	
Hours of operation	M-Th 9am Fr-Sa 9am Su 1pm (Sep-Jun)	Start Time	M-Th 9pm Fr-Sa 5pm Su 5pm (Sep-Jun) End Time
Site Visit Information		Responses	
Relevant existing drawings available?	Yes	No	
Does the surveying team have them?	Yes	No	
Survey to verify data completed?	Yes	No	
Date of visit	3/14/2018		
Estimated % of building visited	50-88 %		
Visit made by	Aaron Einck, Mike DiMascio, Alex Stockstrom, Ethan Grossman, Thomas Shouler		
Building History			
Significant alterations or additions	Completed	Outstanding	None
Significant damage or repairs	Completed	Outstanding	None
Hazardous materials or abatement measures	Completed	Outstanding	None
Observations			

1. Building data
2. Façade and exterior structures
3. Interior finishes
4. Historic preservation
5. Accessibility
6. Structural systems
7. IEQ
8. Mechanical systems
9. Electrical systems
10. Plumbing systems
11. Fire & life safety systems

METHODOLOGY



Energy



GHG Emissions



**Historic
Preservation**



Accessibility



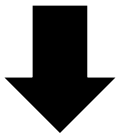
**Building
Systems**



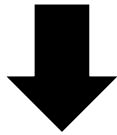
IEQ



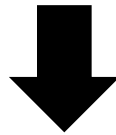
**Fire &
Life
Safety**



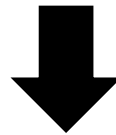
**2015 Data
FirstView**



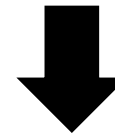
**2015
Data**



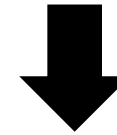
**Site
Observation**



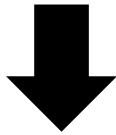
**Site
Observation**



**Site
Observation**



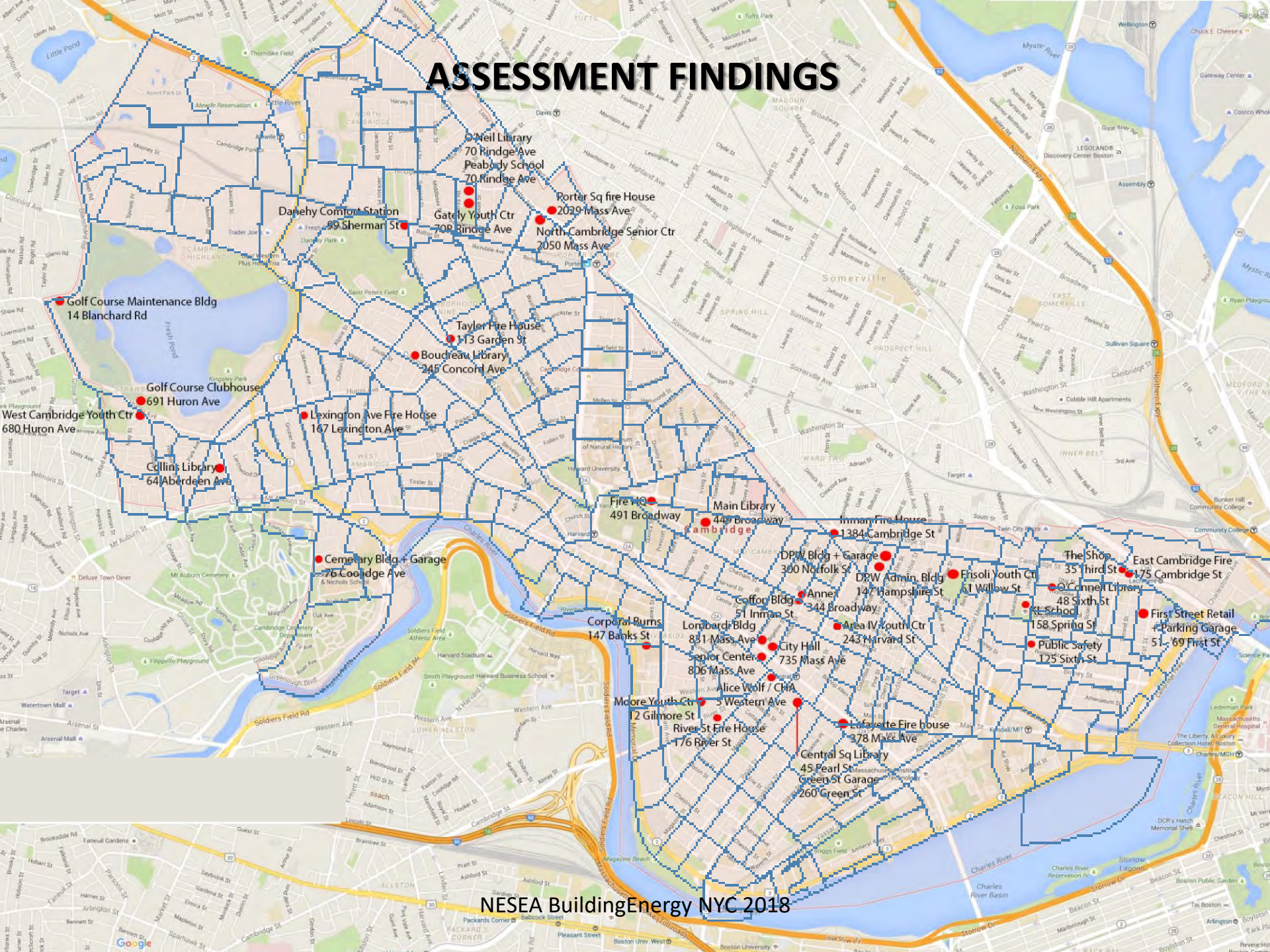
**Occupant
Survey**



**Site
Observation**

- **Site visits by Arup & ICON**
- **FirstView energy analysis by NBI**
- **Occupant surveys by Center for the Built Environment, Univ. of Berkeley**

ASSESSMENT FINDINGS



Score System

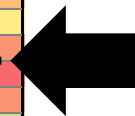
-3	-2	-1	0	1	2	3
worst <				> best		

Typology	Area (sq ft)	Historically Significant?	Community Use?	Weighted Overall Score	Assessment Categories						
					2015 EUI (kBtu/sf/yr)	2015 GHG (CO2e/sf/yr)	Historic Preservation	Accessibility	IEQ	Building Systems	Fire and Life Safety
Other	1,923	Yes	No	-2	-2	-2	1	-3		0	-3
Office	2,874	Yes	Yes	-2	-2	-2	1	-3	1	0	-3
Office	3,591	Yes	No	-2	1	0	-1	-3		-1	-3
Garage	1,830	No	Yes	-2	-2	-2	1	-1		0	-3
School	127,302	No	Yes	-2	0	0	0	-3	-1	0	-3
Other	8,418	Yes	No	-2	2	2	-2	-3	-1	-2	-3
Office	11,542	No	No	-1	-1	0	0	-3	1	0	-3
Public Safety	17,093	No	No	-1	-1	0	0	-3	-1	0	-1
Public Safety	11,213	Yes	No	-1	0	0	1	-3	0	0	-3
Public Safety	30,389	Yes	Yes	-1	0	0	0	-2	0	0	-3
Other	4,610	Yes	Yes	-1	-2	-1	-1	0	0	0	0
Other	1,696	No	Yes	-1	-1	-2	0	-2	2	1	-2
Office	12,550	No	Yes	-1	-1	0	0	-2	0	1	-2
Public Safety	19,080	Yes	No	-1	0	0	1	-3	-1	0	-1
Public Safety	6,525	Yes	No	-1	0	0	1	-3	2	0	-3
Office	21,808	Yes	Yes	-1	-1	-1	1	0	0	0	-2
Garage	44,547	No	No	-1	-1	0	1	-2	-1	0	0
Library	3,300	Yes	Yes	-1	0	0	2	-1	0	0	-3
Youth Center	19,405	No	Yes	-1	-1	-1	0	-1	0	0	1
Public Safety	9,643	Yes	No	0	0	1	2	-3	1	0	-2
Public Safety	16,728	Yes	No	0	1	2	2	-3	-1	0	-2
Youth Center	20,059	No	Yes	0	-1	-1	0	0	1	0	1
Office	31,240	Yes	Yes	0	1	1	1	0	0	0	-3
Office	33,909	Yes	Yes	0	0	0	1	-1	0	1	-1
School	108,989	Yes	Yes	0	0	0	0	-1	1	1	0
Public Safety	16,187	Yes	No	0	-1	0	2	-3	1	1	1
Library	277,185	Yes	Yes	0	-1	-1	2	1	1	1	-2
Office	61,731	Yes	Yes	0	0	0	3	-1	0	0	-1
Public Safety	162,547	No	Yes	0	0	-1	0	1	0	1	0
Other	8,909	No	Yes	0	2	2	1	-1	-1	0	-2
Library	6,427	Yes	Yes	1	0	1	2	0	2	0	-3
Library	1,955	No	Yes	1	2	2	0	0		0	-2
Youth Center	10,537	Yes	Yes	1	0	0	0	1	0	0	1
Youth Center	31,586	No	Yes	1	0	0	0	1	1	1	-1
Garage	378,000	No	Yes	1	2	2	1	-1		0	-2
Library	15,447	No	Yes	1	2	2	1	-2	0	0	-1
Senior Center	27,999	Yes	Yes	1	-1	-1	1	1	1	1	1
Youth Center	14,837	No	Yes	1	2	2	1	-2	1	0	0
Library	4,566	Yes	Yes	1	0	1	0	0	1	1	1
Senior Center	3,623	No	Yes	1	2	2	0	0	1	0	-1
Other	4,319	No	No	1	2	2	0	1	2	0	-1
Garage	110,884	No	Yes	1	2	2	0	1		0	1
Office	58,318	Yes	Yes	1	1	1	2	1	1	1	0
Average Score for City of Cambridge Portfolio				0	0	0	1	-1	0	0	-1

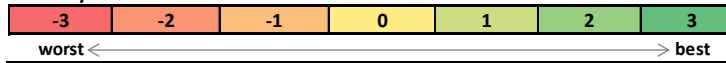
30 of 43 bldgs (70%)
scored negative or
neutral

13 bldgs scored +1

0 bldgs scored +2 or +3



Score System



Typology	Area (sq ft)	Historically Significant?	Community Use?	Weighted Overall Score	Assessment Categories						
					2015 EUI (kBtu/sf/yr)	2015 GHG (CO2e/sf/yr)	Historic Preservation	Accessibility	IEQ	Building Systems	Fire and Life Safety
Other	1,923	Yes	No	-2	-2	-2	1	-3		0	-3
Office	2,874	Yes	Yes	-2	-2	-2	1	-3	1	0	-3
Office	3,591	Yes	No	-2	1	0	-1	-3		-1	-3
Garage	1,830	No	Yes	-2	-2	-2	1	-1		0	-3
School	127,302	No	Yes	-2	0	0	0	-3	-1	0	-3
Other	8,418	Yes	No	-2	2	2	-2	-3	-1	-2	-3
Office	11,542	No	No	-1	-1	0	0	-3	1	0	-3
Public Safety	17,093	No	No	-1	-1	0	0	-3	-1	0	-1
Public Safety	11,213	Yes	No	-1	0	0	1	-3	0	0	-3
Public Safety	30,389	Yes	Yes	-1	0	0	0	-2	0	0	-3

There is work to be done to achieve the City's goals of providing and maintaining high performance buildings & goals for ghg emissions, renewable energy, accessibility, and resilience

Other											
Other											
Office											
Public Safe											
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Garage											
Library											
Youth Cen											
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Average Score for City of Cambridge Portfolio

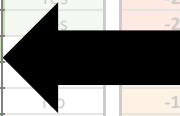


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Library	3,300	Yes	Yes	-1	0	0	2	-1	0	0	-3
Youth Center	19,405	No	Yes	-1	-1	-1	0	-1	0	0	1
Public Safety	9,643	Yes	No	0	0	1	2	-3	1	0	-2
Public Safety	16,728	Yes	No	0	1	2	2	-3	-1	0	-2
Youth Center	20,059	No	Yes	0	-1	-1	0	0	1	0	1
Office	31,240	Yes	Yes	0	1	1	1	0	0	0	-3
Office	33,909	Yes	Yes	0	0	0	1	-1	0	1	-1
School	108,989	Yes	Yes	0	0	0	0	-1	1	1	0
Public Safety	16,187	Yes	No	0	-1	0	2	-3	1	1	1
Library	277,185	Yes	Yes	0	-1	-1	2	1	1	1	-2
Office	61,731	Yes	Yes	0	0	0	3	-1	0	0	-1
Public Safety	162,547	No	Yes	0	0	-1	0	1	0	1	0
Other	8,909	No	Yes	0	2	2	1	-1	-1	0	-2
Library	6,427	Yes	Yes	1	0	1	2	0	2	0	-3
Library	1,955	No	Yes	1	2	2	0	0		0	-2
Youth Center	10,537	Yes	Yes	1	0	0	0	1	0	0	1
Youth Center	31,586	No	Yes	1	0	0	0	1	1	1	-1
Garage	378,000	No	Yes	1	2	2	1	-1		0	-2
Library	15,447	No	Yes	1	2	2	1	-2	0	0	-1
Senior Center	27,999	Yes	Yes	1	-1	-1	1	1	1	1	1
Youth Center	14,837	No	Yes	1	2	2	1	-2	1	0	0
Library	4,566	Yes	Yes	1	0	1	0	0	1	1	1
Senior Center	3,623	No	Yes	1	2	2	0	0	1	0	-1
Other	4,319	No	No	1	2	2	0	1	2	0	-1
Garage	110,884	No	Yes	1	2	2	0	1		0	1
Office	58,318	Yes	Yes	1	1	1	2	1	1	1	0

24 of 43 buildings (56%) are identified as Historically Significant, which speaks to the age of the building stock



Average Score for City of Cambridge Portfolio

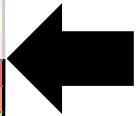
0	0	0	1	-1	0	0	-1
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Score System

-3	-2	-1	0	1	2	3
worst <						> best

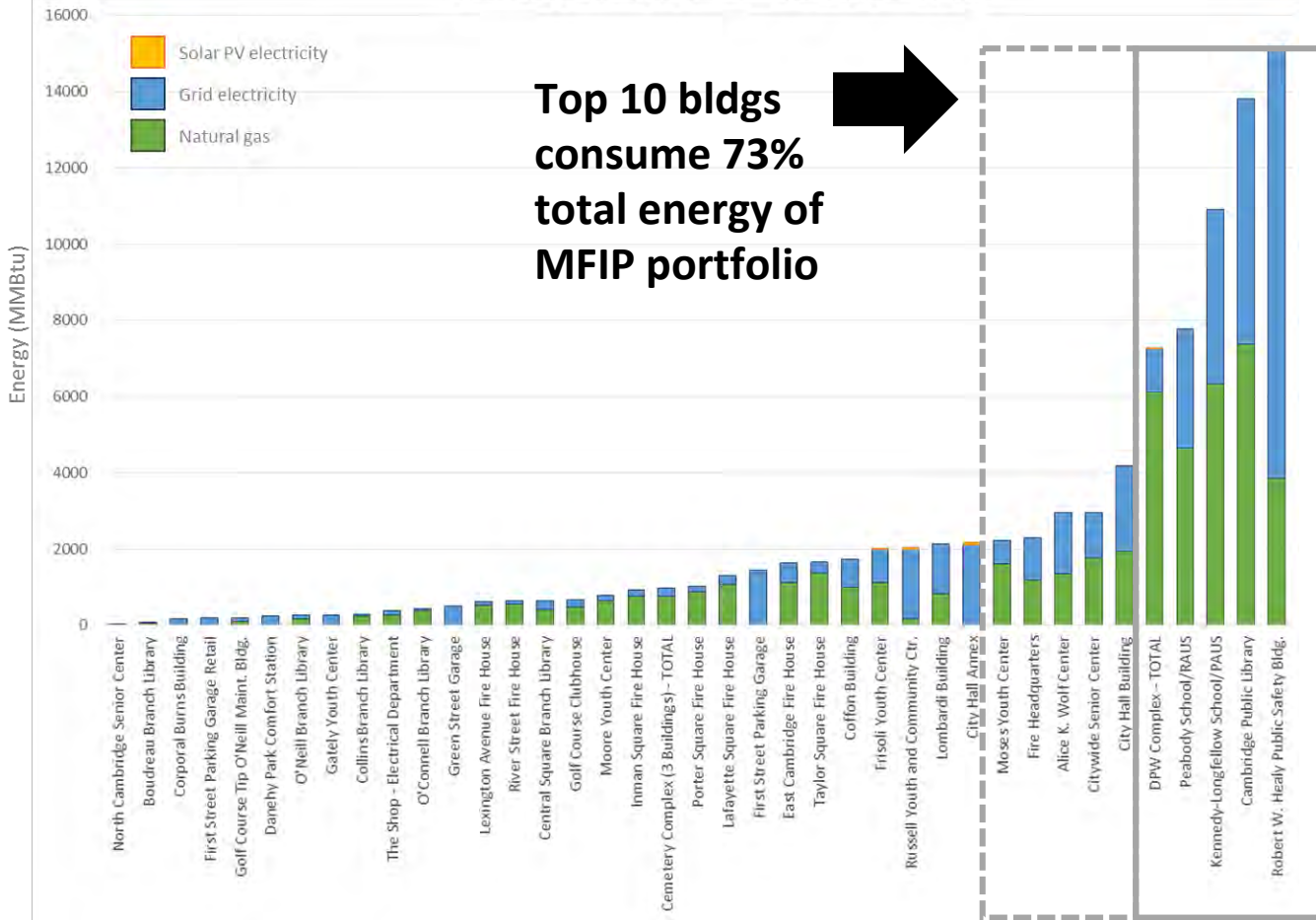
Typology	Area (sq ft)	Historically Significant?	Community Use?	Weighted Overall Score	Assessment Categories						
					2015 EUI (kBtu/sf/yr)	2015 GHG (CO2e/sf/yr)	Historic Preservation	Accessibility	IEQ	Building Systems	Fire and Life Safety
Other	1,923	Yes	No	-2	-2	-2	1	-3		0	-3
Office	2,874	Yes	Yes	-2	-2	-2	1	-3	1		-3
Office	3,591	Yes	No	-2	1	0	-1	-3		-1	-3
Garage	1,830	No	Yes	-2	-2	-2	1	-1		0	-3
School	127,302	No	Yes	-2	0	0	0	-3	-1	0	-3
Other	8,418	Yes	No	-2	2	2	-2	-3	-1	-2	-3
Office	11,542	No	No	-1	-1	0	0	-3	1	0	-3
Public Safety	17,093	No	No	-1	-1	0	0	-3	-1	0	-1
Public Safety	11,213	Yes	No	-1	0	0	1	-3	0	0	-3
Public Safety	30,389	Yes	Yes	-1	0	0	0	-2	0	0	-3
Other	4,610	Yes	Yes	-1	-2	-1	-1	0	0	0	0
Other	1,696	No	Yes	-1	-1	-2	0	-2	2	1	-2
Office	12,550	No	Yes	-1	-1	0	0	-2	0	1	-2
Public Safety	19,080	Yes	No	-1	0	0	1	-3	-1	0	-1
Public Safety	6,525	Yes	No	-1	0	0	1	-3	2	0	-3
Office	21,808	Yes	Yes	-1	-1	-1	1	0	0	0	-2
Garage	44,547	No	No	-1	-1	0	1	-2	-1	0	0
Library	3,300	Yes	Yes	-1	0	0	2	-1	0	0	-3
Youth Center	19,405	No	Yes	-1	-1	-1	0	-1	0	0	1
Public Safety	9,643	Yes	No	0	0	1	2	-3	1	0	-2
Public Safety	16,728	Yes	No	0	1	2	2	-3	-1	0	-2
Youth Center	20,059	No	Yes	0	-1	-1	0	0	1	0	1
Office	31,240	Yes	Yes	0	1	1	1	0	0	0	-3
Office	33,909	Yes	Yes	0	0	0	1	-1	0	1	-1
School	108,989	Yes	Yes	0	0	0	0	-1	1	1	0
Public Safety	16,187	Yes	No	0	-1	0	2	-3	1	1	1
Library	277,185	Yes	Yes	0	-1	-1	2	1	1	1	-2
Office	61,731	Yes	Yes	0	0	0	3	-1	0	0	-1
Public Safety	162,547	No	Yes	0	0	-1	0	1	0	1	0
Other	8,909	No	Yes	0	2	2	1	-1	-1	0	-2
Library	6,427	Yes	Yes	1	0	1	2	0	2	0	-3
Library	1,955	No	Yes	1	2	2	0	0		0	-2
Youth Center	10,537	Yes	Yes	1	0	0	0	1	0	0	1
Youth Center	31,586	No	Yes	1	0	0	0	1	1	1	-1
Garage	378,000	No	Yes	1	2	2	1	-1		0	-2
Library	15,447	No	Yes	1	2	2	1	-2	0	0	-1
Senior Center	27,999	Yes	Yes	1	-1	-1	1	1	1	1	1
Youth Center	14,837	No	Yes	1	2	2	1	-2	1	0	0
Library	4,566	Yes	Yes	1	0	1	0	0	1	1	1
Senior Center	3,623	No	Yes	1	2	2	0	0	1	0	-1
Other	4,319	No	No	1	2	2	0	1	2	0	-1
Garage	110,884	No	Yes	1	2	2	0	1		0	1
Office	58,318	Yes	Yes	1	1	1	2	1	1	1	0
Average Score for City of Cambridge Portfolio				0	0	0	1	-1	0	0	-1

TOP 13
5 Youth/Community Centers
4 Libraries
3 Garages
1 Office

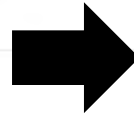


2015 TOTAL ENERGY USE

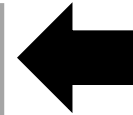
Cambridge Municipal Facilities – 2015 Total Energy Use



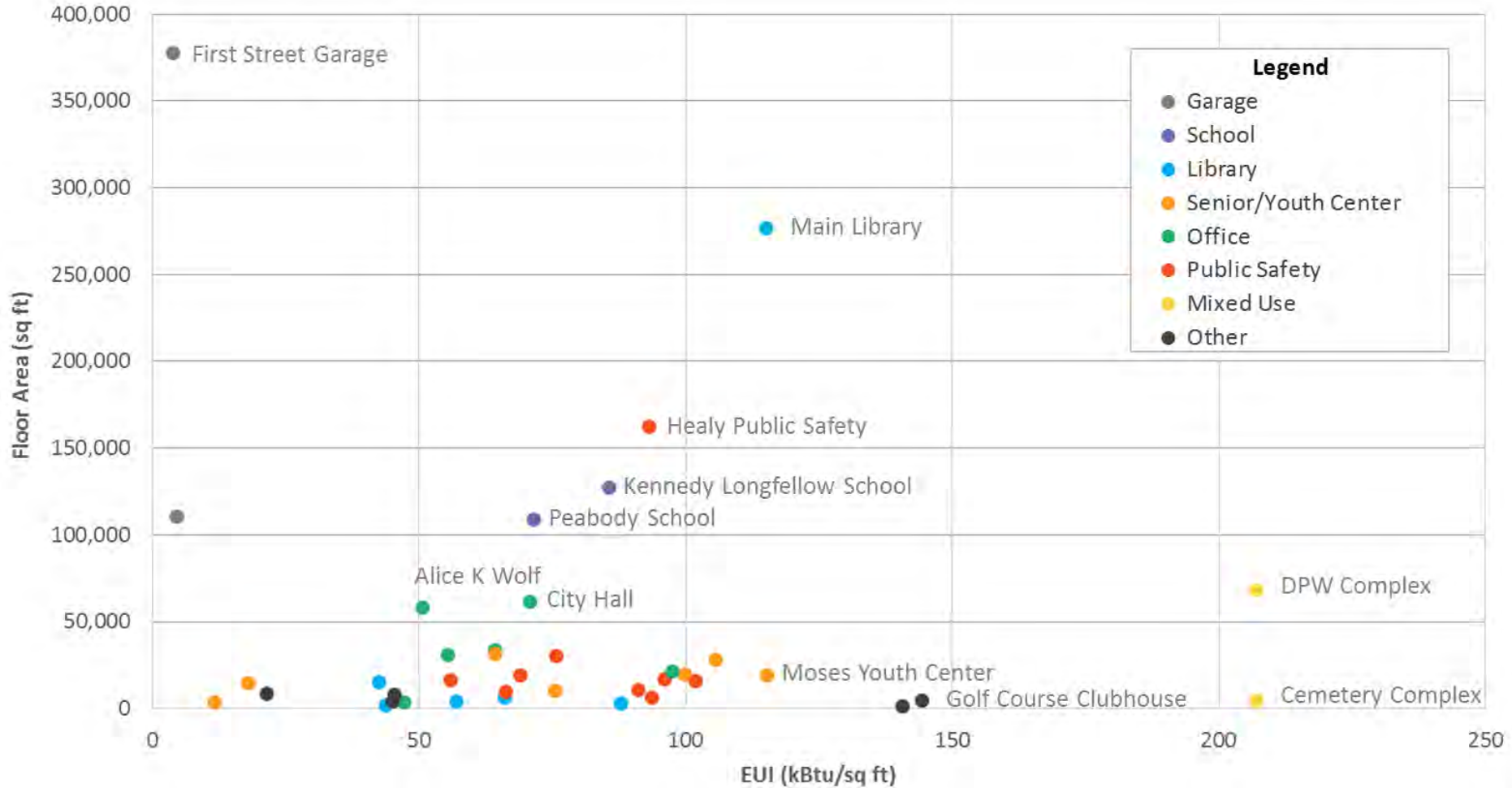
**Top 10 bldgs
consume 73%
total energy of
MFIP portfolio**



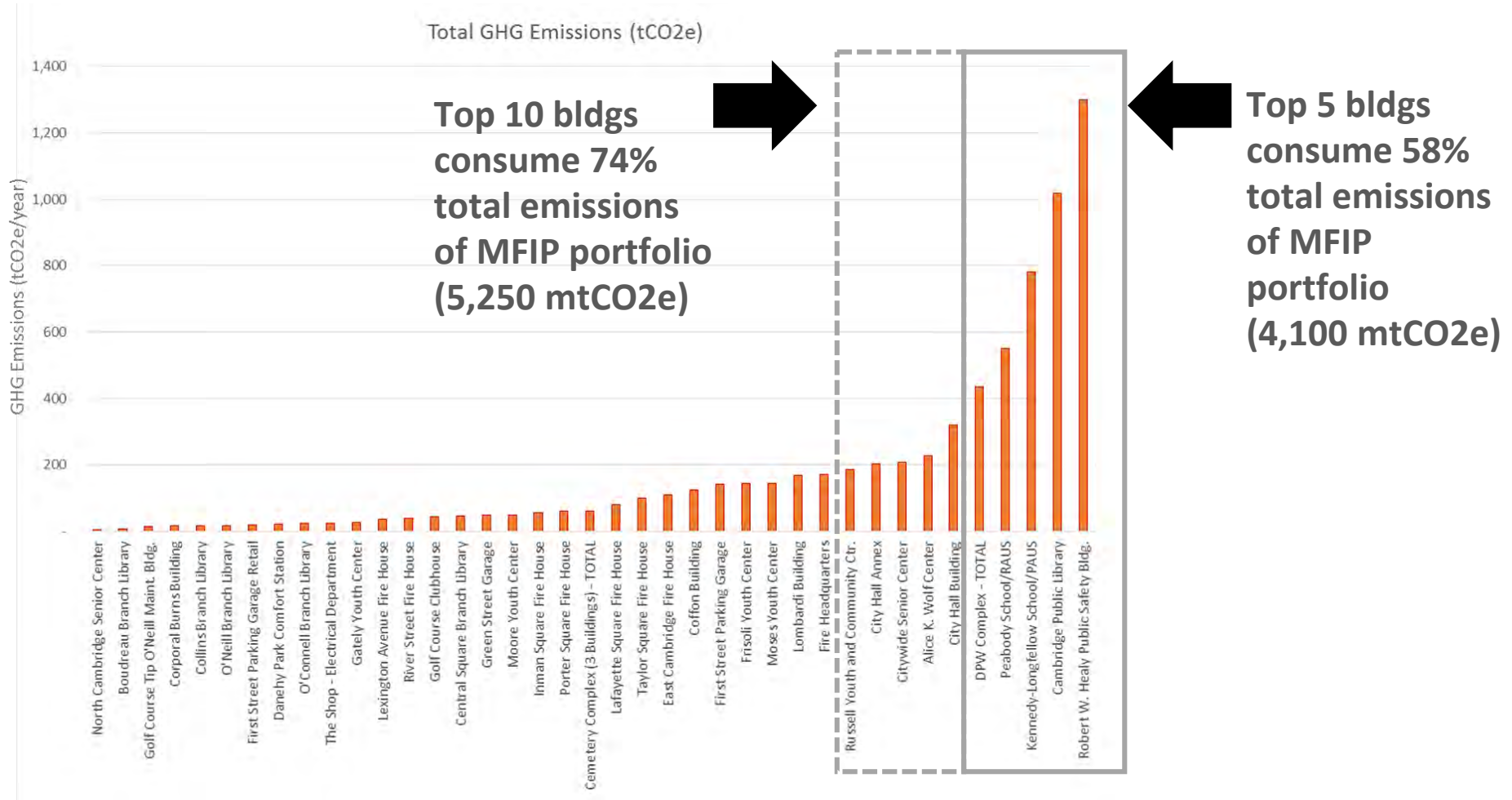
**Top 5 bldgs
consume 58%
total energy of
MFIP portfolio**



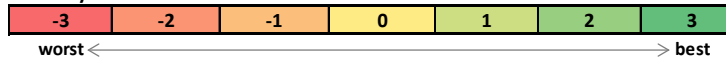
ENERGY (EUI) & SQUARE FOOTAGE



TOTAL GHG EMISSIONS



Score System




Typology	Area (sq ft)	Historically Significant?	Community Use?	Weighted Overall Score	Assessment Categories						
					2015 EUI (kBtu/sf/yr)	2015 GHG (CO2e/sf/yr)	Historic Preservation	Accessibility	IEQ	Building Systems	Fire and Life Safety
Other	1,923	Yes	No	-2	-2	-2	1	-3		0	-3
Office	2,874	Yes	Yes	-2	-2	-2	1	-3	1	0	-3
Office	3,591	Yes	No	-2	1	0	-1	-3		-1	-3
Garage	1,830	No	Yes	-2	-2	-2	1	-1		0	-3
School	127,302	No	Yes	-2	0	0	0	-3	-1	0	-3
Other	8,418	Yes	No	-2	2	2	-2	-3	-1	-2	-3
Office	11,542	No	No	-1	-1	0	0	-3	1	0	-3
Public Safety	17,093	No	No	-1	-1	0	0	-3	-1	0	-1
Public Safety	11,213	Yes	No	-1	0	0	1	-3	0	0	-3
Public Safety	30,389	Yes	Yes	-1	0	0	0	-2	0	0	-3
Other	4,610	Yes	Yes	-1	-2	-1	-1	0	0	0	0
Other	1,696	No	Yes	-1	-1	-2	0	-2	2	1	-2
Office	12,550	No	Yes	-1	-1	0	0	-2	0	1	-2
Public Safety	19,080	Yes	No	-1	0	0	1	-3	-1	0	-1
Public Safety	6,525	Yes	No	-1	0	0	1	-3	2	0	-3
Office	21,808	Yes	Yes	-1	-1	-1	1	0	0	0	-2
Garage	44,547	No	No	-1	-1	0	1	-2	-1	0	0

Use the assessment TOOL to develop the MFIP, a 13 year improvement plan

Library	3,300										
Youth Center	19,405										
Public Safety	9,643										
Public Safety	16,728										
Youth Center	20,059										
Office	31,240										
Office	33,909										
School	108,989	Yes	Yes	0	0	0	0	-1	1	1	0
Public Safety	16,187	Yes	No	0	-1	0	2	-3	1	1	1
Library	277,185	Yes	Yes	0	-1	-1	2	1	1	1	-2
Office	61,731	Yes	Yes	0	0	0	3	-1	0	0	-1
Public Safety	162,547	No	Yes	0	0	-1	0	1	0	1	0
Other	8,909	No	Yes	0	2	2	1	-1	-1	0	-2
Library	6,427	Yes	Yes	1	0	1	2	0	2	0	-3
Library	1,955	No	Yes	1	2	2	0	0		0	-2
Youth Center	10,537	Yes	Yes	1	0	0	0	1	0	0	1
Youth Center	31,586	No	Yes	1	0	0	0	1	1	1	-1
Garage	378,000	No	Yes	1	2	2	1	-1		0	-2
Library	15,447	No	Yes	1	2	2	1	-2	0	0	-1
Senior Center	27,999	Yes	Yes	1	-1	-1	1	1	1	1	1
Youth Center	14,837	No	Yes	1	2	2	1	-2	1	0	0
Library	4,566	Yes	Yes	1	0	1	0	0	1	1	1
Senior Center	3,623	No	Yes	1	2	2	0	0	1	0	-1
Other	4,319	No	No	1	2	2	0	1	2	0	-1
Garage	110,884	No	Yes	1	2	2	0	1		0	1
Office	58,318	Yes	Yes	1	1	1	2	1	1	1	0

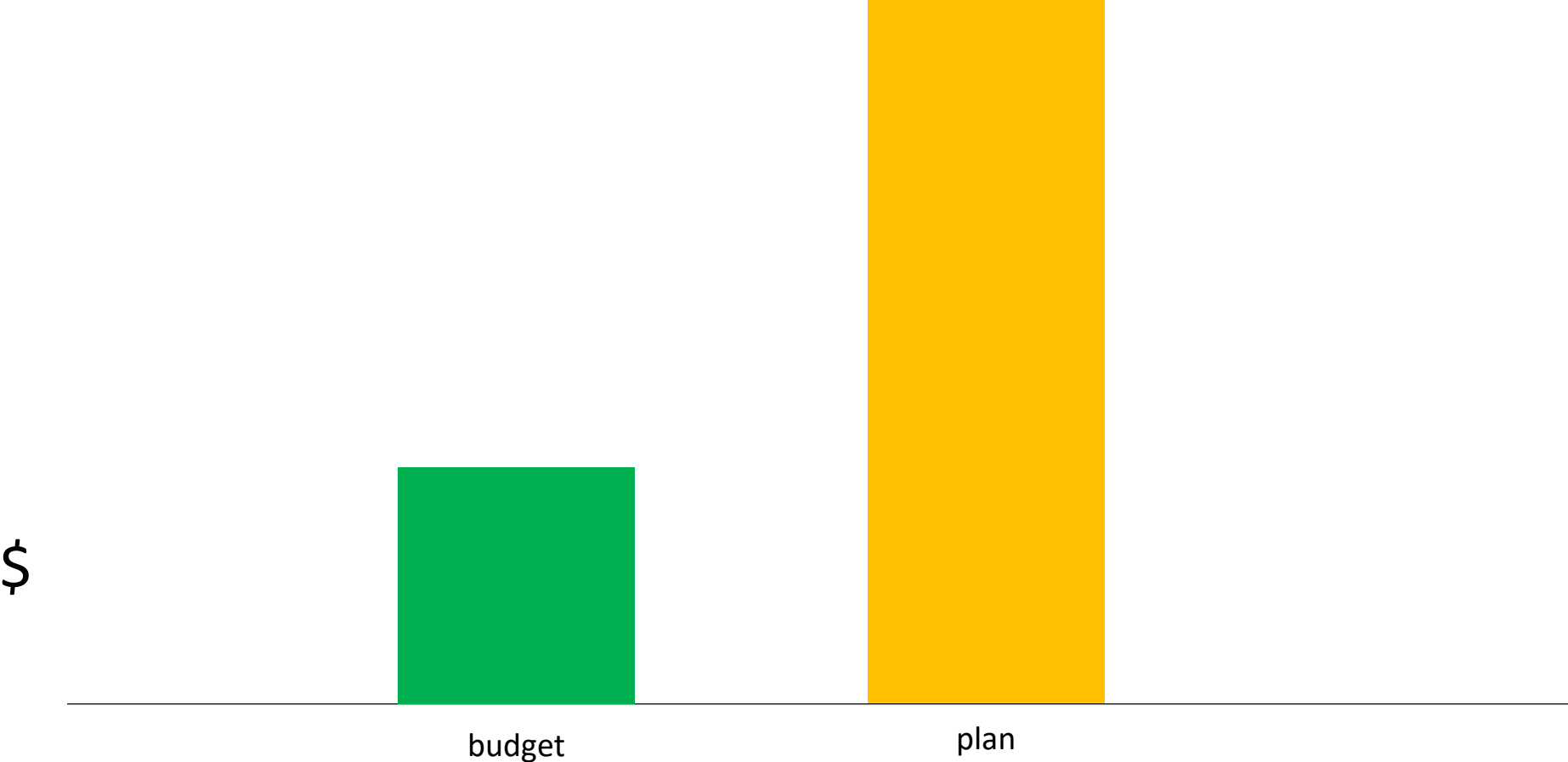
Average Score for City of Cambridge Portfolio	0	0	0	1	-1	0	0	-1
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Any questions on the ASSESSMENT PHASE/TOOL?

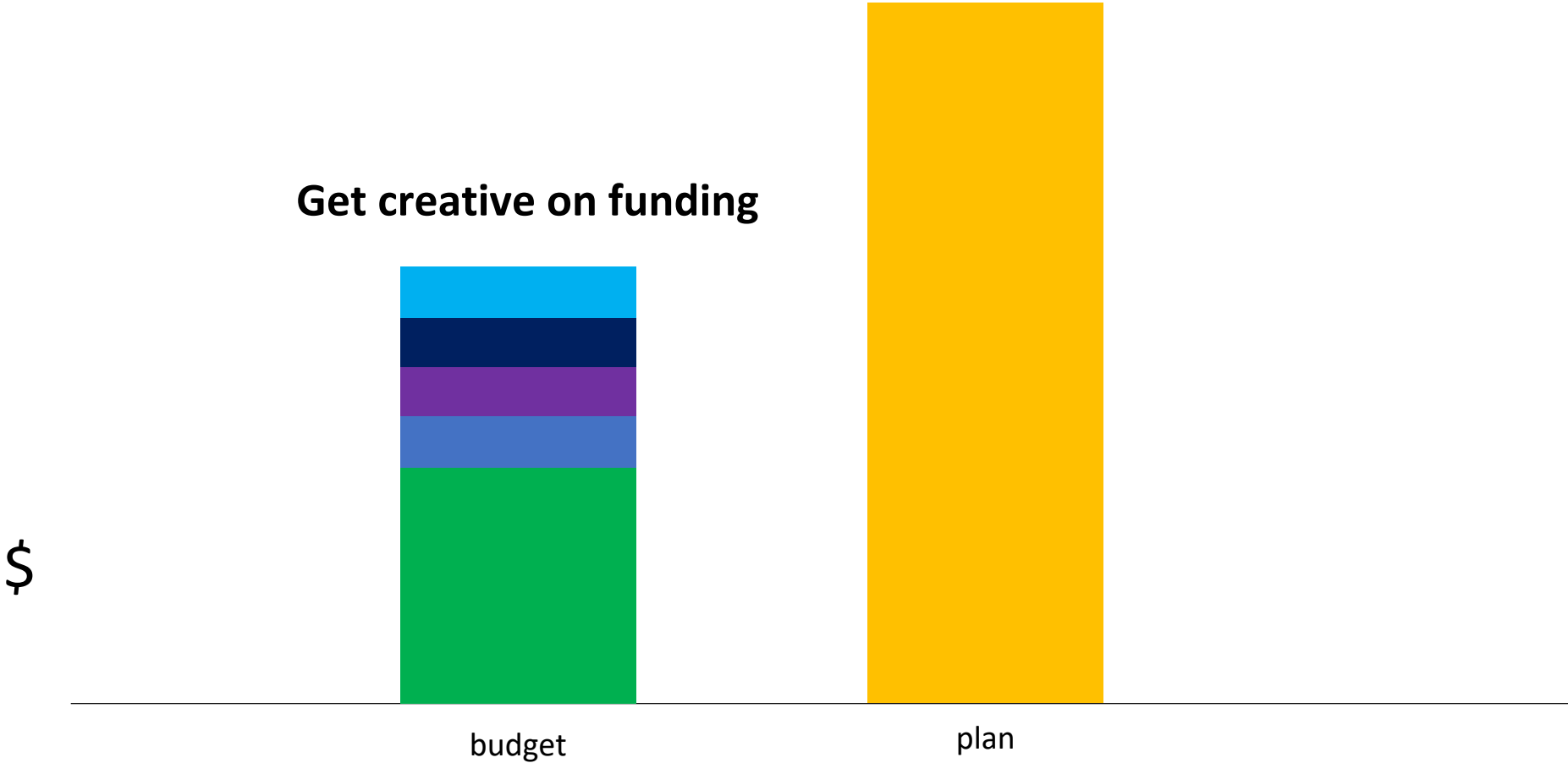
 Respond at PollEv.com/nedcollier051

Top

The preliminary plan identified exceeds the budget.



The preliminary plan identified exceeds the budget.



The preliminary plan identified exceeds the budget.

How do we prioritize?

Will we achieve our goals?

GUIDING PRINCIPLES

Get our **newest construction** operating optimally, as designed.

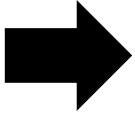
Bring our **worst performers** up to better standards.

Manage our buildings to **minimize future needs** and investments.

Demonstrate leadership in NZE, show it can be done.

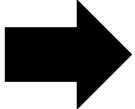
GUIDING PRINCIPLES

Get our **newest construction** operating optimally,
as designed.

- Alice K Wolf Center
 - Russell Youth & Community Center
 - Cambridge Public Library
 - Healy Public Safety
 - City Hall Annex
- 
- Energy Audits
 - RCx
 - Monitoring performance
 - Ongoing maintenance
 - Training & education

GUIDING PRINCIPLES

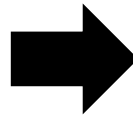
Bring our **worst performers** up to better standards.

- **The Shop**
 - **Cemetery Complex**
 - **Fire Houses**
 - **Ryan Garage**
 - **Kennedy Longfellow School**
- 
- **Life safety projects**
 - **Deferred maintenance**
 - **Accessibility**
 - **Training & education**

GUIDING PRINCIPLES

Manage our buildings to **minimize future needs** and investments.

- Youth & Senior Centers
- Libraries
- Office buildings
- Garages



- RCx
- Deferred maintenance
- Upgrade projects
- Ongoing maintenance



Achievable number and scale of projects:

- Large/major renovation: 2020 NZE requirement
- Medium: System or equipment replacements
- Small: RCx, study, windows, metering, etc...
- Operational: policies, maintenance, etc...
- Cross sectional: lighting, controls, etc...
- Renewable energy

Tracking & Monitoring Progress

MFIP APPROACH

3 project classifications developed around funding:

Large Scale Renovations

Greatest need
ZNE requirement
applies

Small Scale Renovations

Improvement
projects to address
accessibility, fire &
life safety,
standards,
renewables,
controls,
electrification, RCx,
etc...

Deferred Maintenance

Projects to address
envelope and
equipment that are
at or beyond useful
life such as roofs,
sealants,
equipment, and
unforeseen issues

MFIP APPROACH

3 project classifications developed around funding:

**Large Scale
Renovations**

**Significant Financial
Investment**

\$2 to \$30M

**Small Scale
Renovations**

**\$3M - \$5M Annual
Budget**

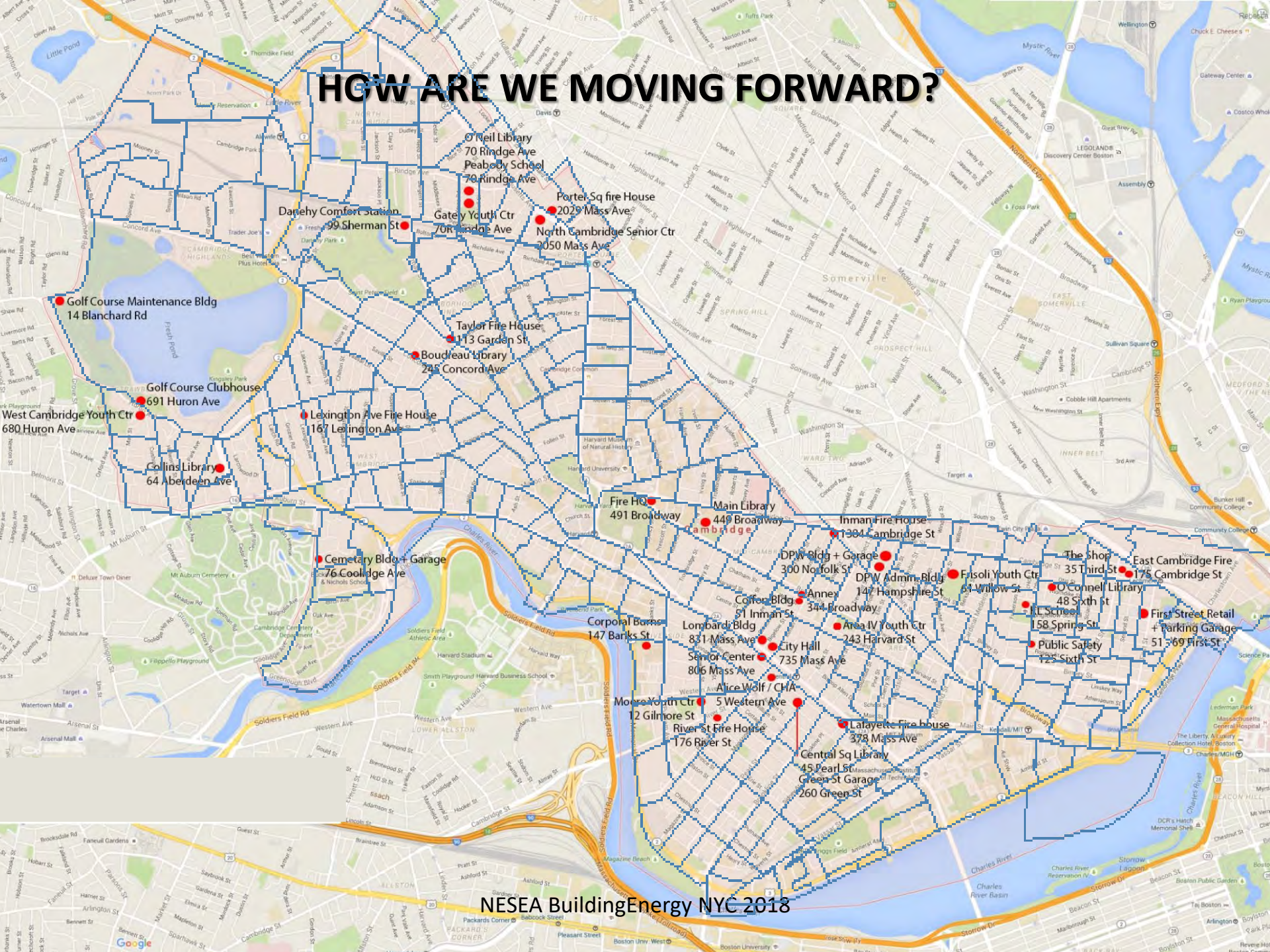
**Range of Financial
Investment
\$5,000 - \$3.5M**

**Deferred
Maintenance**

**\$2M Annual Budget
Range of Financial**

**Investment
\$50,000 - \$2.5M**

HOW ARE WE MOVING FORWARD?



HOW ARE WE MOVING FORWARD?

Projects

Tools

Standards

Advocacy & Communication

PROJECTS UNDERWAY

Newer Construction

- City Hall Annex
- Healy Public Safety
- Cambridge Public Library
- Russell Youth & Community Center
- Alice K Wolf Center

Deferred Maintenance

- Citywide Senior Center
- Moore Youth Center
- Lombardi building
- The Shop
- Ryan Garage
- Golf course clubhouse
- Portfolio projects

De-carbonization

- Solar PV (350 kW): Kennedy Longfellow School, Fletcher Maynard Academy & Cambridge Public Library
- Electrification at Engine 3 & Taylor Square Firehouses

TOOLS & STANDARDS

Main Summary Tables and Charts

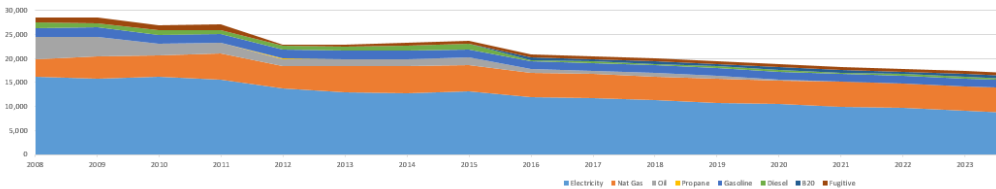
Select Electricity Scenario -----> **Scen 2: ISO NE Grid Aligns with RGGI and RPS by 2030**

By Fuel Type (metric tons CO2)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Electricity	16,178	15,740	16,118	15,563	13,706	13,028	12,839	13,191	12,014	11,712	11,256	10,811	10,440	10,021	9,656	9,109
Nat Gas	3,670	4,760	4,568	5,575	4,645	5,490	5,452	5,462	5,042	5,042	5,012	5,004	4,962	5,061	5,079	5,079
Oil	4,543	4,000	2,418	2,029	1,593	1,343	1,422	1,806	803	680	688	536	232	68	66	66
Propane	3	4	3	3	3	3	4	4	3	3	3	3	3	3	3	3
Gasoline	2,005	1,908	1,871	1,893	1,857	1,770	1,919	1,675	1,620	1,620	1,620	1,620	1,620	1,620	1,620	1,620
Diesel	1,029	969	927	908	850	894	937	1,106	286	286	286	286	286	286	286	286
B20	0	0	0	0	0	0	0	2	60	581	581	581	581	581	581	581
Fugitive	1,058	1,058	1,058	1,058	209	375	648	600	600	600	600	600	600	600	600	600
Total	28,487	28,439	28,363	27,035	22,893	22,304	23,338	23,694	20,870	20,523	20,025	19,500	18,742	18,258	17,691	17,344

By Fuel Type (%)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Electricity	-3%	0%	-4%	-15%	-19%	-21%	-18%	-26%	-28%	-28%	-30%	-33%	-35%	-38%	-40%	-44%
Nat Gas	30%	24%	52%	27%	27%	52%	49%	35%	43%	37%	37%	36%	36%	38%	38%	38%
Oil	-12%	-47%	-55%	-65%	-70%	-69%	-65%	-82%	-85%	-85%	-85%	-87%	-85%	-93%	-93%	-93%
Propane	27%	9%	5%	9%	9%	27%	38%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Gasoline	-5%	-7%	-8%	-7%	-12%	-12%	-4%	-5%	-18%	-18%	-19%	-19%	-18%	-18%	-18%	-18%
Diesel	-6%	-10%	-12%	-17%	-13%	-9%	7%	-72%	-72%	-72%	-72%	-72%	-72%	-72%	-72%	-72%
B20	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Fugitive	0%	0%	0%	-80%	-65%	-39%	-43%	-43%	-43%	-43%	-43%	-43%	-43%	-43%	-43%	-43%
Total	0%	0%	-5%	-5%	-20%	-20%	-10%	-17%	-27%	-28%	-30%	-32%	-34%	-36%	-37%	-39%



Project Timeline

Project Type Key	Project Name
Large Scale Renovation	HVAC 5 YR Plan
Deferred Maintenance	Resident Sticker Fund
Small Scale Renovation	School Dept

Print Sheet

	FY19 Annual Costs	FY2 Annual Costs	FY2 Annual Costs	FY2 Annual Costs	FY2 Annual Costs
MFP Total	\$3,386,103	*****	MFP Total	*****	MFP Total
Non-MFP T	\$345,650	Non-MFP Tot \$189,823	Non-MFP Total	*****	Non-MFP Tot
Large Scale F	\$1,271,351	Large Scale F \$3,171,622	Large Scale Reno	*****	Large Scale F
Deferred M	\$5,834,142	Deferred Maint \$2,462,328	Deferred Maintena	*****	Deferred Maint
Small Scale	\$1,934,679	Small Scale R \$2,249,716	Small Scale Renov.	*****	Small Scale R

File no	Asset Name	Project Name	Project Type	Category	Bond G	Design? Construction? Both	Total Project Cost	Start Date	Completion Date	2019	2020	2021	2022	2023
	Cambridge Pub	Solar PV System 61kW	Small Scale R	Building System	19625	Construction		7/1/2018	8/1/2018					
	Cemetery Comp	Admin Building: Repla	Small Scale R	Building System	19625	Design		2/1/2019	4/1/2019					
	Cemetery Comp	Roof Replacement - D	Deferred Maint	Building System	21625	Design/Construction	\$195,586	7/1/2020	6/30/2022					
	Cemetery Comp	Windows - Chapel St	Small Scale R	Energy & GHG	21625	Design/Construction	\$488,964	7/1/2020	6/30/2022					
	Central Square	LED retrofit & controls	Resident Sticl	Energy & GHG	20625	Design/Construction	\$106,090	7/1/2019	4/1/2020					
	Central Square	Window Replacement	Small Scale R	Building System	20625	Design/Construction			6/30/2021					
	Central Square	Window Replacement	Small Scale R	Building System	21625	Construction			6/30/2021					
	City Hall Annex	ADA Upgrades, Wayf	Deferred Maint	Accessibility	19625	Design/Construction	\$275,000	7/1/2018	6/30/2020					
	City Hall Annex	Entry Accessibility Upd	Deferred Maint	Accessibility	19625	Design/Construction	\$500,000	7/1/2018	9/1/2019					
	City Hall Annex	n.	Small Scale R	Building System	19625	Design/Construction	\$562,500	7/1/2018	9/1/2019					
	City Hall Annex	Sealant & Repeating	Deferred Maint	Building System	19625	Design/Construction		8/1/2018	1/1/2020					
	City Hall Annex	Sealant & Repeating	Deferred Maint	Building System	20625	Construction		7/1/2019	1/1/2020					
	Colton Building	Emergency Egress Upd	Deferred Maint	Fire & Life Saf	19625	Design/Construction	\$200,000	7/1/2016	6/30/2020					
	Colton Building	Roof replacement 2	Deferred Maint	Building System	20625	Design/Construction	\$200,290	7/1/2019	8/1/2020					
	Danahy Park Cd	Roof Replacement - S	Deferred Maint	IEQ	21625	Design/Construction	\$135,000	7/1/2020	6/30/2022					
	Electrical Depar	Major Alteration 2	Large Scale F	Condition - All	20625	Design/Construction		7/1/2019	7/1/2021					
	Electrical Depar	Major Alteration 2	Large Scale F	Condition - All	21625	Construction		7/1/2020	7/1/2021					
	Fire Headquar	Fire Alarm Systems - T	Small Scale R	Fire & Life Saf	19625	Design/Construction	\$145,000	1/1/2018	1/1/2018					
	Fire Headquar	Major Alteration 1	Large Scale F	Condition - All	19625	Design/Construction								
	Fire Headquar	Ventilation - Apparate	Small Scale R	Fire & Life Saf	19625	Design/Construction	\$200,000	7/1/2016	1/1/2019					
	Fire Headquar	Window AC Replacem	Deferred Maint	Building System	20625	Design/Construction	\$20,000	7/2/2019	6/30/2021					
	Frisoli Youth Ce	Destratification Fans	HVAC 5 YR Pl	IEQ	21625	Design/Construction	\$30,000	7/1/2020	6/30/2022					
	Frisoli Youth Ce	HVAC - DayCare VRF	Small Scale R	Building System	19625	Design/Construction	\$220,000	7/1/2016	6/1/2019					
	Frisoli Youth Ce	LED retrofit & controls	Resident Sticl	Energy & GHG	21625	Design/Construction	\$100,000	7/1/2020	1/1/2021					
	Golf Course Clu	Roof Repair - Slate Rd	Deferred Maint	Building System	21625	Design/Construction	\$100,000	7/1/2020	6/30/2021					
	Golf Course Clu	Window & Door Repla	Small Scale R	Energy & GHG	19625	Design/Construction	\$529,530	7/1/2016	6/30/2019					
	Golf Course Tip	Heating replacement	Deferred Maint	Building System	21625	Design/Construction	\$150,000	7/1/2020	6/30/2021					
	Green Street G	Fire Sprinkler System	Deferred Maint	Fire & Life Saf	19625	Design/Construction	\$500,000	7/1/2016	6/30/2019					

Tools

- Capital Planning
- GHG emissions tracking
- Facilities Maintenance Program

Standards

- Controls Standard
- Lighting Guidelines & Standards
- Signage/Wayfinding

TOOLS & STANDARDS: CAPITAL PLANNING

eline

Project Type Key

Large Scale Renovation	HVAC 5 YR Plan
Deferred Maintenance	Resident Sticker Fund
Small Scale Renovation	School Dept

FY19 Annual Costs	FY2 Annual Costs	FY2 Annual Costs	FY2 Annual Costs	FY2 Annual
MFIP Total \$8,386,109	MFIP Total *****	MFIP Total *****	MFIP Total *****	MFIP T *****
Non-MFIP T \$345,650	Non-MFIP Tot \$189,829	Non-MFIP Total *****	Non-MFIP Tot *****	Non-M *****
Large Scale \$1,271,351	Large Scale F \$3,171,622	Large Scale Reno #REF!	Large Scale F #REF!	Large S *****
Deferred M. \$5,834,142	Deferred Mair \$2,462,329	Deferred Maintena #REF!	Deferred Mair #REF!	Deferre *****
Small Scale \$1,934,679	Small Scale R \$2,249,716	Small Scale Renov #REF!	Small Scale R #REF!	Small S *****

Project Name	Project Type	Category	Bond C	Design? Construction? Both	Total Project Cost	Start Date	Completion Date	Jul-18	Oct-18	Jan-19	Mar-19	Apr-19	Jun-19	Jul-19	Oct-19	Jan-20	Mar-21	Apr-21	Jun-21	Jul-21	Oct-21	Jan-22	Jul-22
								#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####
Solar PV System 61kW	Small Scale R		19625	Construction		7/1/2018	8/1/2018																
Admin Building: Repla	Small Scale R	Building Syste	19625	Design		2/1/2019	4/1/2019																
Roof Replacement - C	Deferred Maint	Building Syste	21625	Design/Construction	\$195,586	7/1/2020	6/30/2022																
Windows - Chapel Sto	Small Scale R	Energy & GHG	21625	Design/Construction	\$488,964	7/1/2020	6/30/2022																
LED retrofit & controls	Resident Stic	Energy & GHG	20625	Design/Construction	\$106,090	7/1/2019	4/1/2020																
Window Replacement	Small Scale R	Building Syste	20625	Design/Construction	#####	7/1/2019	6/30/2021																
Window Replacement	Small Scale R	Building Syste	21625	Construction	#####	6/30/2020	6/30/2021																
ADA Upgrades; Wayfir	Deferred Maint	Accessibility	19625	Design/Construction	\$275,000	7/1/2018	6/30/2020																
Entry Accessibility Upg	Deferred Maint	Accessibility	19625	Design/Construction	\$500,000	7/1/2018	9/1/2019																
n.	Small Scale R	Building Syste	19625	Design/Construction	\$562,500	7/1/2018	9/1/2019																
Sealant & Repointing	Deferred Maint	Building Syste	19625	Design/Construction	#####	8/1/2018	1/1/2020																
Sealant & Repointing	Deferred Maint	Building Syste	20625	Construction	#####	7/1/2019	1/1/2020																
Emergency Egress Up	Deferred Maint	Fire & Life Saf	19625	Design/Construction	\$200,000	7/1/2018	6/30/2020																
Roof replacement 2	Deferred Maint	Building Syste	20625	Design/Construction	\$200,290	7/1/2019	8/1/2020																
Roof Replacement - S	Deferred Maint	IEQ	21625	Design/Construction	\$135,000	7/1/2020	6/30/2022																
Major Alteration 2	Large Scale F	Condition - All	20625	Design/Construction	#####	7/1/2019	7/1/2021																
Major Alteration 2	Large Scale F	Condition - All	21625	Construction	#####	7/1/2020	7/1/2021																
Fire Alarm Systems - 1	Small Scale R	Fire & Life Saf	19625	Design/Construction	\$145,000	1/1/2018	11/1/2018																
Major Alteration 1	Large Scale F	Condition - All	19625	Design/Construction	#####																		
Ventilation - Apparatu	Small Scale R	Fire & Life Saf	19625	Design/Construction	\$200,000	1/1/2018	1/1/2019																
Window AC Replacem	Deferred Maint	Building Syste	20625	Design/Construction	\$20,000	7/1/2019	6/30/2021																
Destratification Fans 1	HVAC 5 YR PI	IEQ	21625	Design/Construction	\$30,000	7/1/2020	6/30/2022																
HVAC - DayCare VRF	Small Scale R	Building Syste	19625	Design/Construction	\$220,000	7/1/2018	6/1/2019																
LED retrofit & controls	Resident Stic	Energy & GHG	21625	Design/Construction	\$100,000	7/1/2020	1/1/2021																
Roof Repair - Slate Rc	Deferred Maint	Building Syste	21625	Design/Construction	\$100,000	7/1/2020	6/30/2021																
Window & Door Replac	Small Scale R	Energy & GHG	19625	Design/Construction	\$528,530	7/1/2018	6/30/2019																
Heating replacement	Deferred Maint	Building Syste	21625	Design/Construction	\$150,706	7/1/2020	6/30/2022																
Fire Sprinkler System	Deferred Maint	Fire & Life Saf	19625	Design/Construction	\$500,000	7/1/2018	6/30/2019																

TOOLS & STANDARDS: CAPITAL PLANNING

Summary Cash Flow

[Print Sheet](#)

Budget Code	Budget Amount	Total Cost	Cash Flow Analysis Start Date	Required Expenditure	Total Expended	Difference	Required Expenditure	Total Expended	Difference	Required Expenditure	Total Expended	Difference	Required Expenditure	Total Expended	Difference
TARGETS →				7/16-3/17			3/17-8/17			8/17-3/18			3/18-8/18		
				10%			45%			75%			95%		
17625	\$ 4,670,000	\$ 10,320,850	7/1/2016	\$ 467,000	\$ 449,534	\$ 17,465.82	\$ 2,101,500	\$ 2,010,639	\$ 90,861.50	\$ 3,502,500	\$ 5,090,058	\$ (1,587,558.36)	\$ 4,436,500	\$ 7,141,367	\$ (2,704,866.78)
TARGETS →				7/17-3/18			3/18-8/18			8/18-3/19			3/19-8/19		
				10%			45%			75%			95%		
18625	\$ 4,670,000	\$ 4,025,850	7/1/2017	\$ 467,000	\$ 1,652,339	\$ (1,185,338.57)	\$ 2,101,500	\$ 2,779,682	\$ (678,182.14)	\$ 3,502,500	\$ 3,285,000	\$ 217,500.00	\$ 4,436,500	\$ 3,310,350	\$ 1,126,150.00
TARGETS →				7/18-3/19			3/19-8/19			8/19-3/20			3/20-8/20		
				10%			45%			75%			95%		
19625	\$ 5,000,000	\$ 25,557,180	7/1/2018	\$ 500,000	\$ 3,526,445	\$ (3,026,444.79)	\$ 2,250,000	\$ 5,645,537	\$ (3,395,537.05)	\$ 3,750,000	\$ 6,824,263	\$ (3,074,263.33)	\$ 4,750,000	\$ 6,923,430	\$ (2,173,430.00)
TARGETS →				7/19-3/20			3/20-8/20			8/20-3/21			3/21-8/21		
				10%			45%			75%			95%		
20625	\$ 5,000,000	\$ 9,317,995	7/1/2019	\$ 500,000	\$ 3,542,852	\$ (3,042,852.29)	\$ 2,250,000	\$ 5,573,706	\$ (3,323,706.36)	\$ 3,750,000	\$ 7,841,534	\$ (4,091,533.92)	\$ 4,750,000	\$ 9,317,995	\$ (4,567,994.75)
TARGETS →				7/20-3/21			3/21-8/21			8/21-3/22			3/22-8/22		
				10%			45%			75%			95%		
21625	\$ 5,000,000	\$ 2,674,488	7/1/2019	\$ 500,000	\$ 1,092,896	\$ (592,896.00)	\$ 2,250,000	\$ 1,610,060	\$ 639,939.83	\$ 3,750,000	\$ 2,287,423	\$ 1,462,576.67	\$ 4,750,000	\$ 2,674,488	\$ 2,075,512.00
TARGETS →				7/21-3/22			3/22-8/22			8/22-3/23			3/23-8/23		
				10%			45%			75%			95%		
22625	\$ 5,000,000	\$ 5,513,636	7/1/2019	\$ 500,000	\$ 3,320,279	\$ (2,820,278.55)	\$ 2,250,000	\$ 5,177,027	\$ (2,927,026.91)	\$ 3,750,000	\$ 5,513,636	\$ (1,763,636.00)	\$ 4,750,000	\$ 5,513,636	\$ (763,636.00)
TARGETS →				7/22-3/23			3/23-8/23			8/23-3/24			3/24-8/24		
				10%			45%			75%			95%		
23625	\$ 5,000,000	\$ 14,639,475	7/1/2019	\$ 500,000	\$ 8,474,650	\$ (7,974,650.00)	\$ 2,250,000	\$ 11,514,788	\$ (9,264,787.50)	\$ 3,750,000	\$ 13,503,225	\$ (9,753,225.00)	\$ 4,750,000	\$ 14,639,475	\$ (9,889,475.00)
TARGETS →				7/23-3/24			3/24-8/24			8/24-3/25			3/25-8/25		
				10%			45%			75%			95%		

NET ZERO DEFINITIONS

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).*

City of Cambridge Net Zero Action Plan

	<p>Net Zero Energy¹</p>	<ul style="list-style-type: none"> • May use fossil fuels or electricity for heating • Generates as much energy on site or nearby as it uses on an annual basis 	<ul style="list-style-type: none"> • Still emits carbon pollution if using gas on site • Not all buildings have solar potential • Generation may not match demand; fossil fuel burning power plants may still be needed during peak hours, leading to higher electricity rates
	<p>Net Zero Carbon²</p>	<ul style="list-style-type: none"> • May use fossil fuels or electricity for heating • Fossil fuel use (on-site or on the grid) is offset with the purchase or generation of low-carbon energy 	<ul style="list-style-type: none"> • Still emits carbon pollution if using gas on site • Carbon offsets are achieved only if purchased clean energy displaces high-emissions energy • There are multiple definitions of when carbon balance is achieved
	<p>Zero Carbon</p>	<ul style="list-style-type: none"> • No fossil fuel burned on site • Only uses clean electricity or low-carbon fuels 	<ul style="list-style-type: none"> • Increased demand on clean electricity grids • Biofuels still emit carbon pollution and can only be considered carbon neutral if feedstocks are sustainably managed and fugitive emissions are addressed

Infographic courtesy of Pembina institute

TOOLS & STANDARDS: CAPITAL PLANNING

Print Sheet

Project Name	Project Type	Budget Code	Design? Construction? Or both?	Design Start Date	Construction End Date	MFIP budget (\$)	Total Project Cost (all included + escalation)
Solar PV System 61 kW - CO19625	Small Scale Renovation	19625	Construction		8/1/2018		
Admin Building: Replace window AC with energ	Small Scale Renovation	19625	Design	2/1/2019	5/1/2019		
ADA Upgrades; Wayfinding	Deferred Maintenance	19625	Design/Construct	7/1/2018	6/30/2020		\$275,000.00
Entry Accessibility Upgrades	Deferred Maintenance	19625	Design/Construct	7/1/2018	9/1/2019		\$500,000.00
n.	Small Scale Renovation	19625	Design/Construct	7/1/2018	9/1/2019		\$562,500.00
Sealant & Repointing	Deferred Maintenance	19625	Design/Construct	8/1/2018	1/1/2020		\$2,500,000.00
Emergency Egress Upgrades	Deferred Maintenance	19625	Design/Construct	7/1/2018	6/30/2020		\$200,000.00
Fire Alarm Systems - 13 buildingsLafayette Fire	Small Scale Renovation	19625	Design/Construct	1/1/2018	11/1/2018		\$145,000.00
Major Alteration 1	Large Scale Renovation	19625	Design/Construct				\$18,618,750.00
Ventilation - Apparatus Bay replacement & Kitc	Small Scale Renovation	19625	Design/Construct	1/1/2018	1/1/2019		\$200,000.00
HVAC - DayCare VRF	Small Scale Renovation	19625	Design/Construct	7/1/2018	6/1/2019		\$220,000.00
Window & Door Replacement - Operable Wood	Small Scale Renovation	19625	Design/Construct	7/1/2018	6/30/2019		\$528,530.00
Fire Sprinkler System Upgrade	Deferred Maintenance	19625	Design/Construct	7/1/2018	6/30/2019		\$500,000.00
Hazardous Abatement/Flr. Finishes	Deferred Maintenance	19625	Design/Construct	7/1/2018	6/30/2020		\$100,000.00
Roof replacement 3	Deferred Maintenance	19625	Design/Construct	7/1/2018	7/1/2019		\$460,000.00
Daycare space HVAC Repair Feasibility Study	Resident Sticker Fund	19625	Design/Construct	12/1/2018	7/1/2019		\$300,000.00
Daycare space HVAC Repair Feasibility Study	Resident Sticker Fund	19625	Construction	12/1/2018	7/1/2019		\$250,000.00
Patio Roof - Phase 2- ramping stair	Deferred Maintenance	19625	Construction	7/1/2018	12/1/2018		\$155,500.00
Pole Compartmentalization	Deferred Maintenance	19625	Design/Construct	7/1/2018	6/30/2020		\$20,000.00
RTU-1 Redundancy, dry coolers + upgrades + chi	Deferred Maintenance	19625	Design/Construct	8/1/2018	8/1/2019		\$392,400.00
RTU-1 Redundancy, dry coolers + upgrades + chi	Deferred Maintenance	19625	Construction	8/1/2018	8/1/2019		\$300,000.00
HVAC, Controls, Water infiltration upgrades	Deferred Maintenance	19625	Construction	5/1/2018	1/1/2020		\$350,000.00
BMS Upgrades	HVAC 5 YR Plan	19625	Design/Construct				\$15,000.00
FY Total:						\$0.00	\$26,592,680.00

TOOLS & STANDARDS: GHG EMISSIONS TRACKING

Main Summary Tables and Charts

Partially Protected Worksheet

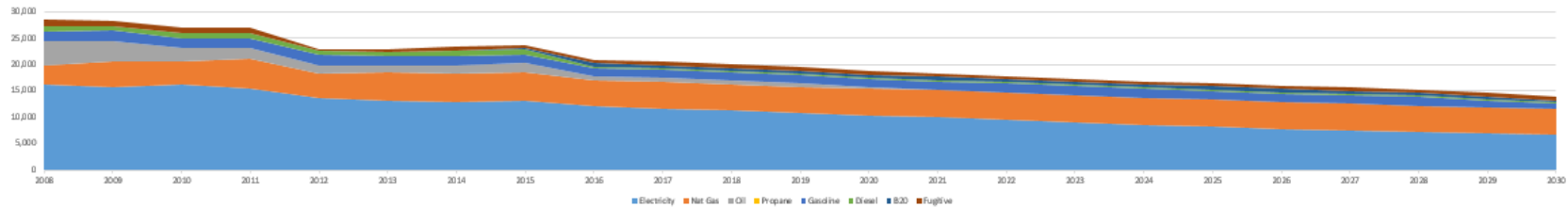
Select Electricity Scenario -----> **Scen 2: ISO NE Grid Aligns with RGGI and RPS by 2030**

By Fuel Type (metric tons CO2)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Electricity	16,178	15,740	16,118	15,569	13,706	13,028	12,839	13,191	12,014	11,712	11,256	10,811	10,440	10,021	9,656	9,109	8,592	8,276	7,864	7,531	7,320	7,056	6,792
Nat Gas	3,670	4,760	4,568	5,575	4,645	5,430	5,566	5,452	4,965	5,042	5,012	5,004	4,982	5,081	5,079	5,079	5,077	5,050	5,002	4,932	4,862	4,860	4,856
Oil	4,543	4,000	2,418	2,029	1,583	1,343	1,422	1,606	803	680	668	596	232	66	66	66	66	61	0	0	0	0	0
Propane	3	4	3	3	3	3	4	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Gasoline	2,005	1,908	1,871	1,893	1,857	1,770	1,919	1,675	1,620	1,620	1,620	1,620	1,620	1,620	1,620	1,620	1,620	1,620	1,620	1,620	1,620	1,336	1,053
Diesel	1,029	969	927	908	850	834	937	1,106	286	286	286	286	286	286	286	286	286	286	286	286	286	286	286
B20	0	0	0	0	0	0	2	60	581	581	581	581	581	581	581	581	581	581	581	581	581	581	581
Fugitive	1,058	1,058	1,058	1,058	209	375	648	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600
Total	26,487	26,459	26,965	27,855	22,853	22,903	23,336	23,694	20,670	20,523	20,025	19,500	18,742	18,256	17,691	17,344	16,825	16,476	15,956	15,613	15,271	14,570	13,866

By Fuel Type (%)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Electricity	-3%	0%	-4%	-15%	-19%	-21%	-18%	-26%	-28%	-30%	-33%	-35%	-35%	-38%	-40%	-44%	-47%	-43%	-51%	-53%	-55%	-56%	-58%
Nat Gas	30%	24%	52%	27%	50%	52%	43%	35%	37%	37%	36%	36%	36%	38%	38%	38%	38%	38%	36%	34%	32%	32%	32%
Oil	-12%	-47%	-55%	-65%	-70%	-63%	-65%	-82%	-85%	-85%	-87%	-85%	-85%	-89%	-89%	-89%	-89%	-89%	-100%	-100%	-100%	-100%	-100%
Propane	21%	3%	-5%	3%	3%	3%	27%	38%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Gasoline	-5%	-7%	-6%	-7%	-12%	-4%	-16%	-19%	-19%	-19%	-19%	-19%	-19%	-19%	-19%	-19%	-19%	-19%	-19%	-19%	-19%	-33%	-47%
Diesel	-6%	-10%	-12%	-17%	-13%	-3%	7%	-12%	-12%	-12%	-12%	-12%	-12%	-12%	-12%	-12%	-12%	-12%	-12%	-12%	-12%	-77%	-82%
B20	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Fugitive	0%	0%	0%	-80%	-65%	-33%	-43%	-43%	-43%	-43%	-43%	-43%	-43%	-43%	-43%	-43%	-43%	-43%	-43%	-43%	-43%	-43%	-43%
Total	0%	-5%	-5%	-20%	-20%	-16%	-17%	-27%	-28%	-30%	-32%	-34%	-34%	-36%	-37%	-39%	-41%	-42%	-44%	-45%	-46%	-49%	-52%



TOOLS & STANDARDS: GHG EMISSIONS TRACKING

Projects Input Tab												
Individual Project Input												
Project ID	Asset Name	Project Name	Solar PV Project	Fuel Type	Related Spreadsheet	Most Recent Annual Fuel Type Use	Unit	Fuel Savings Input Type (% Or Absolute)	Annual Percentage Change (%)	Annual Energy Change (Absolute)	Start Date	Completion Date
1	Inman Square Fire House	Major Alteration		Electricity	Elec_Grid	46,978	kwh	Absolute		67,503		
1	Inman Square Fire House	Major Alteration		Nat Gas	Nat_Gas	6,086	therms	%	-100%			
1	Inman Square Fire House	Major Alteration	Yes	Electricity	Elec_Grid	46,978	kwh	Absolute		(21,798)		
2	Lafayette Square Fire House	Major Alteration		Electricity	Elec_Grid	73,652	kwh	Absolute		80,835		
2	Lafayette Square Fire House	Major Alteration		Nat Gas	Nat_Gas	8,842	therms	%	-100%			
2	Lafayette Square Fire House	Major Alteration	Yes	Electricity	Elec_Grid	73,652	kwh	Absolute		(7,056)		
6	Porter Square Fire House	Major Alteration		Electricity	Elec_Grid	43,920	kwh	Absolute		61,607		
6	Porter Square Fire House	Major Alteration		Nat Gas	Nat_Gas	8,004	therms	%	-100%			
6	Porter Square Fire House	Major Alteration	Yes	Electricity	Elec_Grid	43,920	kwh	Absolute		(9,042)		
3	Electrical Department -The Shop	Major Alteration		Electricity	Elec_Grid	23,580	kwh	Absolute		31,303		
3	Electrical Department -The Shop	Major Alteration		Nat Gas	Nat_Gas	2,898	therms	%	-100%			
4	Fire Headquarters	Major Alteration		Electricity	Elec_Grid	309,162	kwh	Absolute		32,655		
4	Fire Headquarters	Major Alteration		Nat Gas	Nat_Gas	10,105	therms	%	-100%			
502	Morse School	PV	Yes	Electricity	Elec_Grid	520,860	kwh	Absolute		(271,743)	7/1/20	9/1/21
11	Collins Branch Library	Major Alteration		Electricity	Elec_Grid	10,319	kwh	Absolute		20,416		
11	Collins Branch Library	Major Alteration		Nat Gas	Nat_Gas	2,001	therms	%	-100%			
11	Collins Branch Library	Major Alteration	Yes	Electricity	Elec_Grid	10,319	kwh	Absolute		(8,064)		
5	River Street Fire House	Major Alteration		Electricity	Elec_Grid	30,884	kwh	Absolute		36,025		
5	River Street Fire House	Major Alteration		Nat Gas	Nat_Gas	4,614	therms	%	-100%			
5	River Street Fire House	Major Alteration	Yes	Electricity	Elec_Grid	30,884	kwh	Absolute		(8,084)		
12	Lexington Avenue Fire House	Major Alteration		Electricity	Elec_Grid	23,618	kwh	Absolute		36,880		
12	Lexington Avenue Fire House	Major Alteration		Nat Gas	Nat_Gas	4,132	therms	%	-100%			
12	Lexington Avenue Fire House	Major Alteration	Yes	Electricity	Elec_Grid	23,618	kwh	Absolute		(10,332)		
7	Coffon Building	Major Alteration		Electricity	Elec_Grid	212,320	kwh	Absolute		46,137		
7	Coffon Building	Major Alteration		Nat Gas	Nat_Gas	8,831	therms	%	-100%			
7	Coffon Building	Major Alteration	Yes	Electricity	Elec_Grid	212,320	kwh	Absolute		(22,131)		
10	East Cambridge Fire House	Major Alteration		Electricity	Elec_Grid	135,200	kwh	Absolute		57,946		
10	East Cambridge Fire House	Major Alteration		Nat Gas	Nat_Gas	8,647	therms	%	-100%			
10	East Cambridge Fire House	Major Alteration	Yes	Electricity	Elec_Grid	135,200	kwh	Absolute		(23,346)		
8	Area IV Youth Center	Major Alteration		Electricity	Elec_Grid	168,720	kwh	Absolute		107,162		
8	Area IV Youth Center	Major Alteration		Nat Gas	Nat_Gas	13,839	therms	%	-100%			
8	Area IV Youth Center	Major Alteration	Yes	Electricity	Elec_Grid	168,720	kwh	Absolute		(26,388)		
9	Lombardi Building	Major Alteration		Electricity	Elec_Grid	335,520	kwh	Absolute		(27,198)		
9	Lombardi Building	Major Alteration		Nat Gas	Nat_Gas	5,335	therms	%	-100%			
9	Lombardi Building	Major Alteration	Yes	Electricity	Elec_Grid	335,520	kwh	Absolute		(16,920)		
153	Golf Course Clubhouse	Window Replacements		Electricity	Elec_Grid	48,667	kwh	Absolute		(49)	1/1/19	1/1/20
153	Golf Course Clubhouse	Window Replacements		Nat Gas	Nat_Gas	4,317	therms	Absolute		(9)	1/1/19	1/1/20
153	Golf Course Clubhouse	Window Replacements		Electricity	Elec_Grid	48,667	kwh	Absolute		0	1/1/19	1/1/20
14	Golf Course Clubhouse	Major Alteration		Electricity	Elec_Grid	48,667	kwh	Absolute		33,425		
14	Golf Course Clubhouse	Major Alteration		Nat Gas	Nat_Gas	4,317	therms	%	-100%			

TOOLS & STANDARDS: GHG EMISSIONS TRACKING

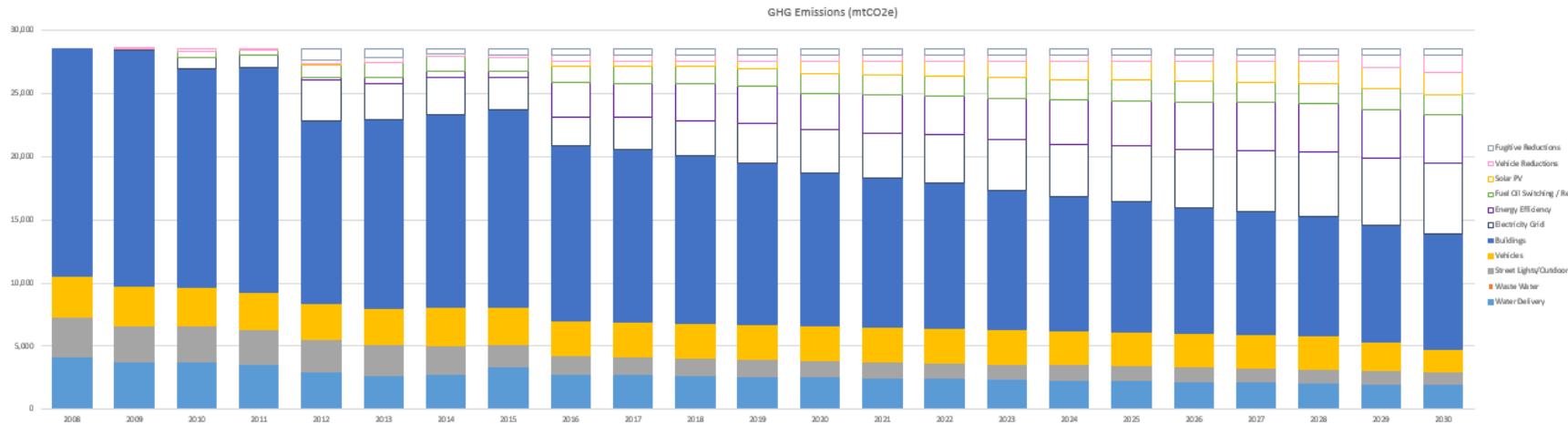
Main Summary Tables and Charts

Partially Protected Worksheet

Select Electricity Scenario -----> **Scen 2: ISO NE Grid Aligns with RGGI and RPS by 2030**

Vehicle Reductions	0	151	236	233	345	376	183	198	554	554	554	554	554	554	554	554	554	554	554	554	554	989	1,424	
Fugitive Reductions	0	0	0	0	849	663	410	458	458	458	458	458	458	458	458	458	458	458	458	458	458	458	458	458
Total	0	151	236	233	1,194	1,039	593	656	1,012	1,012	1,012	1,012	1,012	1,012	1,012	1,012	1,012	1,012	1,012	1,012	1,447	1,882		

By Building Project Type (%)	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Electricity Grid		-4%	-4%	-3%	-1%	-10%	-10%	-3%	-8%	-9%	-10%	-11%	-12%	-13%	-14%	-14%	-15%	-15%	-16%	-17%	-18%	-19%	-20%
Energy Efficiency		5%	2%	7%	0%	-2%	-2%	-2%	-9%	-9%	-10%	-10%	-10%	-11%	-11%	-11%	-12%	-12%	-13%	-13%	-13%	-13%	-13%
Fuel Oil Switching / Reduction		-1%	-3%	-3%	-4%	-4%	-4%	-4%	-5%	-5%	-5%	-5%	-5%	-6%	-6%	-6%	-6%	-6%	-6%	-6%	-6%	-6%	-6%
Solar PV		0%	0%	0%	0%	0%	0%	0%	-1%	-1%	-1%	-2%	-4%	-4%	-4%	-5%	-5%	-5%	-5%	-6%	-6%	-6%	-6%
Vehicle Reductions		-1%	-1%	-1%	-1%	-1%	-1%	-1%	-2%	-2%	-2%	-2%	-2%	-2%	-2%	-2%	-2%	-2%	-2%	-2%	-2%	-3%	-5%
Fugitive Reductions		0%	0%	0%	-3%	-2%	-1%	-1%	-2%	-2%	-2%	-2%	-2%	-2%	-2%	-2%	-2%	-2%	-2%	-2%	-2%	-2%	-2%
Total		0%	-3%	-3%	-2%	-2%	-1%	-1%	-2%	-2%	-3%	-3%	-4%	-4%	-5%	-5%	-5%	-5%	-6%	-6%	-6%	-6%	-7%



ADVOCACY & COMMUNICATION



CITY OF
CAMBRIDGE

Quick Links ▾ Subscribe Translate ▾ 57°

Services ▾ I Want To ▾ Departments ▾



A - C

- Animal Commission
- Assessing
- Auditing
- Budget
- Cambridge Arts
- City Clerk's Office
- City Council
- City Manager's Office
- Commission for Persons with Disabilities
- Community Development
- Consumers' Council

D - F

- Election Commission
- Electrical
- Emergency Communications
- Equity & Inclusion
- Family Policy Council
- Finance
- Fire Department

G - L

- Historical Commission
- Human Rights Commission
- Human Service Programs
- Immigrant Rights & Citizenship (CIRC)
- Information Technology
- Inspectional Services
- Law
- LGBTQ+ Commission
- Library
- License Commission

M - P

- Mayor's Office
- Peace Commission
- Personnel
- Police Department
- Police Review and Advisory Board
- Public Health
- Public Works (DPW)
- Purchasing

Q - Z

- Retirement Board
- School Department
- Tourism Office
- Traffic, Parking, and Transportation
- Veterans' Services
- Water Department
- Weights & Measures
- Women's Commission

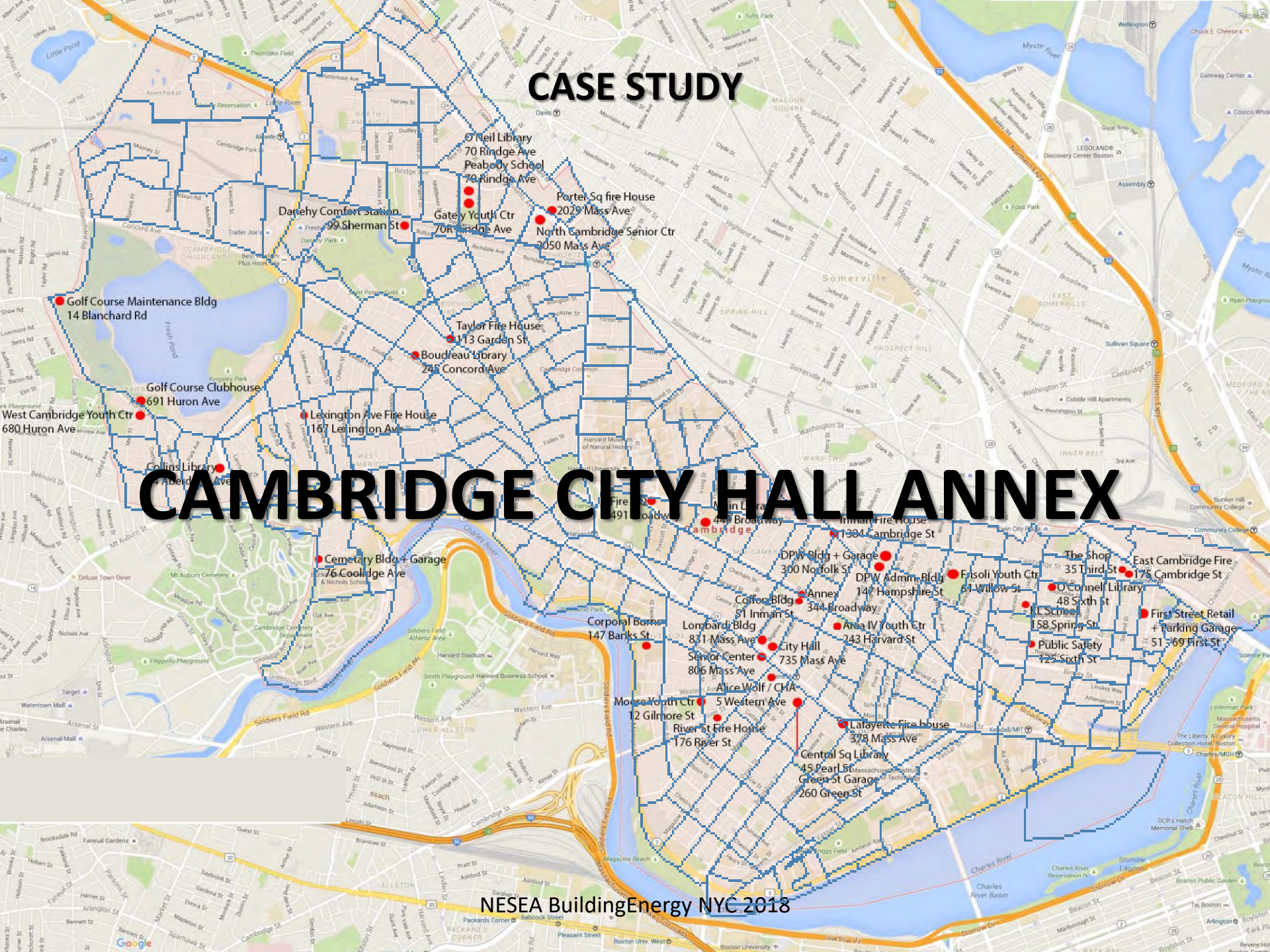
#

22-CityView

DEPARTMENT DIRECTORY



CASE STUDY



CAMBRIDGE CITY HALL ANNEX

NESEA BuildingEnergy NYC 2018

Cambridge City Hall Annex : LEED Historic Buildings

iar 411-02 : fall 2011 : interior architecture department : group v : city hall investigation : jeff linn



Historic structure - repurposed to become a city hall



bservant and respectful
of existing structure,
while still achieving a
modern feel.

Sources:
Cambridge City Hall Anne
(n.d.), from
<http://oikos.com/library/s>
Cambridge City Hall Anne
<http://www.preservationstudies/cambridge-city-ha>
William R. Hammer. (2008). Old Is New Again. High Performing Buildings, (Spring), 42-51.



The elevator is located here but there is no sign directing visitors to it.

The staircase immediately lures you up to the second level if you do not already know where you are going.

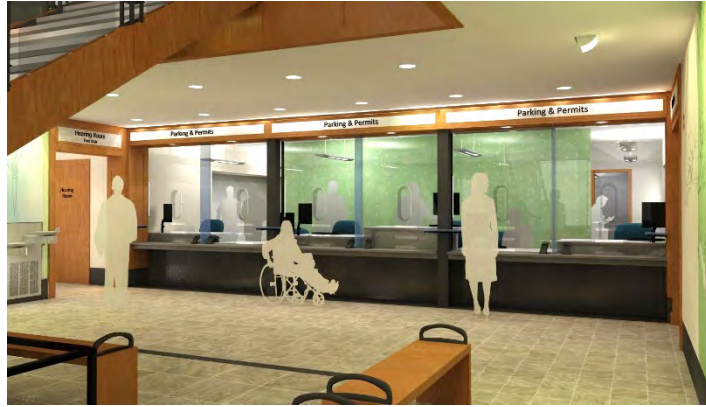


Sequence of visitor entering building intuitively taking the stair and then backtracking down the stairs again looking confused. When asked he said he was looking for the elevator.

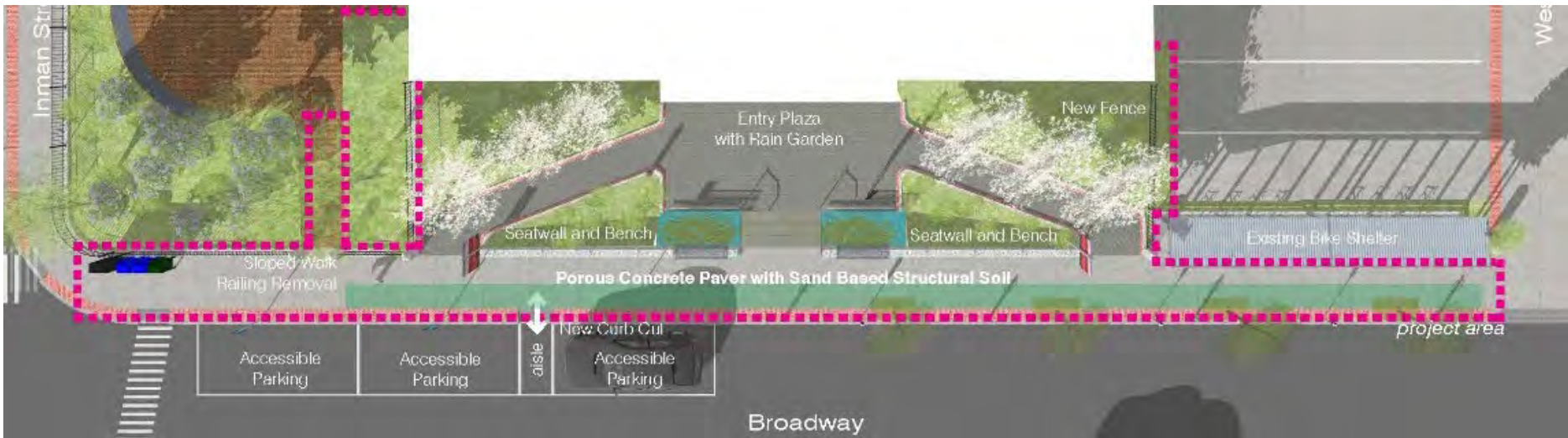
ENVELOPE IMPROVEMENTS



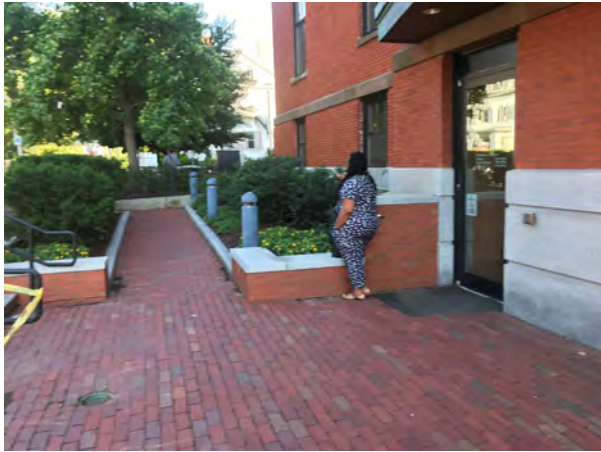
INCLUSIVE DESIGN

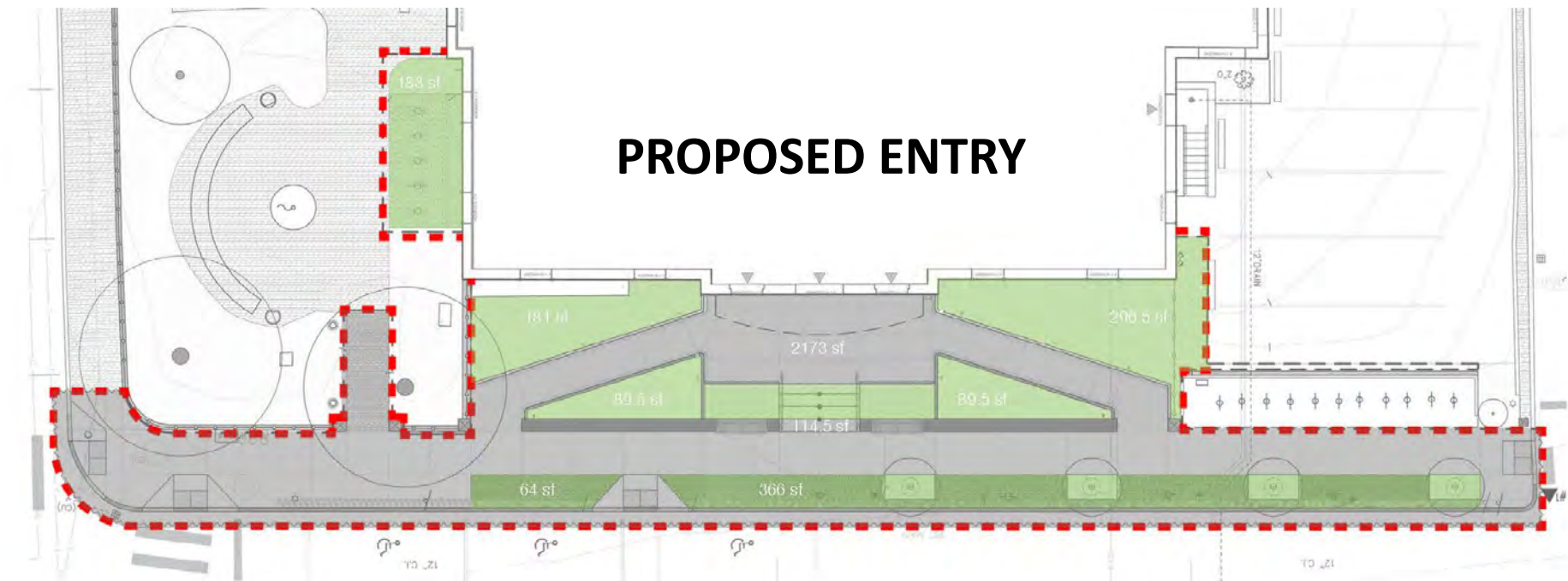
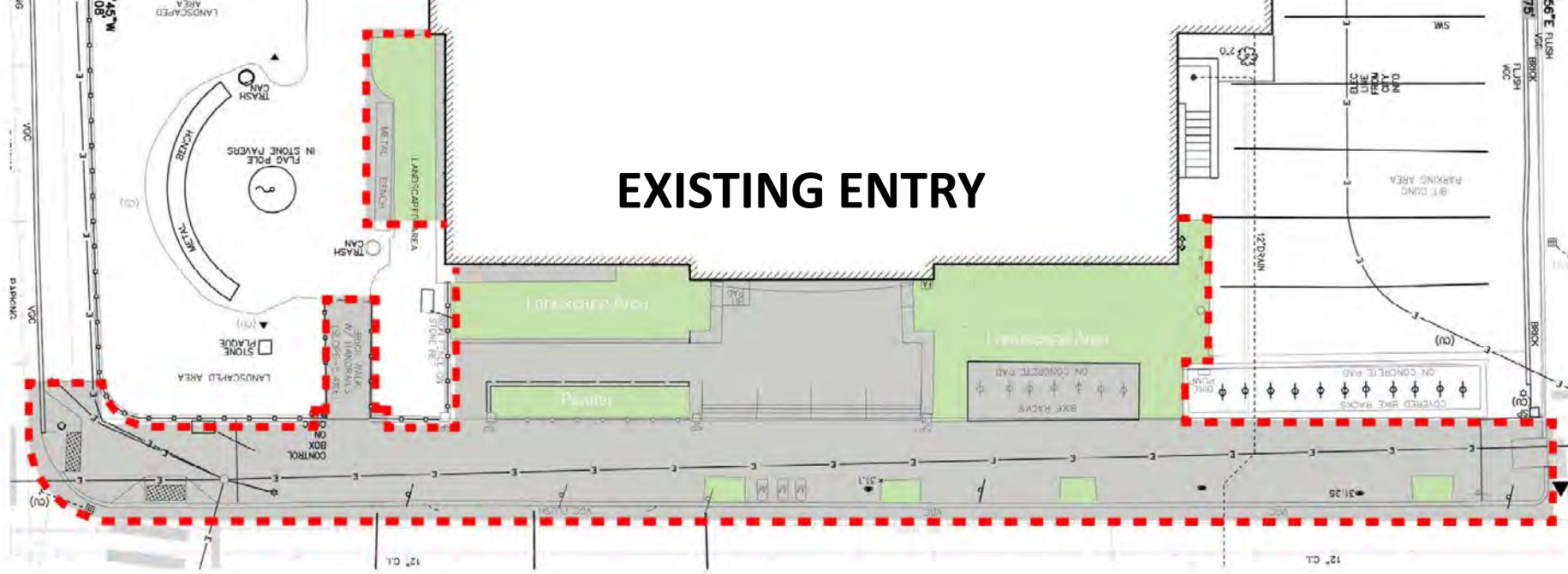


WAYFINDING



STORMWATER & ACCESS IMPROVEMENTS










HANDICAPPED
PARKING
PERMIT
REQUIRED

CITY HALL ANNEX

344 BROADWAY





NESEA BuildingEnergy NYC 2018



Cambridge Arts Council

Elevator
Waiting D

City Hall Annex
Building Directory
Transit Information

Animal Commission

Elevator

**Elevator
Building Direct**

- 4
- 3
- 2
- 1

▲
Elevator
& Parking

▶
Elevator
West Star

▶
Animal
Commission

Parking & Permits

Parking & Permits

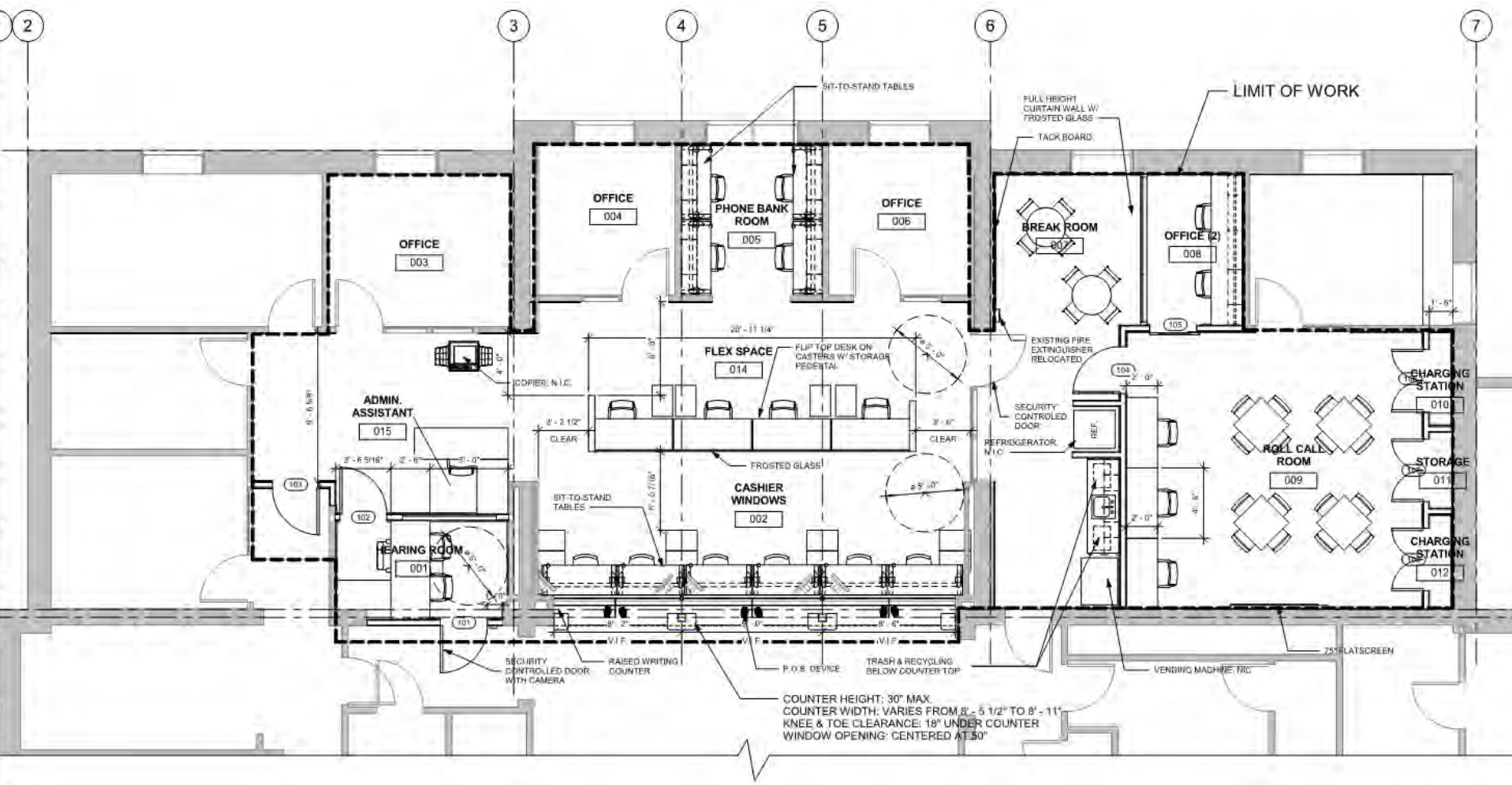
- 4 Community Development Department Offices Room 40
- 3 Community Development Department Reception Room 30
- 2 Cambridge Arts Council Gallery
Cambridge Arts Council Offices
Planning Board Meeting Room
Traffic, Parking & Transportation Administration Room 20
- 1 Traffic, Parking & Transportation Reception
Animal Control Commission Room 10



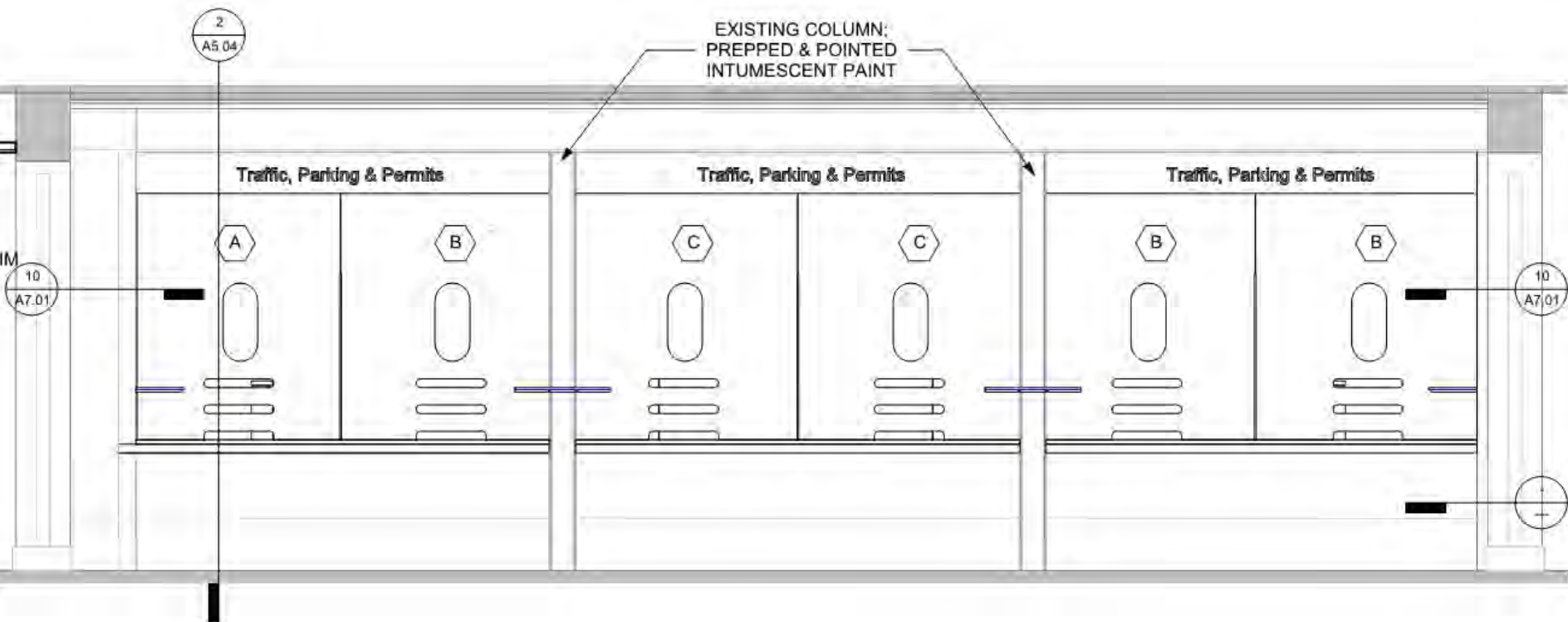
Parking & Permits

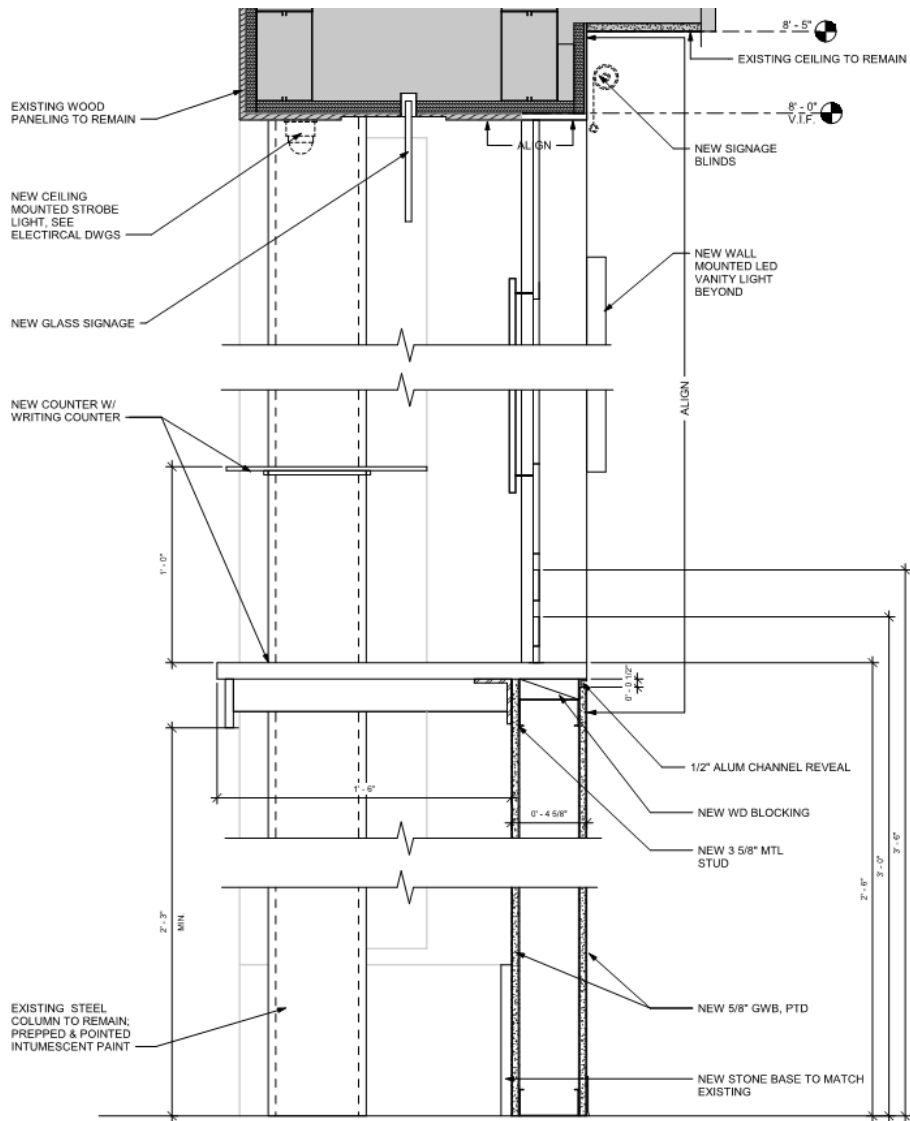
Parking & Permits

Parking & Permits



FF&E







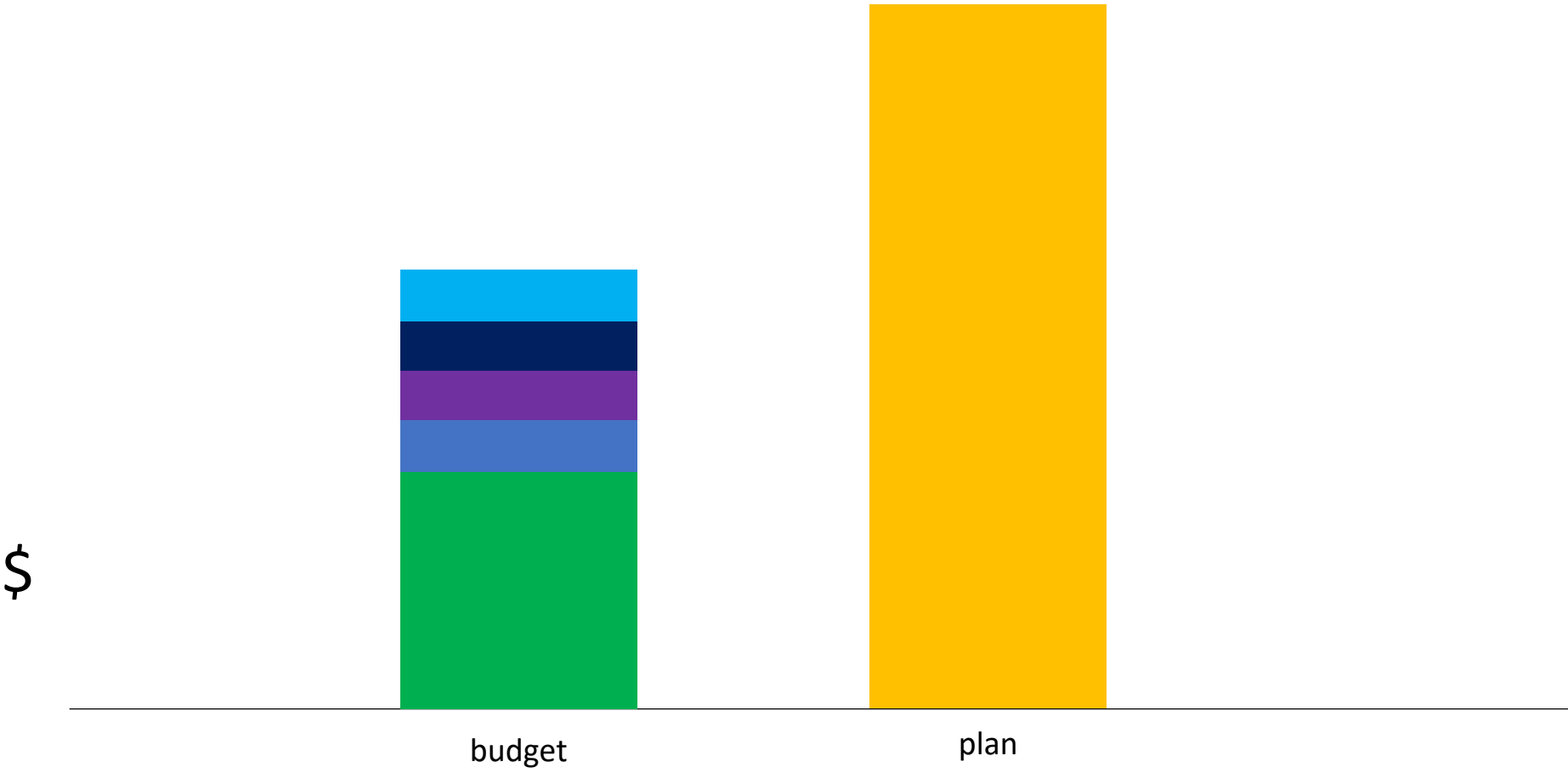
Projects

Tools

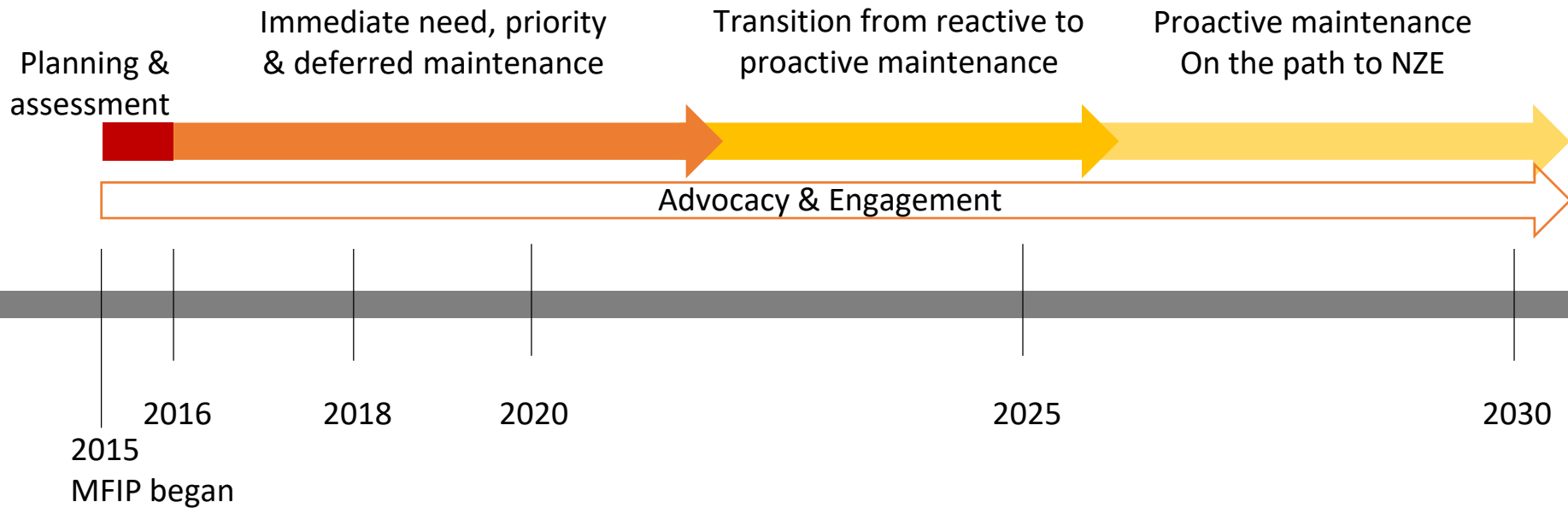
Standards

Advocacy & Communication

The preliminary plan identified exceeds the budget.



MUNICIPAL FACILITIES IMPROVEMENT PLAN



LEARNING OUTCOMES

- Can you better define **energy, maintenance, and accessibility goals** encompassing large building portfolios?
- Can you better establish **strategies for collaborative design process?**
- Can you better **set project energy targets?**
- Can you better identify areas for **building portfolio standardization?**

Questions?

 Respond at PollEv.com/nedcollier051

Top



THANK YOU!



NESEA BuildingEnergy NYC 2018