Envision Cambridge

## Climate & Environment Working Group: Session 1 May 8, 2017

## **ENVISION** CAMBRIDGE

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City of Cambridge



**Process Overview** 

**Existing Conditions** 

**Issues, Goals, and Opportunities** 

# Process Overview



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## **Project Framework**



## Climate and Environment Working Group's Role

Six working groups will provide input to the Envision Cambridge Advisory Committee for plan development.







#### City of Cambridge

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Climate and Environment Working Group: Session 1

rking Group: Session 1 May 8, 2017

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## Spring/Summer 2017 Working Group Schedule



## Vision & Core Values

"Cambridge is a forward-thinking, welcoming, and diverse city. We enjoy a high quality of life and thrive in a sustainable, inclusive, and connected community."





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#### Cambridge has a robust foundation for climate & environment planning

#### **Advisory Committees**

- Transit Advisory Committee
- Pedestrian Committee
- Bicycle Committee
- Climate Protection Action Committee (CPAC)
- Community Health Improvement Plan Steering Committee (co-chair)
- Recycling Advisory Committee

#### **Goals and Plans**

- CPAC Goals and Objectives
- E&T Strategic Plan
- Net Zero Action Plan
- Climate Vulnerability Assessment and Preparedness Plan
- Cambridge Bike Plan
- Cambridge Transit Plan
- Pedestrian Plan

#### **Collaborations/Frameworks**

- Compact for a Sustainable Future
- Kendall Square EcoDistrict
- Compact of Mayors
- STAR Community Rating







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Cambridge outperforms peer cities on sustainability initiatives, having achieved the highest-ever STAR Communities assessment score



Source: Star Communities, 50 Certified STAR Communities report (2016)



## Cambridge's built environment enables environmentally friendly lifestyle choices



Dense, mixed use neighborhoods



Robust options for transit and non-motorized transportation



However, sustainability is not felt equally from household-to-household or neighborhood-to-neighborhood, and there is still much to do to fulfill the City's ambitions



Source: City of Cambridge (tree canopy), MassGIS (roads, water, boundary), Google

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## Energy use in buildings accounts for more than 80% of GHG emissions



## Today, New England's electricity supply comes from one of the nation's cleaner grids



• There have been drastic reductions in electricity generation from oil and coal-fired power plants, which accounted for 22% and 18% of the grid mix in 2000, respectively.

- Those have largely been replaced by natural gas-fired power plants. Natural gas produces fewer GHG emissions relative to other fossil fuels; its growth has been fueled by low commodity prices.
- Nuclear power, a carbon-free source of electricity, will decrease in the future as plants retire.
- Renewables have experienced modest growth to-date but are poised for rapid growth in the coming years.

Source: NPCC New England Subregion Resource Mix (eGRID2014v2)

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#### Renewables will play an even larger role in the future of the New England grid



#### Projected Grid Mix and Carbon Intensity

- The Commonwealth's Renewable Portfolio Standard (RPS) calls for 15% of generation from new renewable energy sources by 2020 and an additional 1% each year thereafter
- The 2016 Energy bill (H.4568: An Act Relative to Energy Diversity) is expected to spur development of offshore wind and large-scale solar photovoltaic systems
- The new Solar Massachusetts Renewable Target (SMART) program, expected to start in early 2018, provides resources to double the Commonwealth's existing solar capacity
- Additional incentives available for solar projects in lowincome neighborhoods, promoting equitable access to the benefits of clean energy

Source: NPCC New England Subregion Resource Mix (eGRID2014v2); BuroHappold analysis assuming linear implementation of the Massachusetts RPS

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### Locally, rooftop solar installations have been increasing steadily for two decades



#### Cambridge's Solar PV Capacity

- Approximately 4.5 MW of solar PV systems were installed in Cambridge as of January 2016
- The technical potential for solar PV systems is estimated to be as high as 307 MW, which would generate approximately 20% of Cambridge's annual electricity usage (based on *current* consumption patterns)

Source: Cambridge Energy Alliance (left); Getting to Net Zero Appendix F (right)

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However, we primarily rely upon fossil fuels to heat our buildings; natural gas constitutes 60% of stationary energy consumption in Cambridge



**Stationary Energy Consumption in Cambridge** 

Source: Cambridge GHG Emissions Inventory

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### Climate change will result in milder winters and hotter summers



**Projected Annual Heating and Cooling Degree Days** 

2070

Source (right): Petri, Y. and Caldeira, K. Impacts of global warming on residential heating and cooling degree-days in the United States (2015), and BuroHappold analysis

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### Extreme heat events are projected to increase in frequency and severity

- Number of days over 90 degrees will nearly triple by 2030
- 2. Heat waves projected to be more likely and frequent
- 3. Especially significant for vulnerable populations without access to cooling options



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15	16	17	18	19	20	21	15	16	17	18	19	20
22	23	24	25	26	27	28	22	23	24	25	26	27
29	30	1	2	3	4	5	29	30	1	2	3	4
6	7	8	9	10	11	12	6	7	8	9	10	11
13	14	15	16	17	18	19	13	14	15	16	17	18
20	21	22	23	24	25	26	20	21	22	23	24	25
27	28	29	30	31	1	2	27	28	29	30	31	1
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27	28	29	30	31	1	2
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Source: Kleinfelder, City of Cambridge Climate Change Preparedness & Resiliency (CCPR) Plan, November 2016

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## Meanwhile, hotter summers will increase cooling demands and place strain on the electrical grid





In order to meet summer peak demands, a renewables-based grid will require the use of fast-ramping natural gas turbines or large-scale energy storage (in addition to distributed energy resources). Simultaneously, residential energy reduction strategies (behavioral DR, dynamic pricing, "bring your own thermostat" programs) will help with peak shaving.



Sources (left chart): Petri, Y. and Caldeira, K. Impacts of global warming on residential heating and cooling degree-days in the United States (2015), and BuroHappold analysis

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Cantabrigians are moving away from single occupancy vehicles and towards lowcarbon modes. However, passenger vehicles still account for 82% of transportrelated emissions.



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2015)

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The Cambridge Water Department has been proactive in minimizing contamination threats to the city's water supply; drought has emerged as an unexpected issue.



• Source: City of Cambridge Water Department, Drinking Water Quality Reports (2007-

- Water shortage has emerged as a surprise issue; the City had to switch to using MWRA water for a significant part of the past year (at great expense)
- Because of the developed nature and types of land uses within the Cambridge watershed, the city's source waters are considered as having "high" susceptibility to contamination.
- In 2011, the Cambridge Water Department updated its comprehensive Source Water Protection Program, which includes:
  - Extensive monitoring
  - Hazardous materials emergency response planning
  - Partnership development with other parties in the watershed
  - Proactive site review and monitoring
  - Stormwater management
  - Community outreach

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#### As a result, drinking water quality meets and exceeds all state and federal standards.



*Source: City of Cambridge Water Department, Drinking Water Quality Reports (2007-2015)* 

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Water quality in the Charles River and Mystic River / Alewife Brook have improved over time thanks to infrastructure investments and reduced CSO discharges



- Water quality is a key priority for the City, and work to date to improve stormwater management has made significant improvements for the Charles River and Mystic River / Alewife Brook
- Non-point source pollution continues to be the biggest problem for Alewife Brook
  - Deposition of fertilizers, herbicides, oil, grease, salt, bacteria from animal waste and sediments, especially from construction sites are the most common consequences of non-point source pollution
- CSO events can still occur and discharge untreated sewerage



The occurrence of high volume rain storms is predicted to increase in the future, resulting in increased likelihood and extent of flooding



Source: Kleinfelder, City of Cambridge Climate Change Vulnerability Assessment Report Part 1, November 2015

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In the near term, the largest concern is overland flooding from precipitation, particularly in Alewife...



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Existing Conditions
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### ...with inundation increasing in severity by 2030s...



...and further, to the 2070s



## Additionally, models predict up to 8 inches of sea level rise by 2030,.....



Source: Kleinfelder, City of Cambridge Climate Change Vulnerability Assessment Report Part 1, November 2015; NOAA (2012). Global Sea Level Rise Scenarios for the United States National Climate Assessment

OverviewEnergy & EmissionsWater & FloodingAir QualityTrees & Nat. EcologyMaterials & WasteImage: City of CambridgeUtileEnvision CambridgeClimate and Environment Working Group: Session 1May 8, 2017envision.cambridgema.gov30

#### ..., which will especially impact historic tidal marshland areas after 2030



Historic tidal marshland map of Cambridge - "The Great Swamp" is present day Alewife



Sea level rise and storm surges will likely cause the Amelia Earhart Dam to be flanked and overtopped by mid-century





#### At 1% (100-yr):

- Flanked in 2045-2050
- Overtopped in 2055-2060

At 0.2% (500-yr):

- Flanked in 2030-2035
- Overtopped in 2040





#### Sea Level Rise (SLR) / Storm Surge (SS) Flooding

Percent probability of exceedance



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# Improvements in air quality have accompanied national and regional efforts to reduce emissions from power plants and vehicles

- Ozone and particle pollution have decreased in the region, largely due to the phase out of coal-fired power plants and older diesel engines, as well as stricter emissions requirements for new vehicles
- Air quality improvements are largely driven by regulations set at the state and federal level
- Locally, transportation demand management strategies have also shifted commuters to modes with lower emissions, including electric vehicles
- Particulate matter from diesel trucks remains an issue, although this will continue to improve over time with changes in engine technology.





## **Trees and Natural Resources**

- There are 21,890 trees and tree wells in Cambridge, which together with private trees providing a canopy that covers approximately 30% of the citywide land area.
- There is a maximum physical potential to increase tree canopy to cover another 35% of land area, although that figure cannot be fully achieved due to competing land uses and other factors.
- There is a significant difference in tree canopy coverage between neighborhoods; the City is targeting its tree planting efforts to address this disparity.
- Some areas are very densely developed with narrow sidewalks and little space around buildings, which impacts the potential to increase the tree canopy.





Source: City of Cambridge (tree canopy), MassGIS (roads, water, boundary)



## Materials and Waste

- Cambridge continues to decrease waste to landfill and is studying the feasibility of Net Zero Waste
- Curbside compost pilot is proving to be tremendously popular and successful
- Solid waste disposal is attributable to 6% of citywide GHG emissions



In October 2015, the City expanded free weekly curbside pickup of food scraps to 5000 additional households on the Monday collection route

#### Source: City of Cambridge, Zero Waste Master Plan RFQ, 2016



Curbside Trash

\*Includes DPW curbside + CHA buildings with city services only

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## Materials and Waste

#### **Contaminated Sites**

- Contaminated sites can complicate and/or increase the costs of redevelopment or reuse of parcels due to the presence or potential presence of hazardous substances, pollutants, or contaminants.
- Unlike some other communities, the presence of contamination has not been a deterrent to redevelopment given the high cost of land.



#### Source: MassDEP

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# Issues, Goals, and Opportunities

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## Methodology

To help generate a baseline set of issues, draft goals, and opportunities for the working group to discuss, in addition to drawing on the existing conditions analysis, the team synthesized takeaways from community engagement conducted to date.

#### Listening Phase (March-June 2016)

Mobile engagement station, 1 online and in-person survey, community workshops, & targeted focus groups. Community members voiced on opportunities and challenges for Cambridge across multiple topic areas.

Visioning Phase (April-July 2016) Mobile engagement station, 3 online and in-person surveys, 2 community visioning workshops, & 2 pop-up events. Community members voiced their opinion on the <u>core values</u> and <u>vision</u> for Cambridge.

#### Issues

- <sup>1.</sup> We need to reduce GHG emissions to net zero by around mid-century to avoid catastrophic climate change (staying below the 2° Celsius rise in global temperatures) while continuing to enable economic development
- <sup>2.</sup> Population growth, while presenting many benefits to the City of Cambridge, can also lead to an aggregate increase in GHG emissions from greater energy consumption (more buildings and vehicles) and increased solid waste generation, unless per capita reductions are large enough to offset this growth
- <sup>3.</sup> Meanwhile, we are already feeling the impacts of climate change:
  - Higher temperatures lead to increase in energy use and demand for cooling, resulting in greater GHG emissions and stress on the electric grid, as well as more need for outdoor shaded spaces.
  - More intense rainfall results in greater flooding and stormwater runoff, impacting the economy and the water quality of our waterways.
- <sup>4.</sup> These climate impacts exacerbate existing environmental (air quality), economic (energy affordability), and health (heat, indoor air quality) challenges that already disproportionally impact vulnerability populations/households
- <sup>5.</sup> In addition to their human impacts, rising sea levels and storm flooding may result in salinization of natural resource areas, damaging habitats as well as infrastructure and buildings

## **Draft Goals**

#### **Goal 1: Environmental Protection**

Protect Cambridge's environment and natural resources, ensuring clean air, clean water, and responsible management of land and open space.

#### Goal 2: Carbon Neutral by 2050 [existing goal]

- Net Zero Emission Buildings by mid-century [existing target]
- Solar target: 60MW by 2020, 160MW by 2040 [existing target]

#### **Goal 3: Resilience**

Protect the lives and livelihoods of members of the Cambridge community that are at risk from climate change impacts and, in the process, enhance the well-being of the Cambridge community

#### **Goal 4: Clean Energy Economy**

Increase proportion of energy supply that comes from no and low carbon sources to catalyze the market for clean energy, reduce greenhouse gas emissions, and enhance community resilience

#### **Goal 5: Integrated Stormwater Management**

Implement best practices in stormwater management to reduce stormwater runoff, reduce Combined Sewer Overflows, and help clean waterways

#### **Goal 6: Maximized Tree Canopy**

Maximize the Cambridge's tree canopy across all neighborhoods to help manage stormwater, provide shade and cooling, and provide habitat protection

#### **Goal 7: Zero Waste**

Eliminate waste to landfills and help catalyze a circular economy

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#### **Goal 8: Environmental Justice** Ensure all communities benefit from the City's climate and environment initiatives

#### For Each Goal:

Does this goal adequately respond to the issues facing Cambridge? How could it be improved or enhanced?

Do you see this as a goal in and of itself or a means to an end in achieving other goals?

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## City's Existing Goals (Goal 0)

- Carbon neutral by 2050
- 70% reduction in emissions from the Cambridge building stock by 2040, including:
  - Energy Efficiency in Existing Buildings
  - Net Zero New Construction
  - State Renewable Energy
  - Renewable Energy generated in Cambridge
- Solar targets
  - 60MW by 2020
  - 160MW by 2040



### Jointly-Revised Draft Goals [this slide to be completed in real time]

Base Goal	Revised Goal
<b>Goal 1: Environmental Protection</b> Protect Cambridge's environment and natural resources, ensuring clean air, clean water, and responsible management of land and open space.	
<ul> <li>Goal 2: Carbon Neutral by 2050 [existing goal]</li> <li>Net Zero Emission Buildings by mid-century [existing target]</li> <li>Solar target: 60MW by 2020, 160MW by 2040 [existing target]</li> </ul>	
<b>Goal 3: Resilience</b> Protect the lives and livelihoods of members of the Cambridge community that are at risk from climate change impacts and, in the process, enhance the well-being of the Cambridge community.	
<b>Goal 4: Clean Energy Economy</b> Increase proportion of energy supply that comes from no and low carbon sources to catalyze the market for clean energy, reduce greenhouse gas emissions, and enhance community resilience	
<b>Goal 5: Integrated Stormwater Management</b> Implement best practices in stormwater management to reduce stormwater runoff, reduce Combined Sewer Overflows, and help clean waterways	
<b>Goal 6: Maximized Tree Canopy</b> Maximize the Cambridge's tree canopy across all neighborhoods to help manage stormwater, provide shade and cooling, and provide habitat protection	
Goal 7: Zero Waste Eliminate waste to landfills and help catalyze a circular economy	
<b>Goal 8: Environmental Justice</b> Ensure all communities benefit from the City's climate and environment initiatives	

## Confirming Goal Alignment with Values

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Core Values	Livability	Diversity and Equity	Economic Opportunity	Sustainability & Resilience	Community Health & Wellbeing	Learning
Goal 1: Environmental Protection						
Goal 2: Carbon Neutral by 2050						
Goal 3: Resilience						
Goal 4: Clean Energy Economy						
Goal 5: Integrated Stormwater Management						
Goal 6: Maximized Tree Canopy						
Goal 7: Zero Waste						
Goal 8: Environmental Justice						

## Framing Opportunities From Goals

Protect natural resources

Form a more resilient community

Keep moving toward **cleaner energy sources** 

Reduce stormwater runoff and eliminate CSOs

Expand the tree canopy

Eliminate waste sent to landfills

Promote environmental justice

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• Target underserved neighborhoods for tree planting program to expand the tree canopy and promote environmental justice (example)

## Next Steps: Work Session 2 in June

- Review the City's existing environmental programs and policies in light of goals.
- Identify preliminary strategies to supplement the City's existing tools and advance goals.



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