Minutes

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Project title	Carbon Free Boston - Buildings Sector	Job number 259104
Meeting name and number	TAG #2 01/18	File reference
Location	Boston University Institute for Sustainable Energy	Time and date 9:00am April 4, 2018
Purpose of meeting	Project Update & Coordination	

Present	Cutler Cleveland, Boston University
Chris Meier, Boston University
Michael Walsh, Boston University
Alison Brizius, City of Boston
Benjamin Silverman, City of Boston-EEOS
John Dalzell, City of Boston-BPDA
Maura Zlody, City of Boston-EEOS
Hong-Hanh Chu, Commonwealth of MA-EEOS
Matt Foran, National Grid
James Cater, Eversource
Karthik Rao, Enernoc
Stephanie Horowitz, Zero Energy Design
Jim Newman, Linnean Solutions
Galen Nelson, Mass CEC
Brian Swett, Arup
Rebecca Hatchadorian, Arup
Apologies	
Circulation	Those present
David Ismay, Conservation Law Foundation
Ben Myers, Boston Properties
Dennis Carlberg, Boston University
Chris Schaffner, Green Engineer

Prepared by	Arup
Date of circulation	13 April 2018
Date of next meeting	TBD

Minutes

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Carbon Free Boston - Buildings Sector	259104	April 4, 2018

Action

1.1 Carbon Free Boston Overview [ISE]

Cutler Cleveland presented an update to the overall Carbon Free Boston project.

3 student teams (from MIT, BU, and Northeastern) are completing research for the buildings sector

- MIT team looking at best practices for offsets and RECs
- Northeastern team looking at best practices for energy efficiency

2. Building Stock [Arup]

City of Boston Tax Parcel ID database is the data source for segmenting the building stock.

Boston is an old city and that can be seen in the building stock. Building typologies are segmented by 4 age ranges.

Total of 633million SF and 86,500 buildings in the City

Key parts of the segmentation methodology;

- o Residential classified as single-family, small multi-family (2-4 family), and large multi-family (5+)
- o Living area square footage defined the square footage of residential and gross square feet defined the square footage of commercial.
- o Year of construction is based on the first COO; it does not account for renovations
- o Each building has a single classification, even if it's mixed use (i.e. a building with ground floor retail in an office building would be classified as office). The dominant use defined the typology classification.
- o Universities or campuses are mixed into the different categories based on the use of the building
- ISE is working with GRC to look at overall ownership type to identify "first movers" – includes state, federal, universities, hospitals, etc.
- Q: Are you looking at building construction type? This will likely dictate retrofit strategies, etc.

Minutes

Action

- - A: Age ranges have assumptions about the construction type built into the modeling
    - A; An approach will be developed as we calibrate the models, if further sub-segmentation is needed for a particular typology.
- TAG suggestions to segment these institutions and do an analysis on that building stock.
    - GRC has completed a study for the top 50 owners in the City and this has been shared with ISE. It found these owners comprise about 60% of the total building stock
    - Identify these at the next TAG meeting.

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3. **Modeling Methodology [Arup]**

- The 4 age ranges and building types were chosen the align with the community energy study and the age ranges align with inflection points for major building code changes over time.
- In the process of calibrating the model with the data from utility partners and local knowledge, which will help refine our understanding of each type of building per age range
    - Received anonymized monthly EUI data from utilities by age and use category
    - Project team sends the utilities a list of addresses and then the utility sends back the anonymized data
- Once the calibration is complete for the typologies, the results are scaled up per the building stock segmentation to estimate energy consumption and emissions across the City.
- Q: How are we using the BERDO data in the calibration of the model?
    - BERDO will be used as a second-tier calibration, but it doesn't have monthly data available only annual. The utility data is critical to see how energy use changes over a year (i.e. amount of heating needed in winter, cooling in summer, etc.)
- Q: There are likely to be more brick/stone buildings in Boston than there are in the national datasets or even the data sets used for New England/the northeast, how is the model accounting for that?

Minutes

Project title	Job number	Date of Meeting
Carbon Free Boston - Buildings Sector	259104	April 4, 2018

Action

- ▪ Relying on local knowledge and data to inform how we need to modify the model and then we are changing specific data points in the model to account for the local condition.
- Q: Does the fluctuation in population impact the model in any way (i.e. population changes drastically in the summer when students leave the city for summer break)?
  - ▪ The model accounts for this through the scheduling piece. Schedule assumes less energy use in dorms and other facilities in the summer months.
- The renovation data in the assessor's database is not very robust. If the utility data supplied is able to identify clear distinctions, it will be used. But this is unknown currently.
- Q: How does the model account for climate change and its impact on heating/cooling loads, etc.?
  - ▪ We will be using Weathershift, which creates TMY files based on future climate projections, but we still need to have a conversation about which RCP future scenario will be used.

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4. Strategies [Arup]

- Difference between strategies and policies is that strategies are the different building interventions that we can model and policies are the mechanisms we can use to achieve the outcomes that were modeled using the different strategies.
- The project as a whole will look at changes to the overall supply (and the energy TAG will focus more on that part of the project), but our purview is the buildings sector and the specific strategies that can be implemented by a building owner
- CFB will investigate the impact of the strategies under different scenarios related to the grid – high carbon, low carbon, etc.
- Q: Consider strategies beyond net zero to include net positive, so we don't fall short of what could be achieved.
  - ▪ Consider a phased approach to policy that discusses net zero by a certain timeframe and net positive by another timeframe.

Minutes

Action

- Q: Will the project consider the fossil fuel usage associated with redundant systems (i.e. generators when grid goes down, etc.)?
- Q: Should have a different set of strategies for single-family and small residential vs. large residential and commercial buildings
- Q: How are we accounting for demand-side management, i.e. Nest and other solutions?
- Q: Is the project looking at phased strategies? (i.e. replace all gas/oil burners before requiring passive house, etc.)
    - May only have one shot at replacing gas/oil burners
    - This phased approach would be a good thing to model
- Q: Can we predict what future "transformational" moments may happen (similar to the transformation that took place with the invention of air conditioning) or the fact that the entire South End has been renovated within the last 30ish years?
    - Maybe energy storage will have a transformational effect
- Q: How is cost factored into the analysis?
    - Planning to complete a rough order of magnitude cost analysis with the strategies.
- Q: Couldn't you argue that requiring cogen make drive us backwards?
    - Make sure we don't lock ourselves into this
    - Can have cogen based on renewables, e.g. Deer Island
- Q: We use a lot of high intensity energy for low intensity uses – need to find a way to disaggregate the two
- Q: Need to "max out" certain strategies and then look at opportunities to address the remainder of emissions through cogen and other strategies
- Q: Need to include market-driven incentives and other types of incentives, beyond just municipal incentives

5.   **Next Steps**

Key next steps include;

1. Utility data requests (Eversource, National Grid and Veolia) are ongoing. Target for next TAG meeting to have a model (calibrated) and initial strategy runs.   ARUP / ISE

Minutes

	Action
2. Growth projections	ARUP / ISE
3. Adoption rate research and definition	ARUP / ISE

Next TAG meeting to be scheduled for mid-June 2018.