Minutes

ARUP

Project title	Carbon Free Boston	Job number	259104-00
Meeting name and number	Technical Advisory Group	File reference	
Location	BU CILSE	Time and date	9:00AM June 13, 2018
Purpose of meeting	To present progress and solicit feedback on the Buildings Sector analysis for Carbon Free Boston		
Present			
Apologies			
Circulation	Those present		

1. Project Update

- Northeastern University student project on expanding energy efficiency opportunities in Boston is complete. The study was circulated along with the materials for this meeting.
- The project team presented to the Green Ribbon Commission last week (6/5) and received positive feedback.
- Next TAG meeting to be scheduled for August. The intent is to review preliminary results along with the themes and policies that will be summarized in the final report.

2. Model Calibration & Typology Studies

Arup is in the process of calibrating the model based on the data received from the utility partners. All data received as of a couple weeks ago. Arup & BU are processing the data for calibration.

Comparison of utility data to BERDO data found that the averages of the utility data were low relative to what was reported through BERDO. Arup & BU working to better understand discrepancy and continue calibrate the model. BERDO is not the dataset being used for calibration but is another data point for comparison.

Prepared by	Arup
Date of circulation	
Date of next meeting	TBD

Calibration methodology includes two tests: (1) comparing means of samples and (2) comparing variability in data from month-to-month.

Most models are generally performing in a similar trend as the actual data, but the order of magnitude is still off and that is what we are trying to reconcile.

In-progress results for large multi-family show general agreement across the age ranges, except for the post-2000 age range. Seasonal trends are generally in alignment, but currently showing an overestimation of energy use.

- What new assumptions were made in 2000 that weren't made in earlier years, since the shape of the model is vastly different?
    - One hypothesis is that the model assumes high performance buildings with low leakage, but in reality these buildings are performing more like older buildings.
- Arup to update the charts for same Y axes on all charts.

In-progress results for office show that the overall means are in relative alignment, but there is an issue with winter seasonality (the model and the actual data are diverging).

- Why are the shapes exactly the same across the different age ranges?
    - This is an intentional step in the calibration process based on the automated workflow. It will get more nuanced as we continue to work through the calibration.
- Are these the raw model predictions or do they include some level of calibration?
    - These include a small amount of calibration based on the automated workflow, but we haven't gotten to the level of human intervention.
- How many data sets did we receive?
    - 500 profiles received, filtered out about 10-15%, so we are working with approximately 420 datasets now.
- Is there a potential that the utility data also has inaccuracies?
    - Yes, that's why we are weeding out the outliers.
- For trouble shooting, consider assumptions for electric lighting, not just electric heating, especially in the winter months.

Calibration will be an intense focus over the next month and we will develop a work flow to solicit feedback from the TAG on a more regular basis.

3. Growth in the Building Sector

Existing conditions:

- Existing building stock is 633M sqft
- Small multi-fam is the largest part of the residential sector
- Building stock accounts for ~75% of the city's emissions

Used Imagine Boston 2030 for predicting residential and commercial change. Starting point for projections is 2011.

Methodology: Existing 2017 SF – Demolition + Replacement + New construction = future building stock in 2030 & 2050

Projected housing demand = 53k units by 2030 and an additional 42k units by 2050

- Research shows larger units are coming offline and being replaced with smaller units, so that is built into growth assumptions
- Overall breakdown of new construction growth is based on the Post-2000 residential construction trends: 6% single-fam, 27% small res, 67% large res
- Average of 900 SF/unit
- Results = 67M sqft of residential growth by 2050 (29.5M by 2030, 37.4M 2030-2050)
    - Did you look at trends over time?
        - No. This is the aggregate.
    - Are you taking into account amenity areas?
        - Area is built into the 900 SF per unit assumption.

Projected commercial growth: 20M SF by 2030, additional 20M SF by 2050

- 3 different options for the allocation of that growth – BPDA pipeline report, current allocation, and post-2000 allocation
    - Could we look at the trend lines for each of these options and see what it would mean for the model, i.e. sensitivity analysis? Yes.
    - Have you factored in the fact that commercial space is getting smaller as well (similar to residential)?
        - No, because we used the total growth projection from the BPDA. Not sure if that was factored into their assumptions.

        - One thing to note is that the EUI increases per SF when there are more people in a smaller space.

Total growth by 2050 = 106M SF, which is still a small portion (about 15%) of the overall building stock. Need to focus heavily on the existing building stock toget the City to carbon neutrality.

- Over the last few years there has been +/- 6M SF of growth per year, so it seems like growth projections are being underestimated.
    - One average, if you factor in the recession, it's actually more like 4.5M SF per year, and we need to remember that there will likely be 1-2 recessions between now and 2050.
    - Arup & BU will continue to work with BPDA on growth assumption and it revisions are needed.
- Will there be a sensitivity analysis (e.g. if HQ2 comes to Boston, etc.)?
    - Yes, we will be doing a sensitivity analysis on a variety of scenarios.

4. Adoption Rates & Policy

Existing breakdown of owners who we will need to take actions.

- Is public housing under government?
    - Yes.
    - Affordable housing would be interesting to look at, especially given yesterday's meeting on social equity.

Arup/BU team will be defining 4 adoption rate curves (mandate, incentive, performance, prescriptive) based on existing data on compliance rates related to different policies and incentives, using local data wherever possible and then data from other national and internal cities where needed.

Mandate research:

- BERDO compliance: 73% in 2013 → 82% in 2016
- NYC LL84: ~82% after 4 years of required reporting, now they are at ~90%
    - NYC shows a big uptick at one point. Is that because they started fining?
        - Possibly a result of more people understanding the requirements and how to comply
- SF ECB: ~82% compliance after 4-5 years (lower threshold of 10k SF)

- In Cambridge, when the threshold was reduced, the compliance rate dropped a little (partially as a result of smaller buildings switching contractors more often than large buildings and the new contractors not understanding the requirements)

Incentive research:

- Boston
  - Energy incentives: about 16,900/year take advantage; in 1st 3 years, ~3% of populations; next 3 years, increased to 6.8%. This data includes energy star appliances, not just home audits.
  - Home energy audits: approximately 40% of those that complete an audit take some sort of upgrade action
    - There is some self-selection bias in this.
    - Social equity concern. Who is undertaking these audits and how we get socially vulnerable populations to act? There is likely a weak distribution across socio-economic classes. Majority of people undertaking assessments are owner-occupied units, not rental.
    - This may be true for smaller interventions but larger interventions will not meet these adoption rates.
- NYC 80x50 & Boulder SmartRegs examples presented.
  - Did you also look at Boulder's air source heat pump regulations?
    - No. We will look into this.
- There are a lot of different factors to consider – What is the priority and timeline?
  - Model will help to prioritize impact and timelines. This will be a focus of the report.

5. Discussion & Next Steps

a. What would be the most useful way for the project team to develop a feedback loop with this group between TAG meetings?

b. Need to make sure we are pushing forward and being pioneers, rather than just dealing with minimum requirements and baselines.

c. Boston does not control its Building Code – will there be a legal analysis of what paths the City can take? Yes, high level review will be included in the report.

d. Suggestion to break out usage by government, university and developers, since those are the major actors that we can work with and may be able to make the most impact.