2018-04-06

Carbon Free Boston Energy Advisory Working Group, April 6, 2018 meeting slide deck

Carbon Free Boston

Energy Advisory Working Group

Institute for Sustainable Energy, Boston University

April 6, 2018

Meeting Agenda

Project update (15 mins)

Discussion of proposed grid scenarios (45 mins)

Discussion of other energy supply and equity issues (45 mins)

Recap and next steps (15 mins)

Summary of Work-to-Date (9/1/17 – 4/1/18)

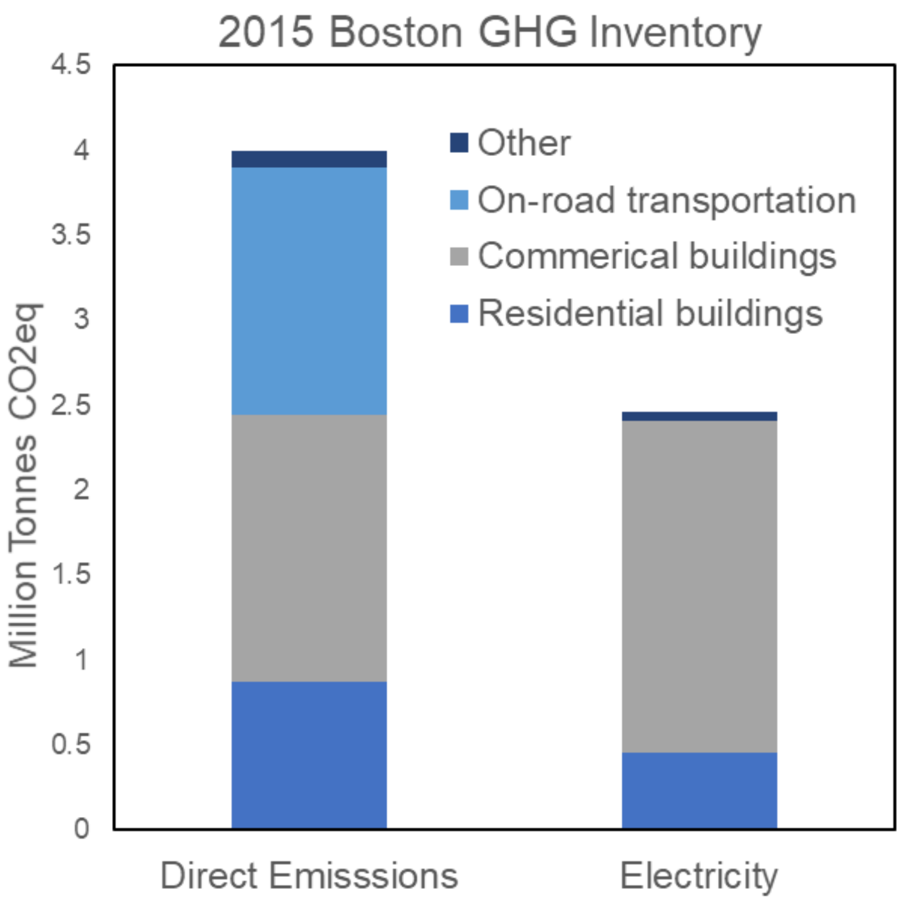
- Consultants selected; contracts executed; SOWs revised and harmonized
- Data collection: utility partners/City/BU/consultants
- Initial parametrization complete (transportation) or in progress (buildings, energy)
- Grid model review/discussions: Brattle, Synapse, MJ Bradley, JGRCI
- First meetings of Energy, Transportation, Buildings TAGs; meet with NGOs
- Planning for meetings with "first movers" and academic researchers
- Social Equity Advisory Group established
- Student projects launched at MIT, BU, Northeastern
- Scoping of Final Report; writing commences for background sections
- Community Meeting held at BU
- Deepening relationship with C40

Summary of Future Work (4/1/18 - 10/15/18)

- March: TAGs and Steering Committee meet; sector models adjusted; grid model finalized
- April: Initial results from Build. and Trans. models; background sections of Final Report; web site up
- May: TAGs and Steering Committee meet; models revised; results from student projects
- June: More model results; start preparation of technical sections of Final Report
- July: TAGS meet; final (small) changes to models; ongoing work on technical sections of Final Report
- August: All sector models finalized; first draft of Final Report (late August)
- September: Consultant final reports (9/15); iterative review/revision of Final Report; Steer. Comm. Meets
- October: Final report delivered

The Importance of the Electricity Sector

Electricity consumption = 40% of City's GHG emissions



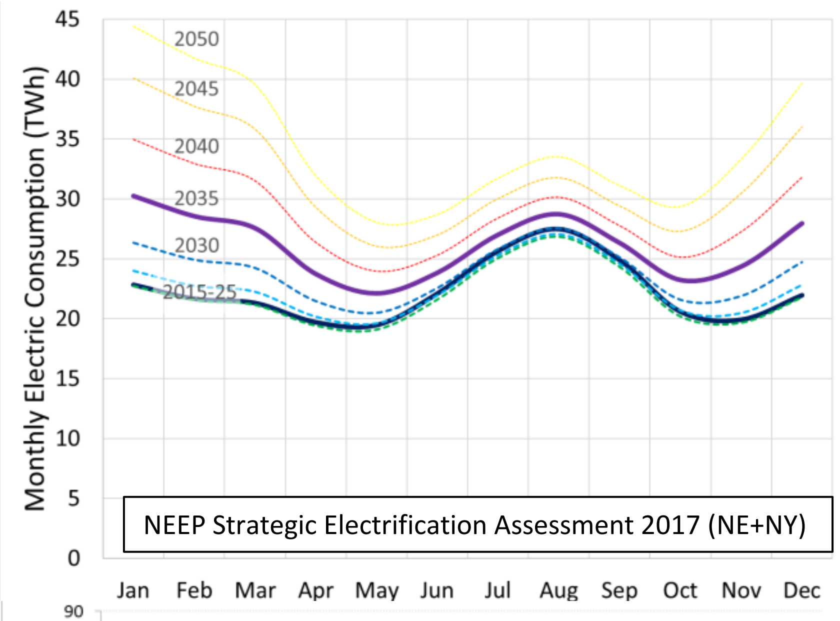
The Importance of the Electricity Sector

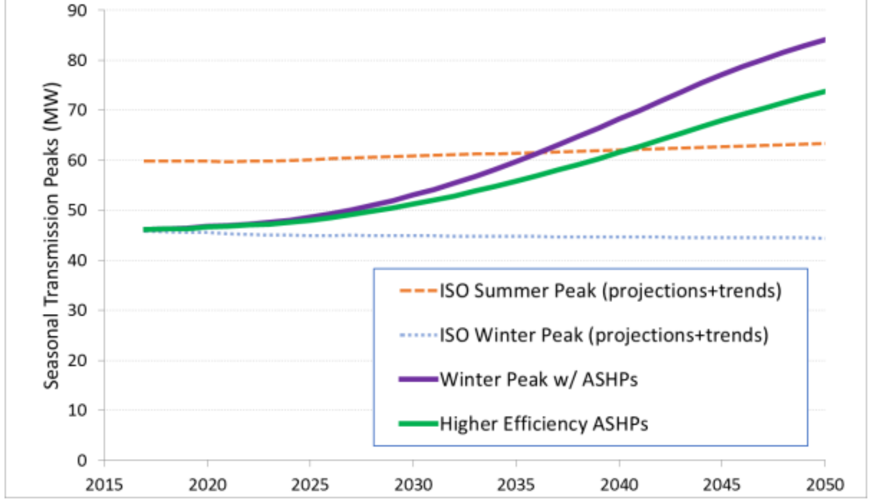
Electricity consumption = 40% of City's GHG emissions

Despite efficiency gains, electricity consumption will increase due to the growth of EV's and electrification of heating systems (NEEP Assessment: 50-60%)

GHG intensity will influence the selection of energy efficiency and electrification strategies across sectors

Thus, evolution of the grid is a paramount factor in overall CFB analysis





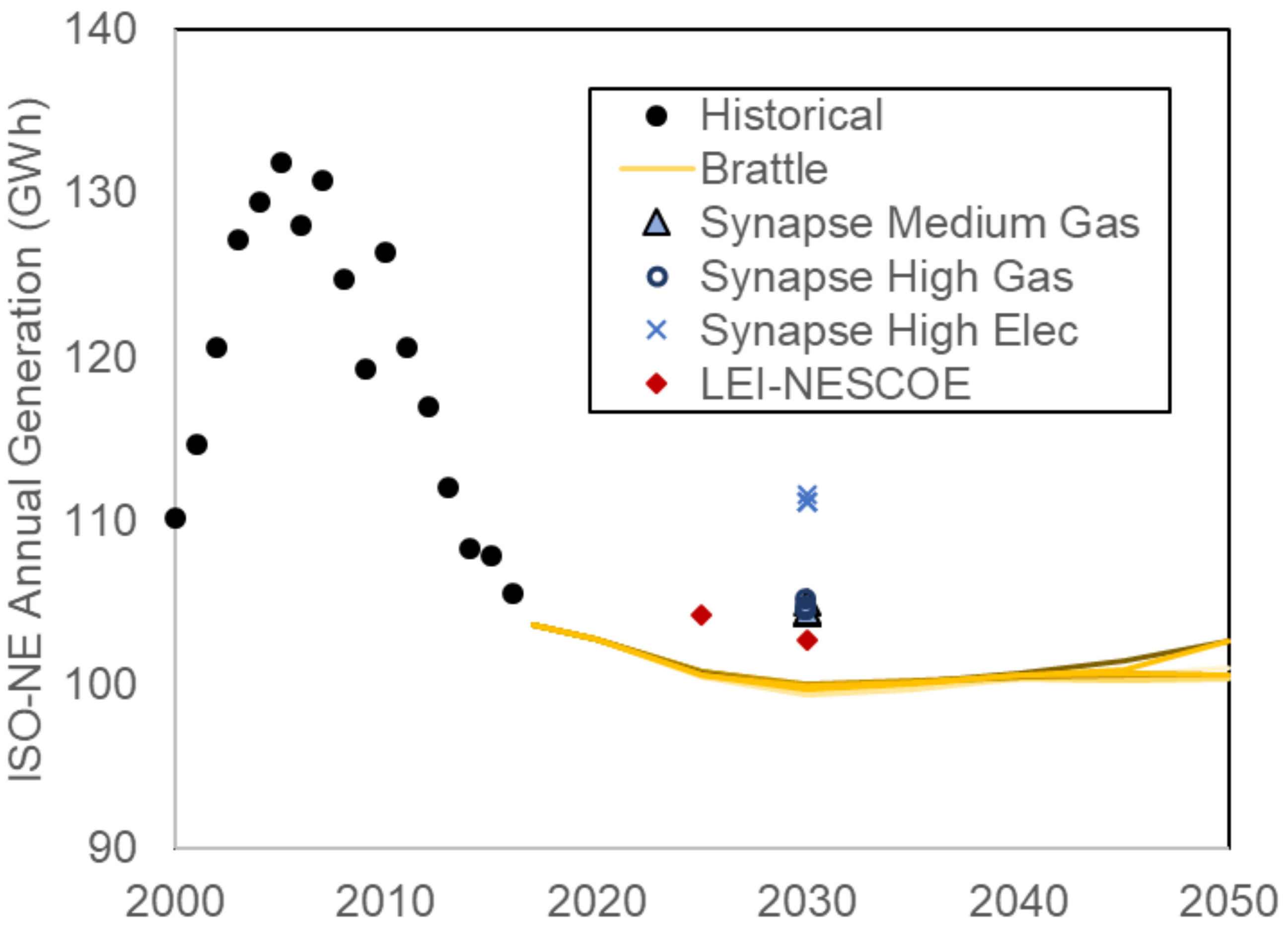
	An Analysis of the Mass. Renewable Portfolio Standard	A Dynamic Clean Energy Market In New England	GCAM-USA Analysis of Electric Power Sector Transitions	NESCOE Mechanisms 2.0
Research Team	Synapse	Brattle	JGCRI/PNNL	LEI
End Date	2030	2030/2050	2050	2030
Spatial Resolution	State/ISO+NE	State/ISO+NE	State/ISO+NE	ISO+NE
Purpose	Effectiveness of RPS	Analysis of a market design	Exploration of pathways to 80% economy wide reductions in CO_2	Infrastructure analysis and capabilities
Policy Focus	RPS & GWSA	Dynamic payments, tax, cap	Emissions cap (80x50)	RPS and clean energy
Region	MA	New England	National	New England
Platform	EnCompass (Anchor)	Scenario Impact Model (Brattle)	GCAM-USA (JGCRI/PNNL)	POOLMod (LEI)
Imports (trade)	Fixed	Fixed	Variable	Fixed
Scenarios	1, 2, 3% yr. RPS increase Moderate natural gas High natural gas **High electrification**	Current Practice CO_2 Cap New-Only Clean Energy Two-Tier New/Existing	Reference 80% Reduction 80% Advanced Tech **80% High Electrification** 80% Reduced Demand 80% Stretch Technology	Base Case Expanded RPS Clean Energy Imports Clean Energy Retirements Combined Renewable and Clean Energy

Scenarios of Future Total Aggregate Generation

- Current conditions in ISO NE:
  - Generation = 104 GWh
  - Imports ~21 GWh
  - Boston Demand ~ 6-7GWh
  - Wholesale prices: ~40-50$/MWh

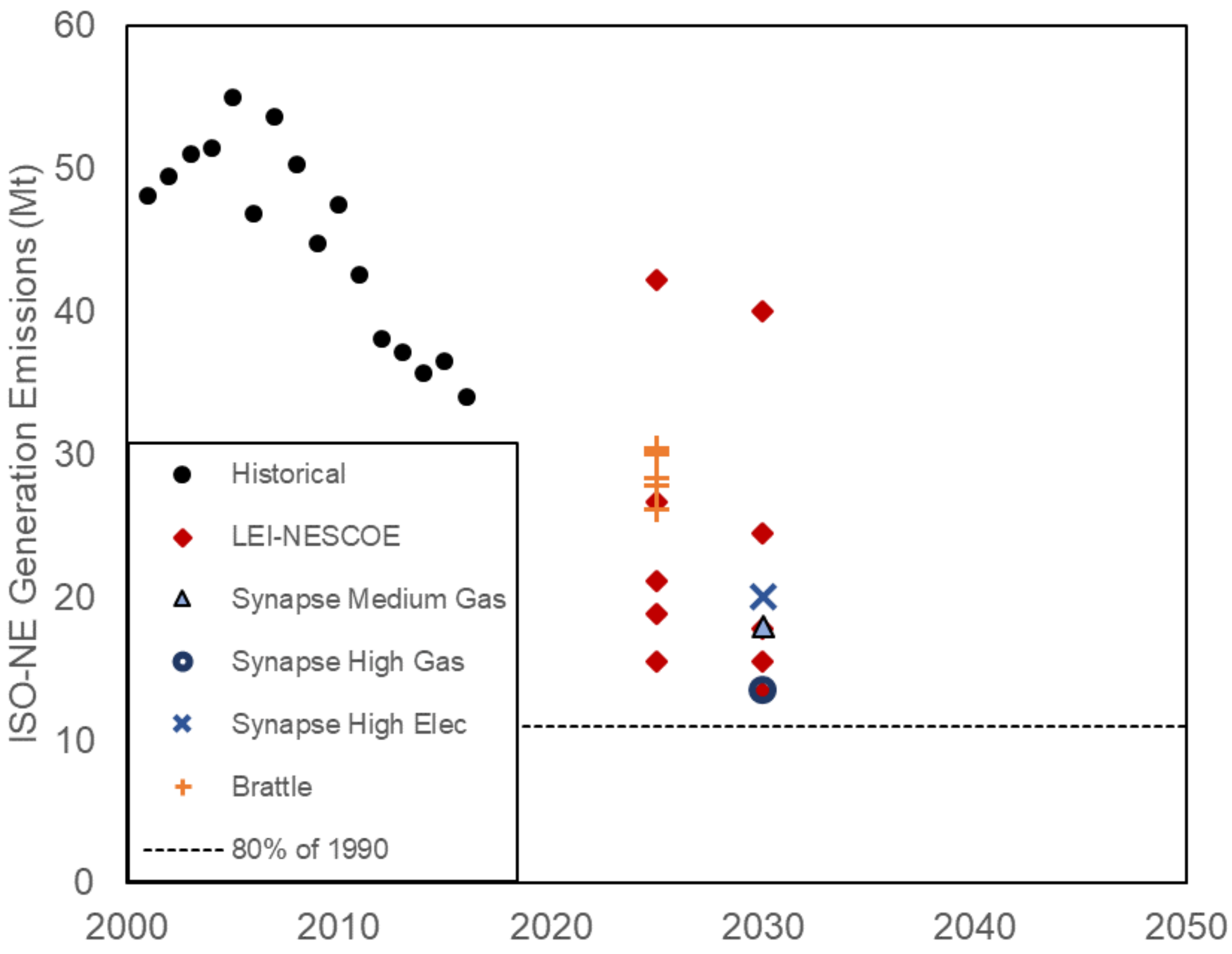
- Projections: relatively constant demand
  - exception: large scale electrification

- CFB will explore higher levels of electrification by 2050
  - Increase in EV's
  - Electrification in heating



Scenarios of Future Emissions

- Renewables grow in most scenarios, driven by:
  - Cost reductions
  - Policy (e.g. RPS)
- High LEI-NESCOE scenario: nuclear replaced with gas
- Low scenarios result from stronger policy and higher FF prices
- Increased demand limits emissions reductions (Synapse High Elec)



Scenarios of Electricity Prices

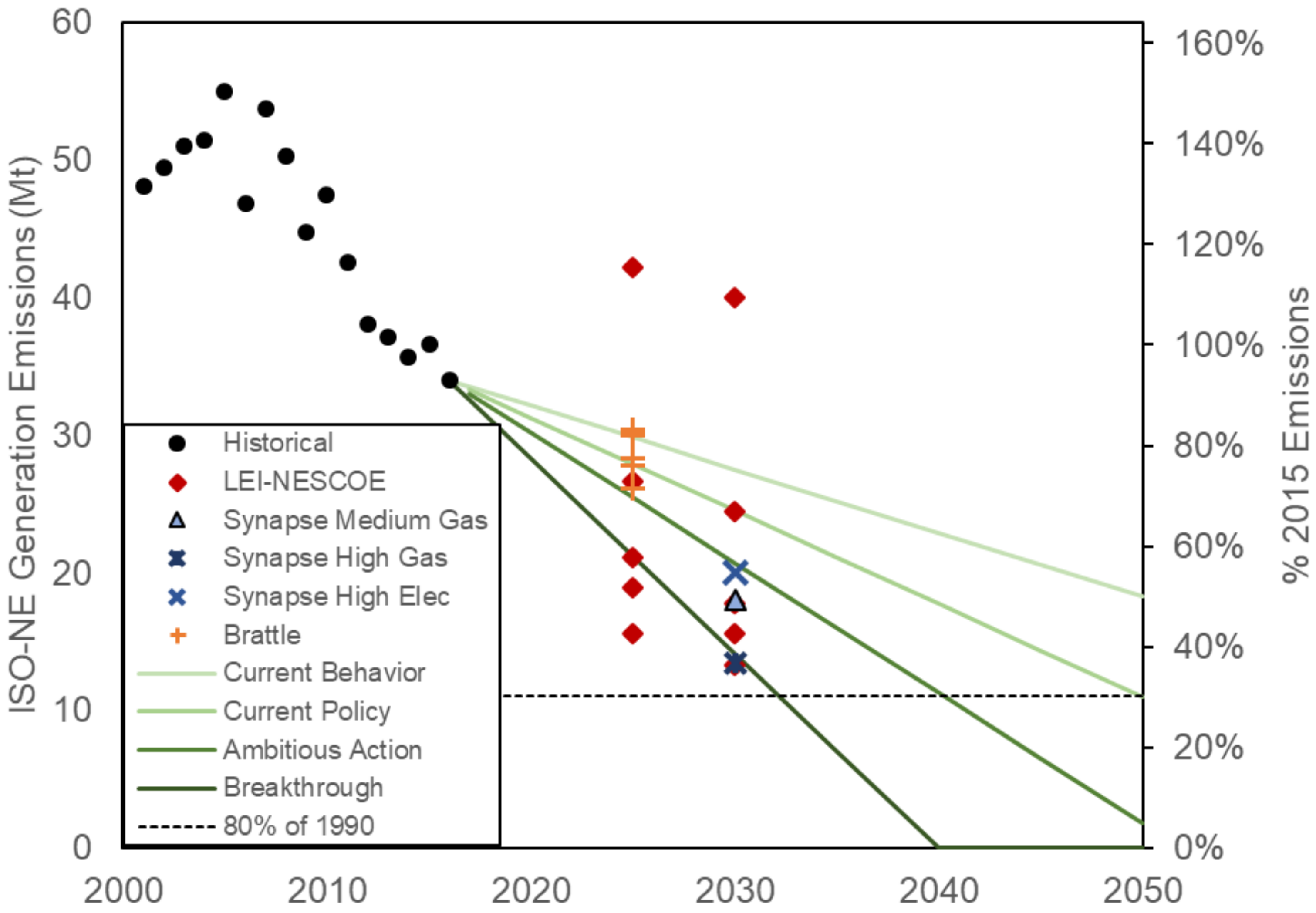
- Prices in 2030:
  - Brattle: 46 - 51 $/MWh
  - Synapse: 41 – 43 $/MWh
  - LEI-NESCOE: 38.2-52.5 $/MWh

- High level points:
  - Declining cost of renewables lead to lower wholesale prices
  - Market design impacts price

Defining Grid Scenarios for CFB

- Generate emissions scenarios that reflect range of potential futures for the NE-ISO grid as defined by recent studies
- Set targets that for those ranges
- Straight-line extrapolation

Proposed Emissions Scenarios

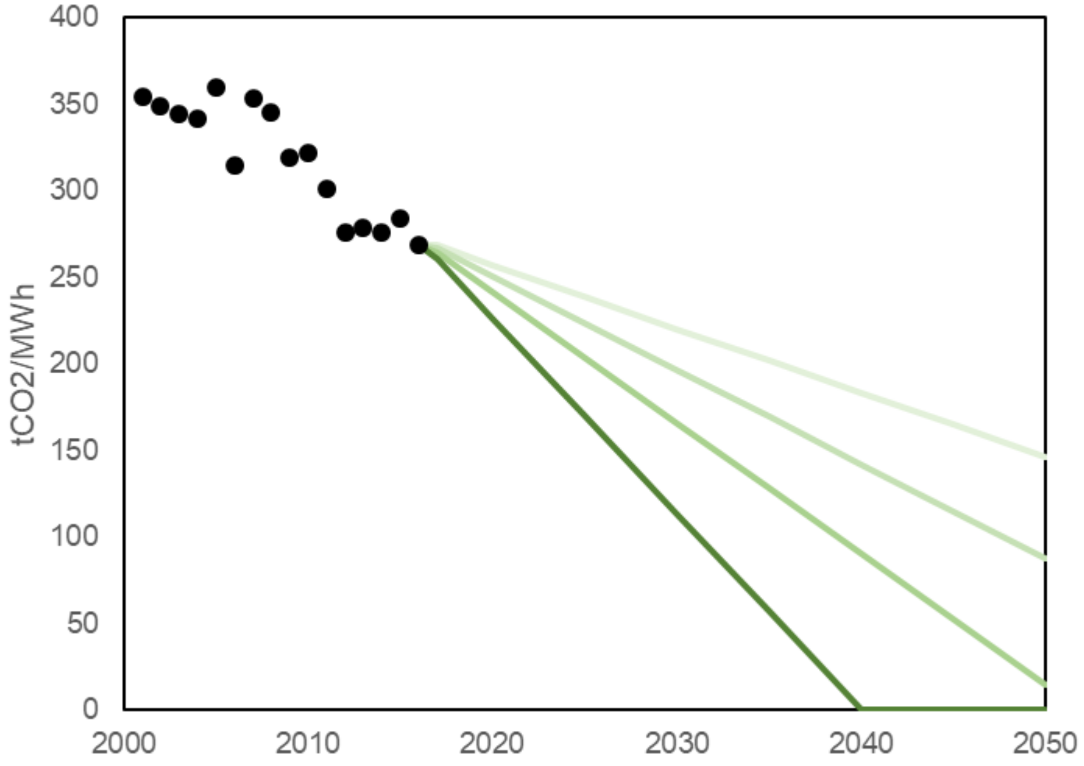


Proposed Approach

- Utilize emissions coefficients to account for emissions from electricity demand in buildings & transportation sections
- Perform scenario analysis with a focus on the middle two scenarios

- Questions:
    - Are these scenarios realistic?
    - Are these scenarios sufficiently robust to evaluate policies and actions for the City and its stakeholders to take?
    - How much context should we give on these scenarios for the report?

Emissions Coefficients



Other Issues for the Energy TAG

- Electrification feedbacks between the City and the grid
- In-boundary supply
- Offsets and renewable energy procurement strategies
- Social equity impacts of GHG mitigation

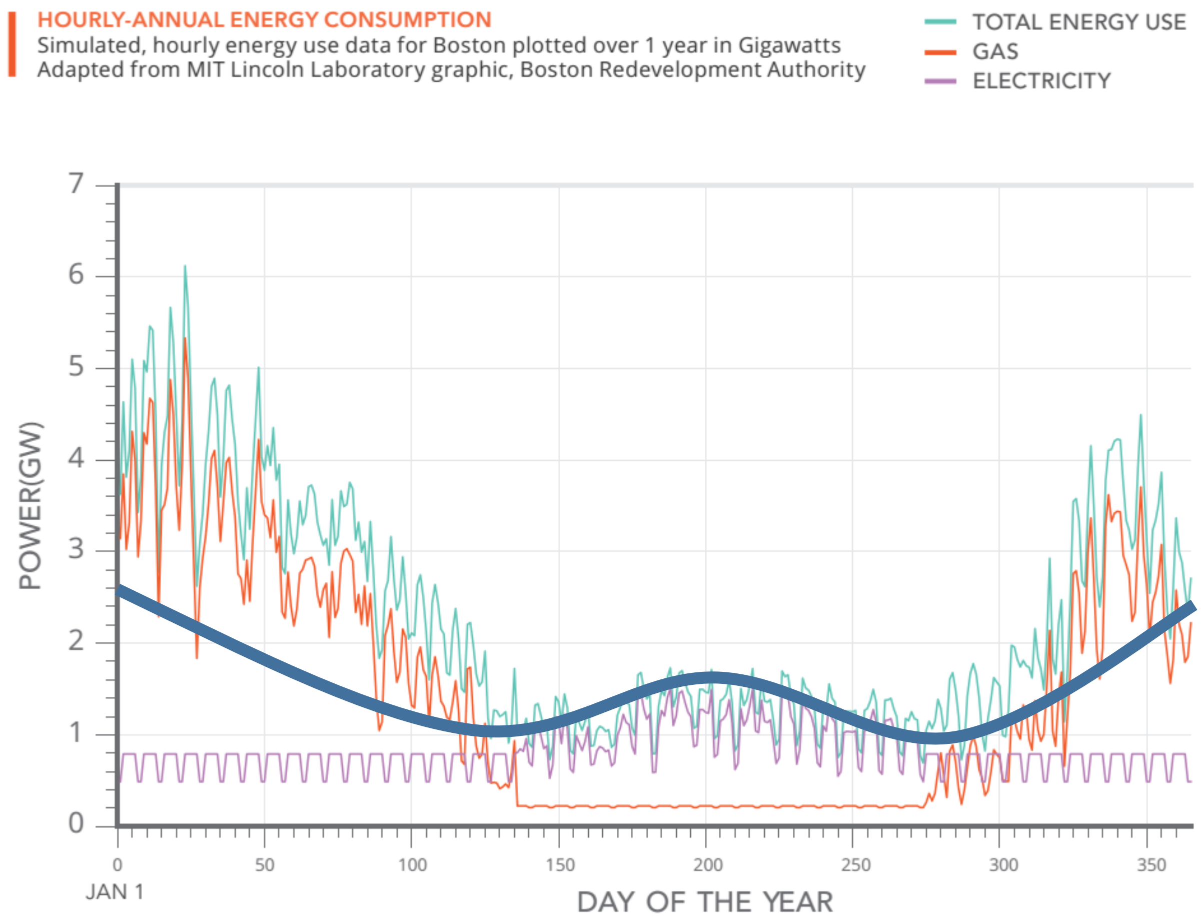
City-Grid Feedbacks

Heating electrification:
- Increases instantaneous and seasonal loads

Transportation:
- Timing and location of vehicle charging

Other sectors:
- In-boundary solar, storage, and microgrids could also create feedbacks

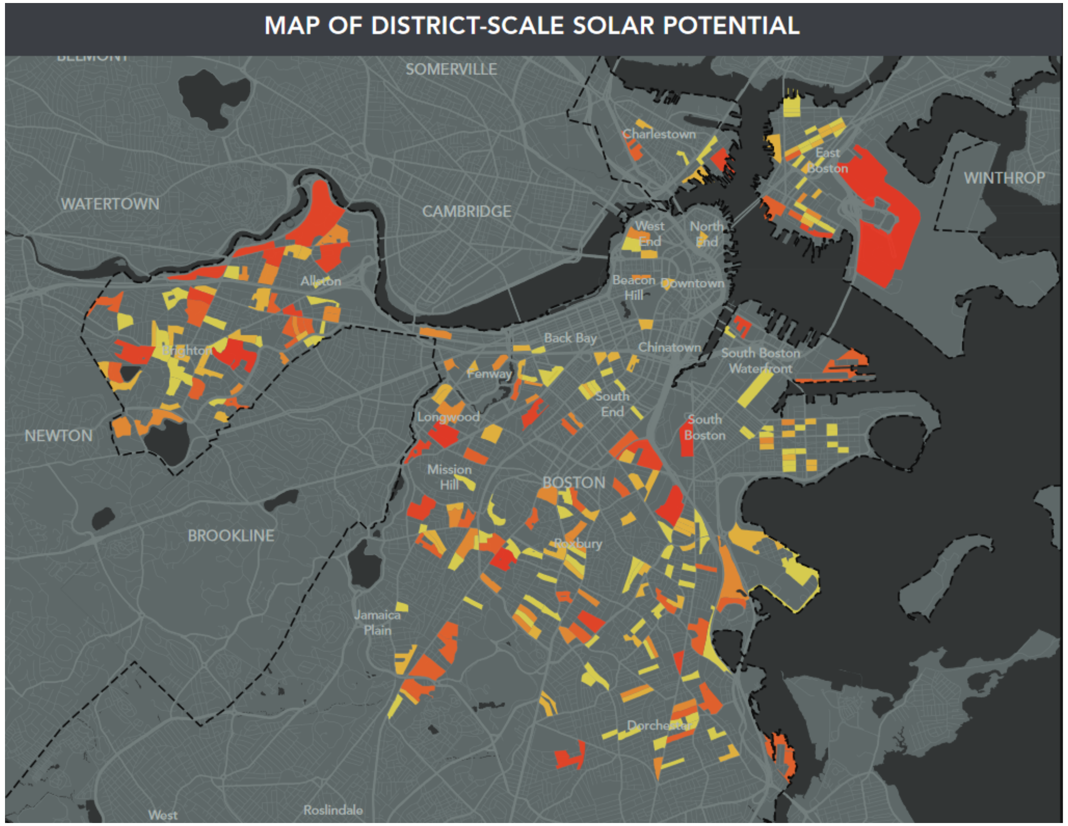
Question: how and to what extent should we be assessing these feedbacks in CFB?



Simulated Building Energy Use, Boston Community Energy Study

In-boundary Supply: Solar

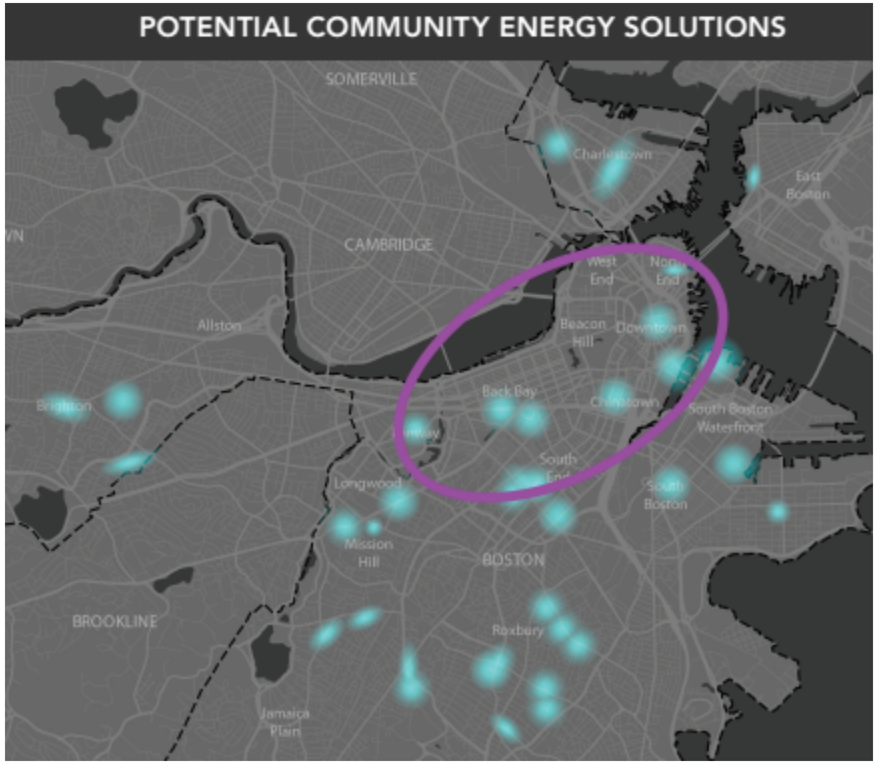
- Assumption: by 2050 we achieve full solar rooftop potential
- BU student data science team is assessing current solar installs using permit data
- Use this information to assess current rates of adoption and identify potential gaps with prior projections for the City (e.g. Community Energy Study, Project Sun Roof)



In-boundary Supply: Microgrids

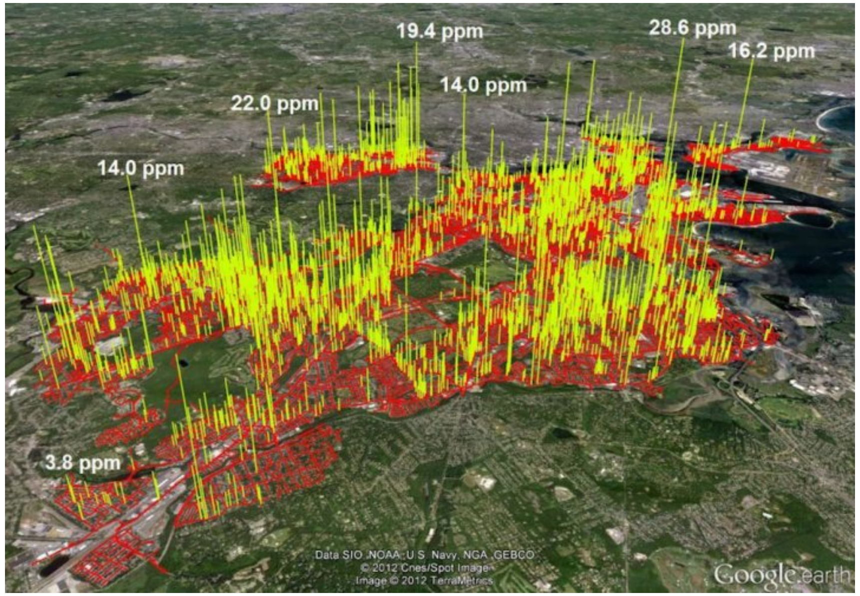
- Assumption:
  - microgrids are important, but secondary to renewable energy generation and storage for CFB analysis
  - ∴ We do not explicitly model microgrids

- But…we will communicate insights from the *Community Energy Study* (and elsewhere) regarding how renewable energy policy is bolstered by microgrids



In-boundary Supply: Gas

- Explore alternative futures for gas:
  - Gas from GHG-free renewable sources
  - H_2
  - Continued (ramped down?) used of methane
- Sensitivity analysis of leak coefficients under those scenarios
- Relative impact of these scenarios vs heating electrification

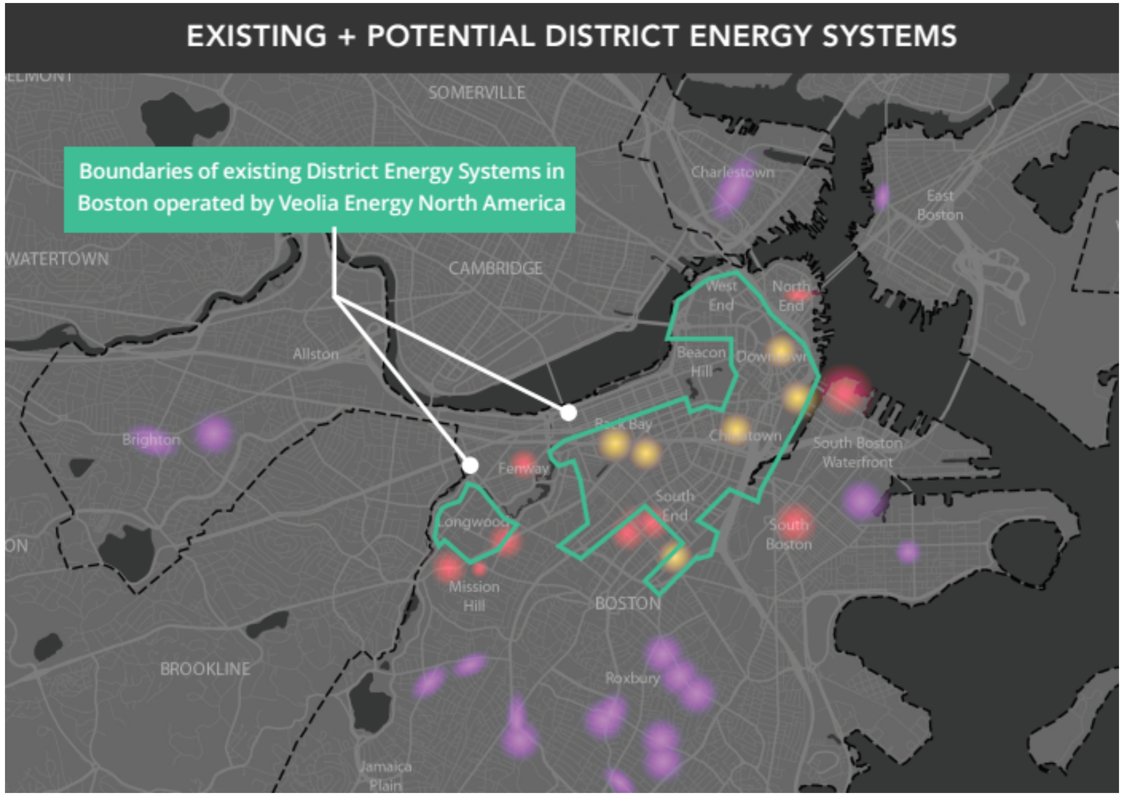


In-boundary Supply: District Energy

- Building Demand: Using data regarding current district energy use in buildings, Arup is currently exploring strategies for district energy systems for buildings.

- Inventory and assess current & planned district energy facilities

- What does the future of district energy in Boston look like?



Offsets and RECs

- Questions
  - Under what conditions should these instruments be used to meet mitigation targets
  - If the City were to employ these instruments, what are the elements of best practices?

- MIT-Sloan School project

Social Equity in the Context of GHG Mitigation

- Questions:
  - What are the key equity issues in the context of GHG mitigation (health, cost and access to energy services, etc.)?
  - How must mitigation policy be formulated to address equity?
  - What are empirical indicators to measure/track progress?
  - What are connections across sectors (buildings, waste, energy supply, transportation)?

Next Steps for Energy TAG

- Meet early summer
    - Review initial results, including in-boundary supply, offsets/RECs, equity, etc.
    - Suggest areas that need new or additional analysis