Zero Net Carbon Building Zoning

On-site Renewable Energy

TAG Meeting #3

boston planning & development agency

June 25, 2021

Zoom Meeting Guidance

The BPDA will record this meeting and post it on BPDA's Zero Net Carbon Building Zoning webpage. The recording will include the presentations, discussions and a transcript of Q&A / Chat comments.

It is possible that participants may be recording this meeting as well.
If you prefer not to be recorded during the meeting, please turn off your microphone and camera.

AGENDA

1. Welcome and Introductions (5 min)
2. TAG Meeting #2 Recap (5 min)
3. ZNC Building Zoning Update (15 min)
   - TAGs, Community Engagement, and Public Meetings
   - Schedule
4. Summary of On-Site RE Recommendations (30 min)
   - Discussion - what is most important for public expanding public awareness, what questions should we anticipate?
5. Financial case studies (20 min)
6. Next Steps (5 min)

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INTRODUCTIONS

CONSULTING AND CITY TEAM

Debra Perry
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Director of Climate & Environmental Planning, Boston

TAG MEMBERS

Ben Myers, Boston Properties

Cammy Peterson, Metropolitan Area Planning Council

Chris Gray, RENU Communities

David Eisenbud, Distributed Solar Development, LLC

Cynthia Cresswell Cook, Earth Energy LLC

Emily Jones, LISC

Isaac Baker, Resonant Energy

James Liebman, HMFH Architects

James Manzer, ReVision Energy

Patrick Haswell, Vicinity Energy

Scott Johnstone, VHB

Scott McBurney, Vicinity Energy

TAG Meeting #2 Recap

ISSUES DISCUSSED

- How to optimize on-site generation in building design
- Definitions
- Guidance
- Physical Exemptions & Exclusions
- Solar minimums
- Submittals

ZNC Building Zoning Updates

TAG STATUS

- **Low Carbon Building**
  Finished, drafting recommendations

- **On-site Renewable Energy**
  Meeting #4 - June 25th

- **Renewable Energy Procurement**
  Finished, drafting recommendations

- **Embodied Carbon**
  Meeting #2 - June 2nd

COMMUNITY ENGAGEMENT

- Neighborhood meetings to be scheduled July / September

PUBLIC MEETING #2

- To be scheduled September

STAKEHOLDER MEETING

- Ongoing through September

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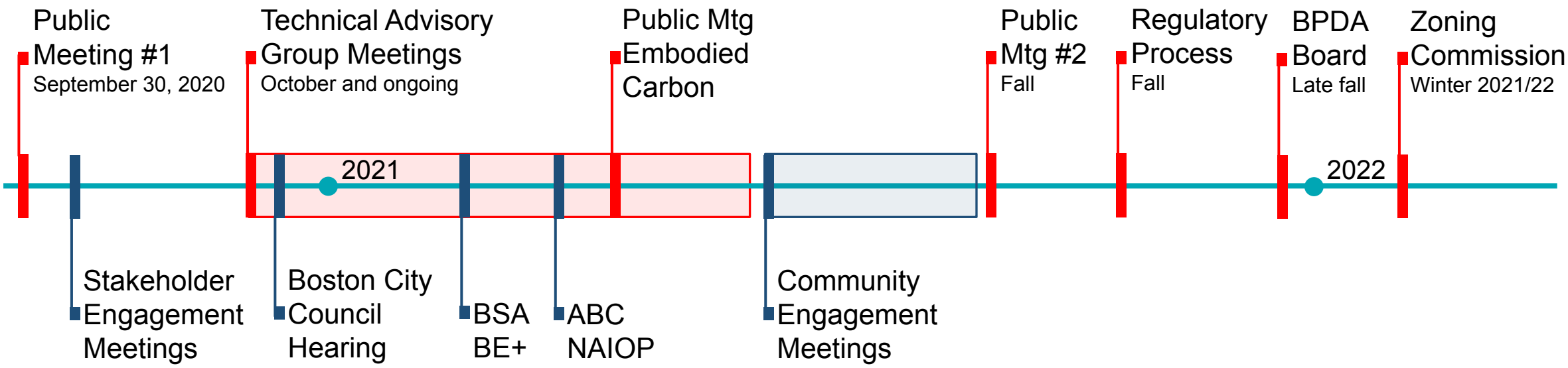
ZNC Building Zoning

PUBLIC PROCESS TIMELINE



- Community Engagement Meetings - *to be scheduled*
- Open House and Office Hours events - *to be scheduled*
- Organizational Meetings – *ongoing as requested*

Summary of On-Site RE Recommendations

Definition: On-Site Generation

On-site renewable energy is located on:

- The building,
- The property upon which the building is located,
- A property that shares a boundary with and is under the same ownership or control as the property on which the building is located, or
- A property that is under the same ownership or control as the property on which the building is located and is separated only by a public right-of-way on which the building is located.

On-Site Generation Goal Statement

- To ensure NZC buildings reduce carbon emission through the use of on-site renewable energy resources by establishing minimum standards for installation of on-site renewable energy systems;
- To reward innovation;
- To maximize the deployment of renewable energy in the City of Boston in order to fully realize the benefits of local energy generation (i.e., resilience, jobs, air quality, grid services);
- To ensure accountability and transparency in compliance with NZC Regulations.

Guiding Principles

The NZC Zoning requirements for on-site generation seek to **maximize the benefits of local generation,** including:

- Emission Reductions
- Electric Grid Management
- Local Job & Business Creation
- Public Health
- Resilience

While recognizing:

- Physical feasibility: shading, roof uses, setbacks/access
- Regulatory feasibility: utility interconnection, zoning code, building code
- Financial feasibility: costs, incentives, credit, electricity rates and ownership models

Net Zero Carbon buildings should optimize on-site renewable energy production.

E+ 232 Highland, Credit: Studio G Architects

Guidance for Building Design

“Solar Optimized” - the Proposed Project shall be planned and designed to maximize the amount and performance of on site, on building, building integrated, and ground mount canopy Solar Energy Systems. Solar optimization and building and urban design options and priorities are to be equally considered.

To best realize opportunities for solar, the City will engage project teams at the earliest stages of project planning and require building designs to:

- Maximize south facing solar opportunities on building roofs, facades, and sites
- Layout roof to maximize space free of obstructions (including minor MEP)
  - Consolidate mechanicals equipment and vents
  - Consider complementary uses (solar as shading for roof decks)
  - Avoid roof forms and slopes unsuitable for solar energy systems

Proposed Process & Submittals

As part of the BPDA Urban Design and Article 37 Review process projects would provide plans, diagrams, descriptions, and analysis to demonstrate that the Proposed Project has optimized the potential for solar energy production, identified the maximum Solar Zone(s), is planned, designed, and engineered to support the proposed system(s), and that the Solar Energy System(s) is installed and fully operational at construction completion:

- Site and building plans illustrating the **maximum feasible Solar Zone(s)** for all structures and all ground plane areas including details on any Solar Exceptions, Solar Exclusions, and Electrical Energy Restrictions.
- Solar Energy System(s) description including layout, configuration, system type, size, energy output, controls, storage, and ownership model.
- Post installation Solar Energy System(s) commissioning reports and certificates.
- Other related information deemed supportive or necessary to understanding project and system planning, design, and installation.

Definition “Solar Zone”

“the building and site area(s) suitable for the Solar Energy System(s)”

The Solar Zone effectively identifies the maximum area available for solar. The applicant will identify the Solar Zone during the preliminary review.

Exceptions:

The following conditions may allow the required Solar Zone(s) to be partially or entirely reduced in size:

- Roof areas where building mechanical and structural systems restrict the available Solar Zone(s).
- Roof, building, and ground plane areas where the Solar Zone(s) is shaded for more than 50 percent of daylight hours annually.
- The total Solar Energy System(s) of a project need not exceed 120% of the annual energy loads of the project.
- Historic Building Preservation or similar Design Overlay District requirements including standards for additional setbacks or other aesthetic exceptions as determined by the Historic Preservation Commission and BPDA Urban Design.

Exclusions

- The Solar Zone(s) may be reduced in size or modified in configuration to accommodate mandatory access and set back areas required by relevant historic preservation, building, and fire codes and regulations.
- The Solar Energy System(s) may be partially or entirely restricted in energy output due to utility electrical distribution system constraints.*
- Solar Energy Systems shall be configured and located so as to ensure the following:
  - Provision of emergency access pathways to and from the roof(s) and roof area(s) required for smoke ventilation as required by building and fire codes. 527 CMR.
  - Snow and ice does not shed into unprotected pedestrian travel area(s).

Defining Minimum Area for Solar

A ZNC Building shall be planned, designed, engineered, and constructed with an Solar Energy System(s) equal to but not less than:

- 50% of the building roof area(s) that is either flat or oriented between 110 degrees and 270 degrees of true north
- 90% of the parking structure deck(s) uncovered
- 50% of the surface parking area(s)
- Less area reductions due to Solar Exemptions and Solar Exclusions

Construction

At construction completion the applicant is to provide Installed Solar documents demonstrating that the Solar Energy System(s) have been installed, commissioned, and certified operational. The Solar Installed documents must be reviewed and approved prior to the issuance the final Certificate of Occupancy.

Recognizing the potential for utility regulations and solar incentives to impact solar project timing, the City could offer a 12 month grace period for projects encountering reasonable installation challenges. During this period, NZC buildings must purchase their renewable energy from off-site sources.

NZC & REC ownership

Recognizing the importance of new local renewable energy systems to Boston's carbon neutral goals AND that the Massachusetts SMART Program is key to the financial feasibility of many solar energy installations and that the SMART program retains the related RECs for the public utilities, the NZC code needs to provide guidance related to SMART Program participation and accounting through BERDO.

"SMART Energy": Solar Energy generated at a ZNC Building by where RECs are not owned by the building owner due to participation in SMART program.

REC Ownership

A ZNC Building must

- optimize on-site energy generation
- utilize 100% renewable energy (RECs owned)

To meet these requirements building can either:

1. Optimize on-site solar, keep RECs, and procure off-site RE as needed
2. Optimize on-site solar, participate in the SMART Program (i.e., generate “Smart Energy”), and procure off-site RE as needed.

Discussion Questions

- Have we captured the recommendations of the TAG?
  - Restate “no need to exceed 120%” minimum requirement” to better reflect Boston’s carbon neutral goal and growth in electricity demand due to building electrification efforts.
  - To update later based on previous discussion
- What additional information would be helpful to bring to the community?
  - Highlight this is a well established industry, not uncertain/experiment
- What kinds of questions/concerns do you anticipate we’ll encounter?
  - Questions around economics and impact on building development
  - Questions on solar zone and roof space, challenges by building developers on value of this space
    - Conflict between desire to create open space on roof (City and developers) and desire to maximize energy generation

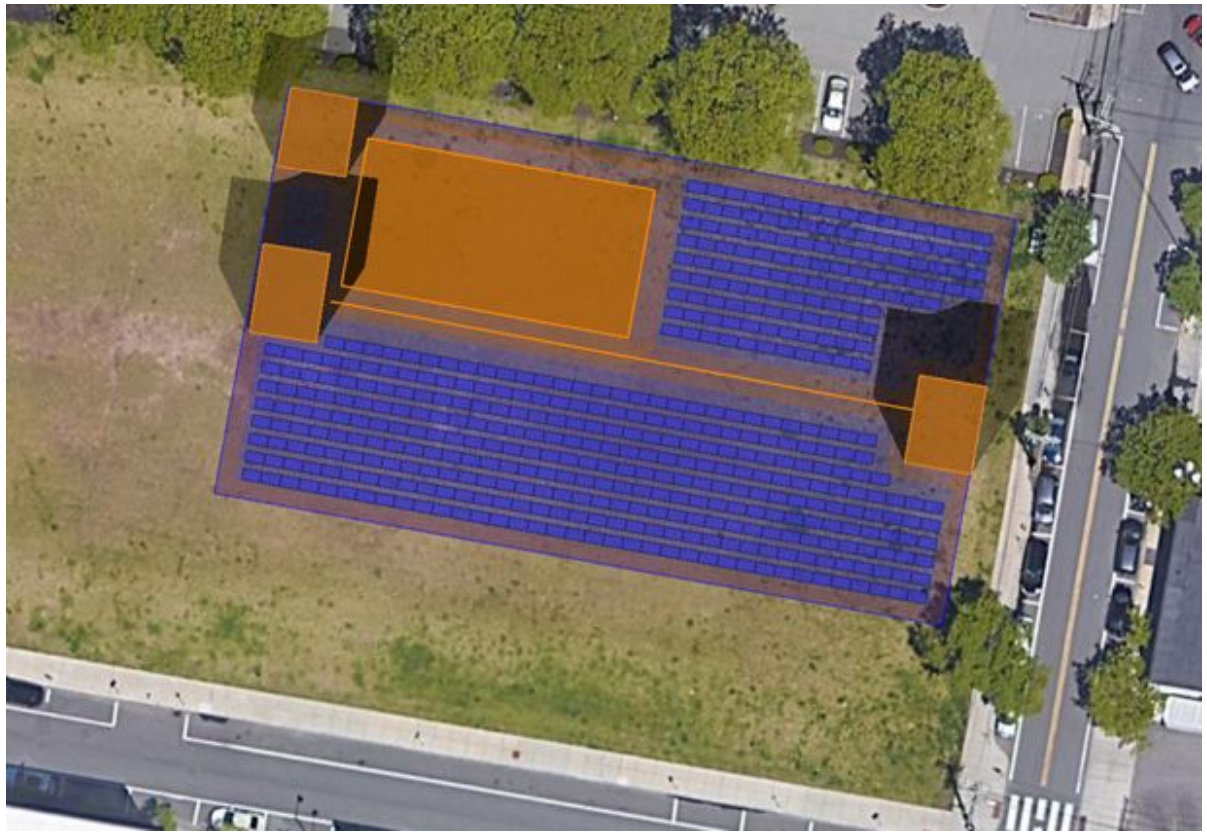
Financial Case Studies

Through two ***illustrative*** case studies we are demonstrating how the NZC would play out and looking at the role of RECs and system ownership. Each case study was evaluated under three ownership scenarios:

1. Direct Ownership, without enrollment in the SMART Program.
2. Direct Ownership, enrolled in the SMART Program.
3. Third-Party Ownership (PPA), enrolled in the SMART Program.

- For NZC buildings, we aren't comparing the return on investment of solar to the option of "doing nothing" or buying standard offer power. All NZC buildings will have to generate or buy 100% RE
- We are not factoring in reduction of demand charges, as it's hard to predict when a net zero building will experience peak load

Case Study #1: Lab



Building Design Specifications

- Total Building Area: 316,500 sf.
- Height: 180 ft.
- Roof Area: 25,816 sf.
- Roof Dimensions: 120 ft. X 215 ft.

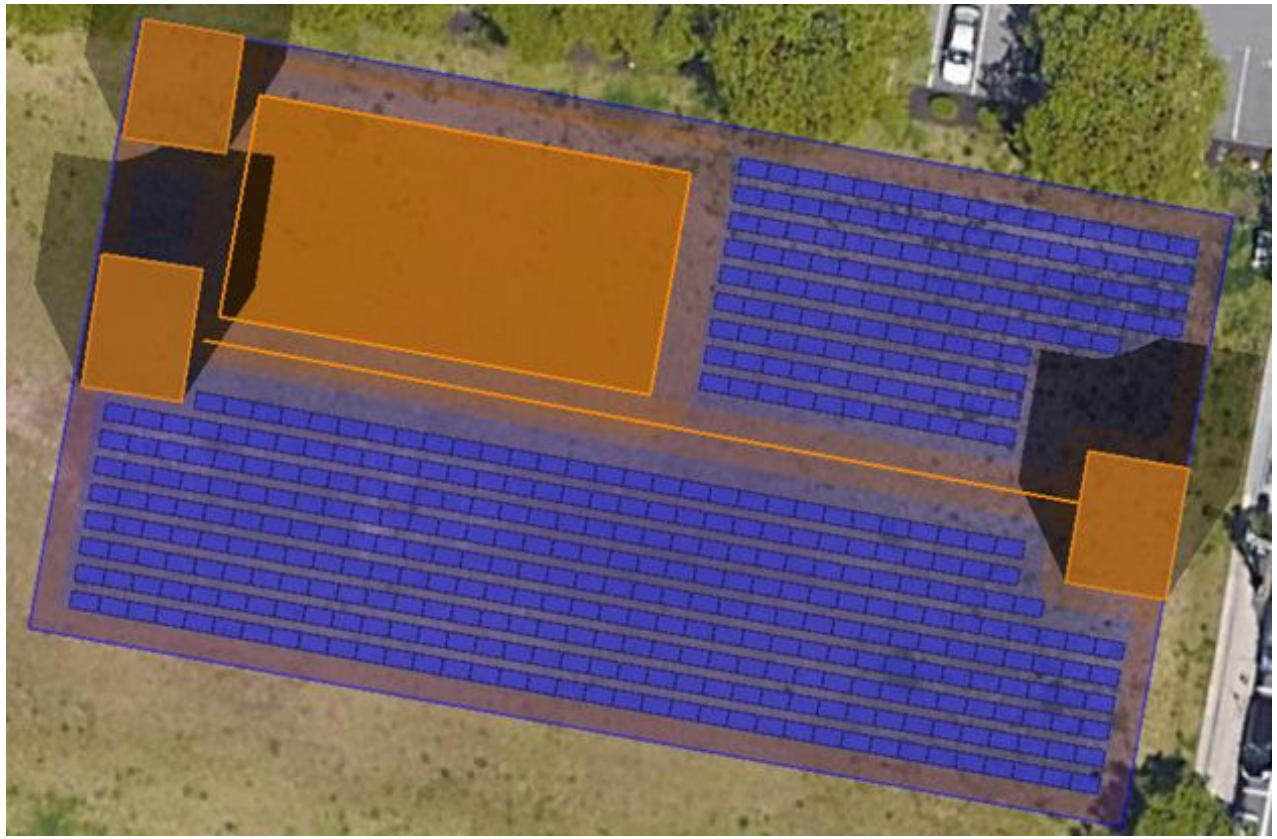
Assumptions

- Setback from Street: 15 ft.
- Annual Common Area Electricity Load: 6,956,626 kWh (579,719 kWh/mo)
- Value of Energy (VOE): $0.1506/kWh

Case Study #1: Lab Estimated PV Array

System Specifications

- PV System Area: 13,544 sf.
- Roof Area/PV Area: 52%
- PV System Capacity (kW-DC): 159.8
- PV System Capacity (kW-AC): 125.3
- Azimuth: 190°
- Annual PV Generation (kWh): 217,000
- Annual Load Offset: 3.12%
- Installed Cost ($2.50/kW): $ 399,500
- Panels: 432



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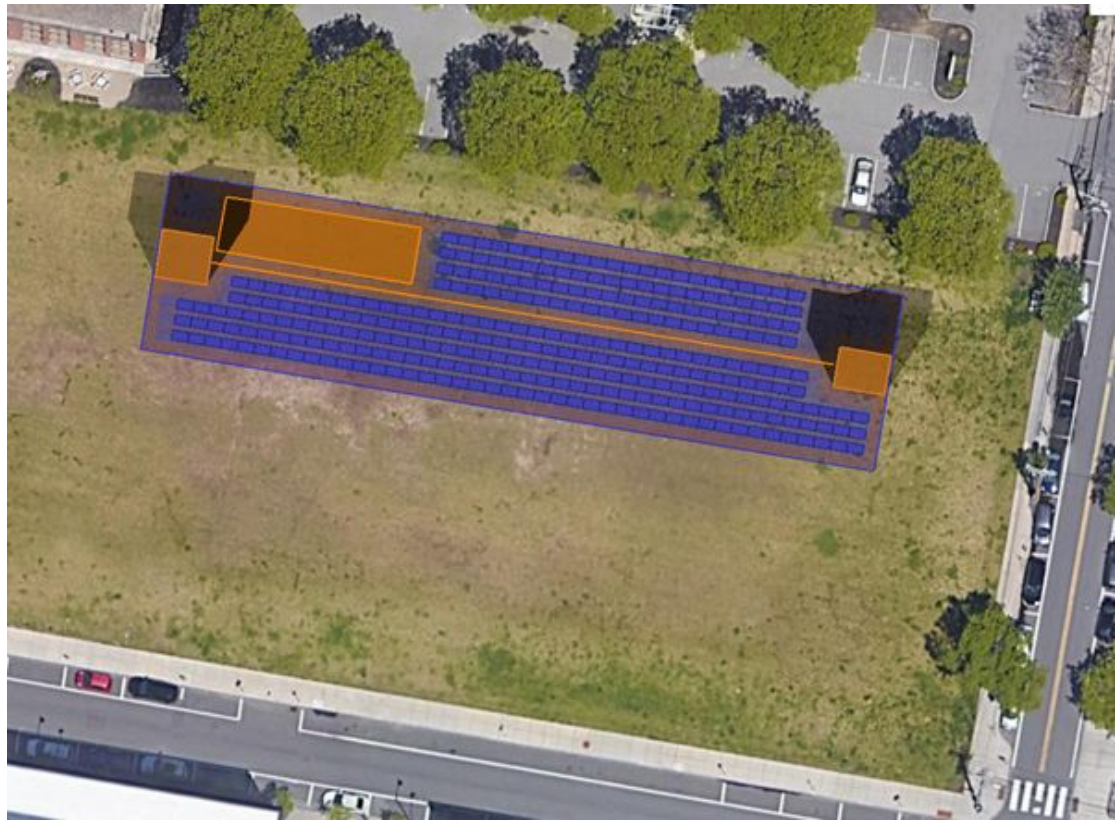
Case Study #2: Multi-Family Residential (MFR)



Building Design Specifications

- Total Building Area: 97,287 sf.
- Height: 84 ft.
- Roof Area: 15,085 sf.
- Roof Dimensions: 60.2 ft. X 250.4 ft.

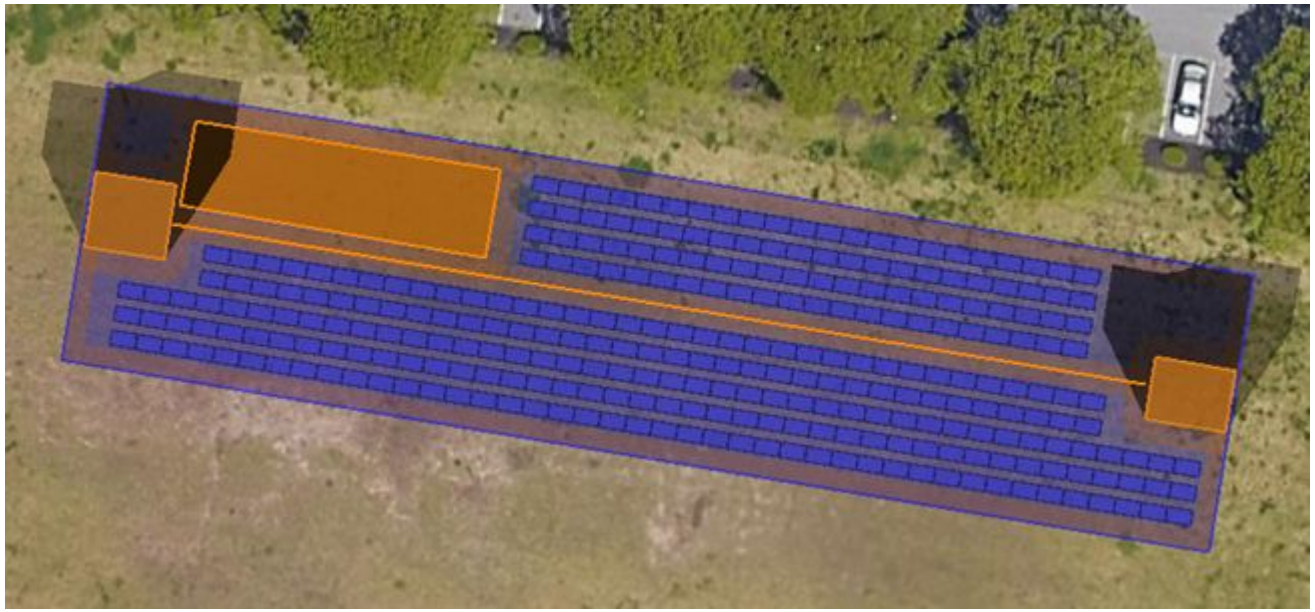
Assumptions

- Setback from Street: 25 ft.
- Annual Common Area Electricity Load: 855,359 kWh (71,280 kWh/mo)
- Value of Energy (VOE): $0.195/kWh

Case Study #2: MFR Estimated PV Array

System Specifications

- PV System Area: 8,078 sf.
- Roof Area/PV Area: 54%
- PV System Capacity (kW-DC): 105.1
- PV System Capacity (kW-AC): 82.4
- Azimuth: 190°
- Annual PV Generation (kWh): 132,200
- Annual Load Offset: 15.46%
- Installed Cost ($2.50/W): $262,750
- Panels: 252



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Financial Analysis: Scenarios

Each Case Study was evaluated under three ownership scenarios:

1. Direct Ownership, without enrollment in the SMART Program.
2. Direct Ownership, enrolled in the SMART Program.
3. Third-Party Ownership (PPA), enrolled in the SMART Program.

Financial Analysis: Lab Modeling Assumptions

Lab Financial Inputs

- Installed Cost ($2.50/kW): $ 399,500
- 100% Green Basic Service Rate: $0.1426/kWh
- VOE: $0.1506/kWh
- Average Monthly Usage: 579,719 kWh
- SMART Incentive Payment: 0.123/kWh
- Federal ITC: 26%
- Project Finance: 53.8%
- Annual Interest Rate: 6.1%
- Debt Tenor: 12 years

Financial Analysis: Lab Direct Ownership Results

Ownership Scenario	Total Capital Install Cost	Value of Federal ITC	Year 1 Avoided Electricity Cost	Year 1 SMART Solar Incentive Payment	25-Year After-tax Cash flow	Project IRR
Direct Ownership (w/o SMART)	$399,500	$103,870	$30,060	$0	$166,910	9%
Direct Ownership (w/SMART)	$399,500	$103,870	$30,060	$26,754.66	$623,461	34%

Financial Analysis: MFR Modeling Assumptions

MFR Financial Inputs

- Installed Cost ($2.50/W): $262,750
- 100% Green Basic Service Rate: $0.1525/kWh
- VOE: $0.195/kWh
- Average Monthly Usage: 71,280 kWh
- SMART Incentive Payment: $0.079/kWh
- Federal ITC: 26%
- Project Finance: 53.8%
- Annual Interest Rate: 6.1%
- Debt Tenor: 12 years

Financial Analysis: MFR Direct Ownership Results

Ownership Scenario	Total Capital Install Cost	Value of Federal ITC	Year 1 Avoided Electricity Cost	Year 1 SMART Solar Incentive Payment	25-Year After-tax Cash flow	Project IRR
Direct Ownership (w/o SMART)	$262,750	$68,315	$25,589	$0	$211,750	16%
Direct Ownership (w/SMART)	$262,750	$68,315	$25,589	$10,440.94	$404,100	32%

Financial Analysis: MFR PPA Example

Private Third-Party Developer

- Owns the system and pays the upfront capital cost of the PV installation
- Receives financial incentives (i.e. Federal ITC)
- Responsible for O&M for project lifetime and decommissioning at end of contract term
- Sells electricity produced to the site host at a reduced PPA rate

Offtaker (MFR Owner)

- No upfront cost as the host customer
- Purchases electricity generated by PV directly from the developer at a reduced rate. For this scenario, assumed a fixed discount rate of 15% with a 1.5% escalation rate.
- Offtaker savings are generated via net avoided cost (Utility electricity rate - PPA electricity rate = Savings.)

Ownership Scenario	Annual Electricity Usage Offset by PV	Utility VOE ($/kWh)	Year 1 PPA Rate (15% discount)	Est. Annual PPA savings	Project IRR
PPA (w/ SMART)	132,200	0.194905	0.165669	$3,865	21%

Discussion Questions & Chat Notes

- Are there ways to modify these case studies to help stakeholders understand the financial aspects of on-site solar for NZC buildings?
- What questions should we anticipate from stakeholders?

Chat Notes:

Bryan Glascock: Q. How about parking garages, warehouses, etc. for example, they should have to exceed the 120%, no?

David Eisenbud - DSD: I agree with that comment and the probability that they are going into SMART where it is a direct to grid feed

dtmussel: Is there any consideration of what is causing the shading - does it have to be a permanent cause, seasonal or what?

Isaac Baker - Resonant Energy: Is 120% of annual load building wide? In the case of multifamily with landlord/tenant metering split, can be complex to produce way more solar than common uses

Joseph LaRusso: Pardon me if I missed this—owners wouldn't be required to own the array, merely take the production, correct?

Joseph LaRusso: Buildings could mitigate demand charges and capacity charges with on-site storage.

James Manzer - ReVision Energy: Did you/would you consider depreciation tax credits in these cash flows?

NEXT STEPS

- Today's TAG Meeting Presentation & Discussion will be posted to Zero Net Carbon Building Zoning Initiative

- In the coming months, the BPDA / City of Boston will host Community Engagement and Public Meetings to present draft ZNC Building Zoning recommendations for public comment.

Contact:

John.Dalzell@Boston.gov

Visit:

Boston Zero Net Carbon Building Zoning

Please sign up on our contact list!

Public and Stakeholder Engagement

Please let us know of any Organization or Association Meeting opportunities.

We will be hosting Open Houses and Office Hours late spring / summer