OBJECTIVES

I. Show how a Smart Utilities Program for integrated planning and design was essential for the promotion of District Energy Microgrids in Boston

II. Explain how the District Energy Microgrid Program can promote other advanced energy systems to capitalize on benefits, while focusing on District Energy Microgrids for locations that have the promise for success
I. Early Stages of multi-user district energy microgrids program

II. Boston Smart Utilities program moves the agenda forward

III. Current status of Boston's multi-user district energy microgrids program
   - Case studies

IV. Q&A
NYC Blackout – 2012
Hurricane Sandy

Back Bay Blackout – 2013
Scotia Street Substation
MICROGRIDS: Early Policy Development Work


- Boston Microgrid Workshops (2014)
  - Straw Proposal: Business Model for Multi-User System in Massachusetts

- USDN Multi-User Microgrids & District Energy Workshops (2015)

- Boston Community Energy Study (2016)
MICROGRIDS: Project-Based Policy Development

Raymond L. Flynn Marine Park Pilot

- Owned by Economic Development and Industrial Corporation (EDIC, dba the Boston Planning and Development Agency (BPDA))
- Prime location for Boston’s ocean trade, maritime industries and industrial uses
- South Boston Waterfront: Prime location for District Energy Microgrid solution
- MassCEC Feasibility Assessment builds on years of tenant engagement
- Home Rule Petition for Public Private Partnership - Enacted City Council November 2017; Hearing but no vote in Legislature
- Location ideal for pilot project to test utility and regulatory solutions
Boston Smart City Playbook: https://monum.github.io/playbook/
RESILIENT BOSTON

GREENOVATE CITY OF BOSTON

Vision Zero

IMAGINE BOSTON 2030

HOUSING A CHANGING CITY

Boston Climate Summit 2018
Boston Harbor
Nor’easter - March 1-3, 2018

Back Bay
Blackout – Scotia Street Substation

North End
Repetitive Street Openings

Boston Underground

Mass Ave.
Traffic Congestion

Mass Ave. & Beacon St.
Smart Sensors Pilot
BOSTON SMART UTILITIES VISION

- Led by inter-departmental Steering Committee
- Provides new model for integrated utility planning and design
- Encourages deployment of Smart Utility Technologies
- Focuses on utilities across four sectors

GOALS

- **Efficiency**
  Make utilities easier to build, maintain and upgrade

- **Equity**
  Reduce utility costs for residents and businesses

- **Resiliency**
  Harden infrastructure against flooding risk and heat waves

- **Economic Development**
  Attract businesses and jobs though world-class essential services

- **Innovation**
  Integrate cutting edge technologies and lead through innovation

Energy  Water & Wastewater  Transit  Telecom
PLACE-BASED POLICY ANALYSIS: PLAN - DORCHESTER AVE
ANALYSIS PHASE - TWO WORK PRODUCTS

**BUSINESS-AS-USUAL REPORT**
Baseline analysis of utility construction in BAU manner in Study Area

**COST BENEFIT ANALYSIS**
Analysis of Costs and Benefits impacts of Smart Utility Technologies deployed in Study Area
SMART UTILITIES TECHNOLOGIES (SUT)

**Energy**
- District Energy Microgrid
- Solar / Battery / EV Microgrid

**Transportation**
- Adaptive Signal Tech.
- Autonomous Vehicles

**Water**
- Green Infrastructure
- Water Reuse - Rainwater
- Water Reuse - Grey water

**Communications**
- Smart Street Lights
- Public Wifi, Smart Sensors
- Telecom Utilidor
PROCESS & STAKEHOLDER ENGAGEMENT

Analysis

**May 2016 – July 2017**
- Analytical Reports
- 3 Stakeholder Sessions*
- Engagement with Developers

**Policy Development**

**Aug 2017 – June 2018**
- Policy Specifications
- BPDA and City Staff Review
- Wider Developer Engagement
- BPDA Board Approval

*Stakeholders*
- Utilities
- Developers
- Technical Experts
- City Staff

Implementation
IMPLEMENTATION TOOLS: CITY WIDE

SMART UTILITY STANDARDS

- A guide with standards for planning and integration of Smart Utility Technologies infrastructure
- Mini “Complete Streets” for the underground

SMART UTILITIES POLICY FOR ARTICLE 80

- Policy defining size thresholds and specifications of select Smart Utility Technologies for city-wide implementation
SMART UTILITY STANDARDS: CROSS SECTIONS

BASELINE

WITH SMART UTILITIES
SMART UTILITIES POLICY FOR ARTICLE 80

Energy
- District Energy Microgrid
  - Solar / Battery / EV Microgrid

Water
- Green Infrastructure
  - Water Reuse- Rainwater
  - Water Reuse- Grey water

Transportation
- Adaptive Signal Tech.
  - Autonomous Vehicles

Communications
- Smart Street Lights
  - Public Wifi, Smart Sensors
- Telecom Utilidor
DISTRICT ENERGY MICROGRID – COMBINED HEAT AND POWER (“CHP”)

An energy system for cluster of buildings that:

Generates electricity on-site

Captures excess heat (otherwise wasted) to provide useful thermal energy (i.e., steam, hot and cold water)

Reduces GHG emissions due to fuel efficiency and integration of renewable DERs

Reduces capital and O&M costs by substituting in-building boilers and chillers

Provides resiliency when operated in “island” mode during outages; (operates with grid during normal operations)
## SMART UTILITIES POLICY FOR ARTICLE 80

<table>
<thead>
<tr>
<th>Article 80 Size Threshold</th>
<th>Specifications</th>
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<tbody>
<tr>
<td>&gt;1.5 million SF</td>
<td>Feasibility Assessment; if feasible, then Master Plan &amp; District Energy Microgrid Ready design</td>
</tr>
<tr>
<td>&gt;100,000 SF</td>
<td>Install to retain 1.25&quot; rainfall on impervious areas (Increase from 1&quot; currently required by BWSC)</td>
</tr>
<tr>
<td>All projects requiring signal installation or improvements</td>
<td>Install AST &amp; related components into the traffic signal system network</td>
</tr>
<tr>
<td>District Energy Microgrid</td>
<td>All Projects requiring street light installation or improvements</td>
</tr>
<tr>
<td>Green Infrastructure</td>
<td>Install additional electrical connection &amp; fiber optics at pole</td>
</tr>
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<td>Solar / Battery / EV Microgrid</td>
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<td>&gt;1.5M SF of Development, or &gt;0.5 Miles of Roadway</td>
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</tr>
<tr>
<td>Smart Street Lights</td>
<td>Install Telecom Utilidor</td>
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<td>Astronautic Vehicles</td>
<td>Telecom Utilidor</td>
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- Analytical Reports
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Policy Development

Aug 2017 – June 2018

- Policy Drafts
- Other Documents Drafts
- BPDA and City Staff Review
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- BPDA Board Approval

Implementation

July 2018 – Present

- 2020 mandated policy review of technologies and thresholds
- Article 80 Dev. Review
- Internal/External Educations Sessions
- Developer Working Groups
- Other City Agencies/Depts. Standards

*Stakeholders
- Utilities
- Developers
- Technical Experts
- City Staff
DISTRICT ENERGY MICROGRID: DEFINING FEASIBILITY

Technical

- **Smart Utilities DE Microgrid Feasibility Assessment**
  - Understanding value of loads and opportunities
  - Screening Analysis will define portfolio of energy solutions

Financial

Ownership & Regulatory

- **Smart Utilities DE Microgrid Master Plan**
  - Bridge technology design & phasing of development
  - Focus on “DE Microgrid Ready” Design

- Framework for challenges of ownership structures
- Framework for utility discussions

Working Group & Meetings with Utilities
BOSTON'S DISTRICT ENERGY MICROGRID PROGRAM

1. Feasibility Assessment and Master Plan Outlines
   a) The "screening analysis" allows for analysis of advanced energy systems in general
2. Mechanism to hire technical expert to assist with review process
3. Iterative and collaborative review process with project proponent's team
4. Allow proponent to define resilience
5. Support across Departments and Agencies
6. Ready to be adapted to other programs and goals (i.e., Carbon Freer Boston)
<table>
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<th>CASE STUDIES</th>
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<td><strong>Case #1</strong></td>
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<tr>
<td>- DE could be feasible but need to wait for anchor loads.</td>
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<tr>
<td>- Cogen at the building level not optimum</td>
</tr>
<tr>
<td>- Maximize rooftop solar</td>
</tr>
<tr>
<td>- District Energy Microgrid Ready Design (Smart Utilities was key to achieve this)</td>
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<td><strong>Case #2</strong></td>
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<tr>
<td>- Cogen at the building level feasible (biotech and R&amp;D loads)</td>
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<td>- Nanogrid: Able to island and provide resilience</td>
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<td>- Plan to consider battery storage during later phases of development</td>
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<td><strong>Case #3</strong></td>
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<td>- Cogen at the building level for house loads feasible</td>
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<tr>
<td>- District Energy Microgrid Ready Design to allow for tenant loads</td>
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<td>- District Energy Microgrid Ready Design to allow for interconnection with future buildings</td>
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DISTRICT ENERGY MICROGRID: DEFINING FEASIBILITY

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Ownership & Regulatory

- Working Group & Meetings with Utilities
  - Framework for challenges of ownership structures
  - Framework for utility discussions

Key lesson: ownership and financing models that address private developer risks are not mature
GREEN INFRASTRUCTURE

Infrastructure like bioretention basins and pavers used for storm water management & pollution control
ADAPTIVE SIGNAL TECHNOLOGY ("AST")

AST is a series of motion sensors and traffic signals that communicate in order to improve traffic flow and safety for all modes.

01 Road Re-Striping
02 Smart Traffic Signals
03 Charging/Idling Spaces
04 Communications Equipment
SMART STREET LIGHTS

Smart technology **mounted on traditional light poles**

Technology for data collection, pollution control, traffic management, safety, etc.
TELECOM UTILIDOR

A set of encased pipes that consolidate wires and fiber optics of cable/internet

Eliminates repetitive street openings

Reduces barriers to entry in telecom sector

Notes:
- Connections and splices will occur at vaults.
- Access is not provided between vaults.
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http://www.bostonplans.org/smart-utilities