

**BOSTON  
SMART  
UTILITIES**



*City of Boston  
Mayor Martin J. Walsh*



**boston planning &  
development agency**



# 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

# OUTLINE

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



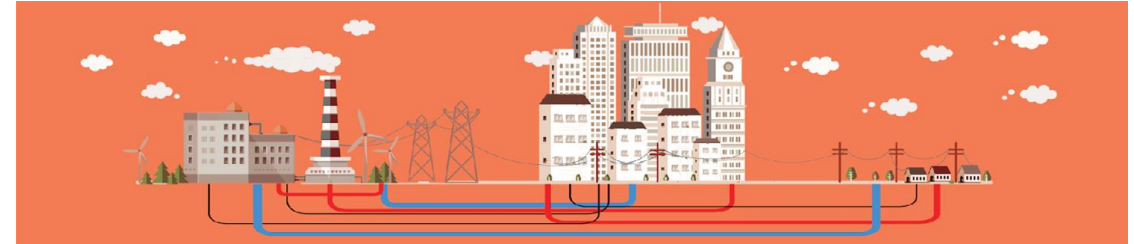
## Back Bay Blackout – 2013

### Scotia Street Substation



# MICROGRIDS: Early Policy Development Work

- Harvard Law School Emmett Center - *Massachusetts Microgrids: Overcoming Legal Obstacles* (2014)
- 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/>





## 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



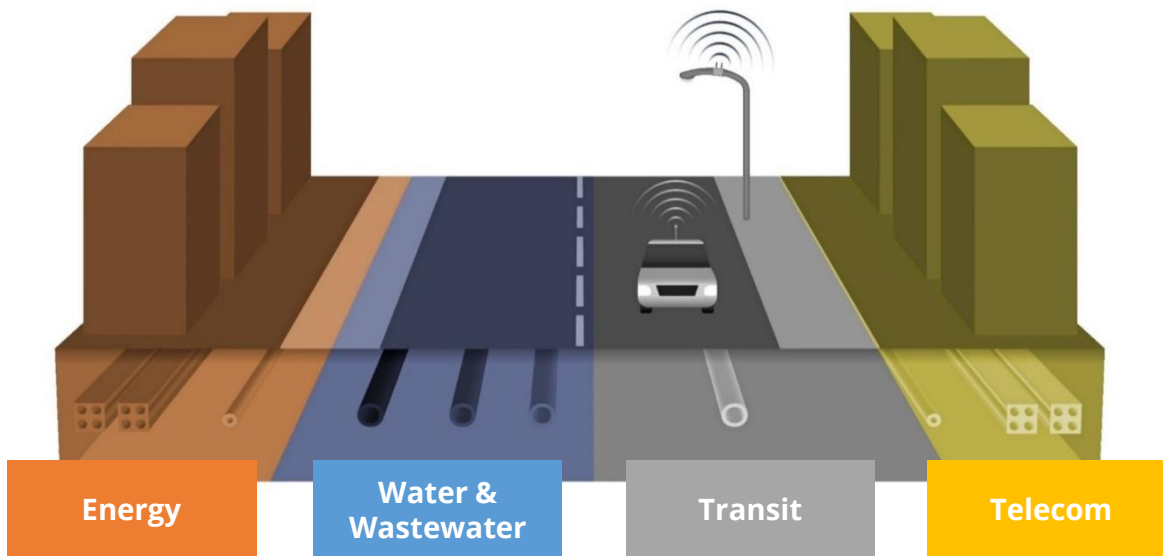
## Mass Ave. & Beacon St.

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 through world-class essential services



### Innovation

Integrate cutting edge technologies and lead through innovation



# PLACE-BASED POLICY ANALYSIS: PLAN - DORCHESTER AVE

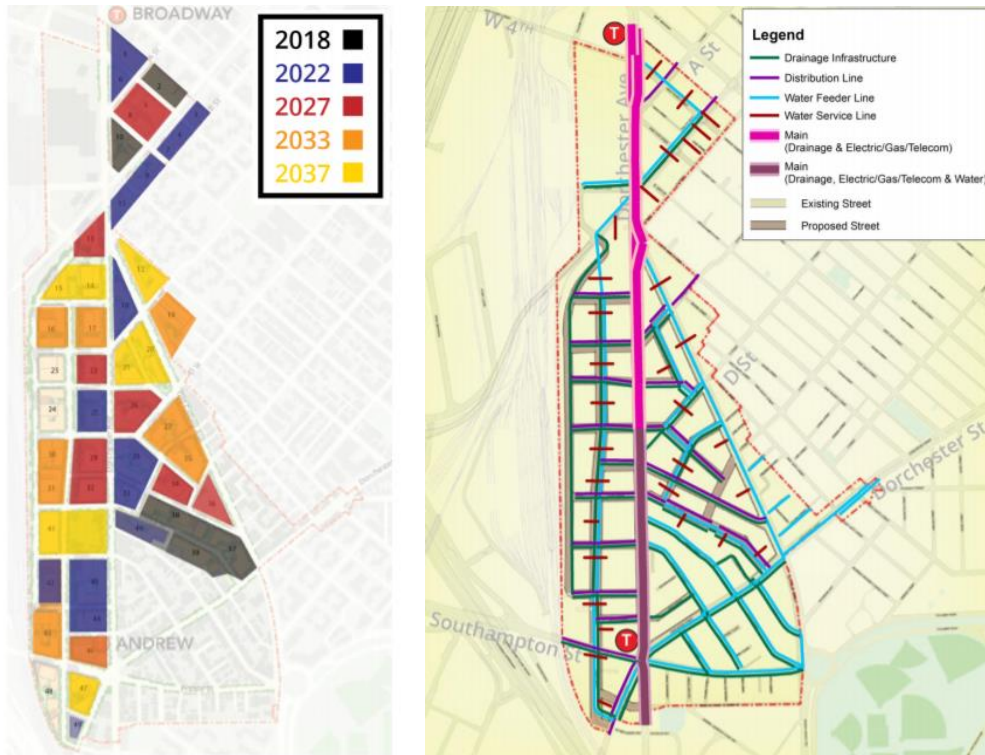


# ANALYSIS PHASE - TWO WORK PRODUCTS



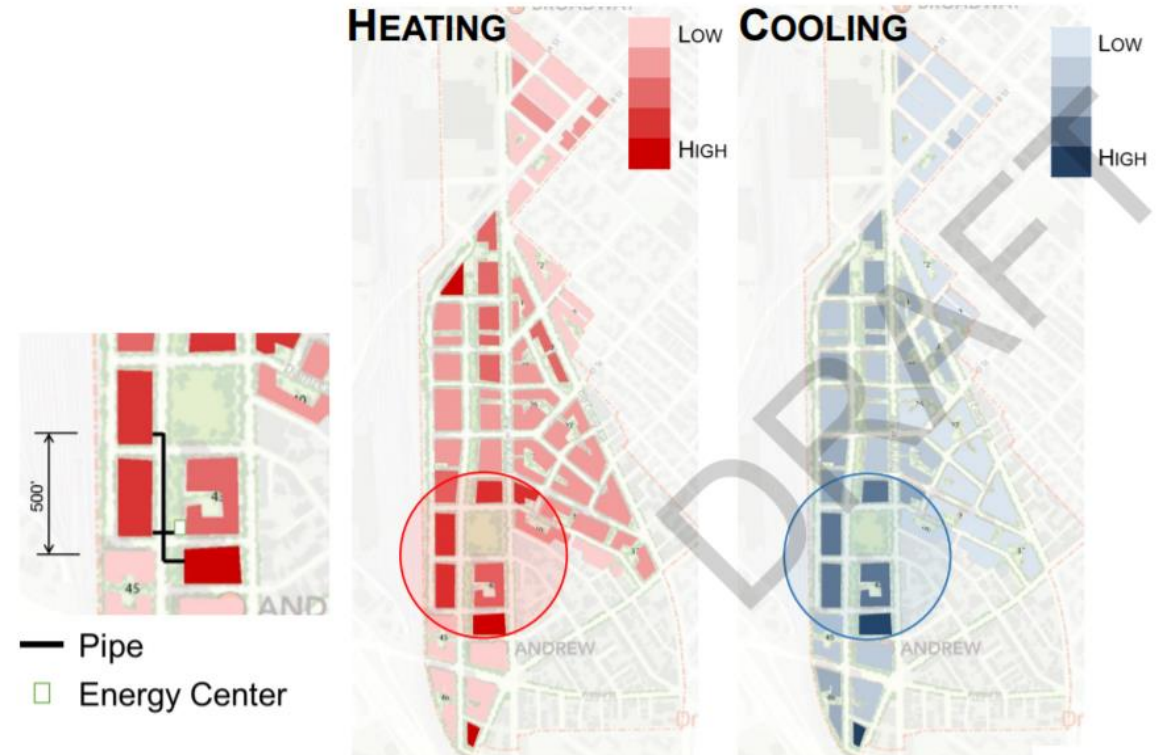
## BUSINESS-AS-USUAL REPORT

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



## 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

# 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

## Implementation



### \*Stakeholders

Utilities

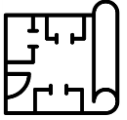
Developers

Technical Experts

City Staff

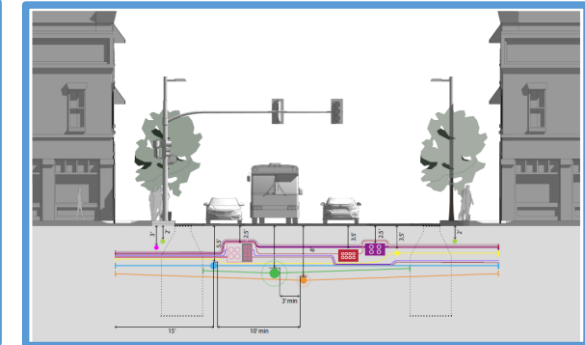
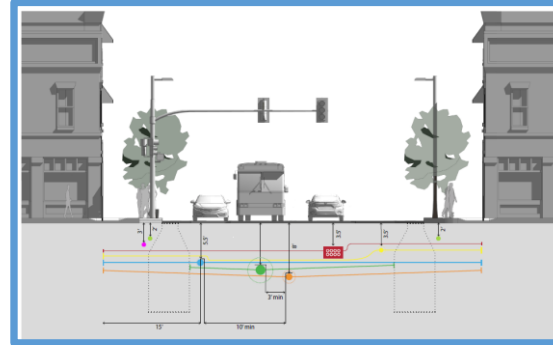


# IMPLEMENTATION TOOLS: CITY WIDE



## SMART UTILITY STANDARDS

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



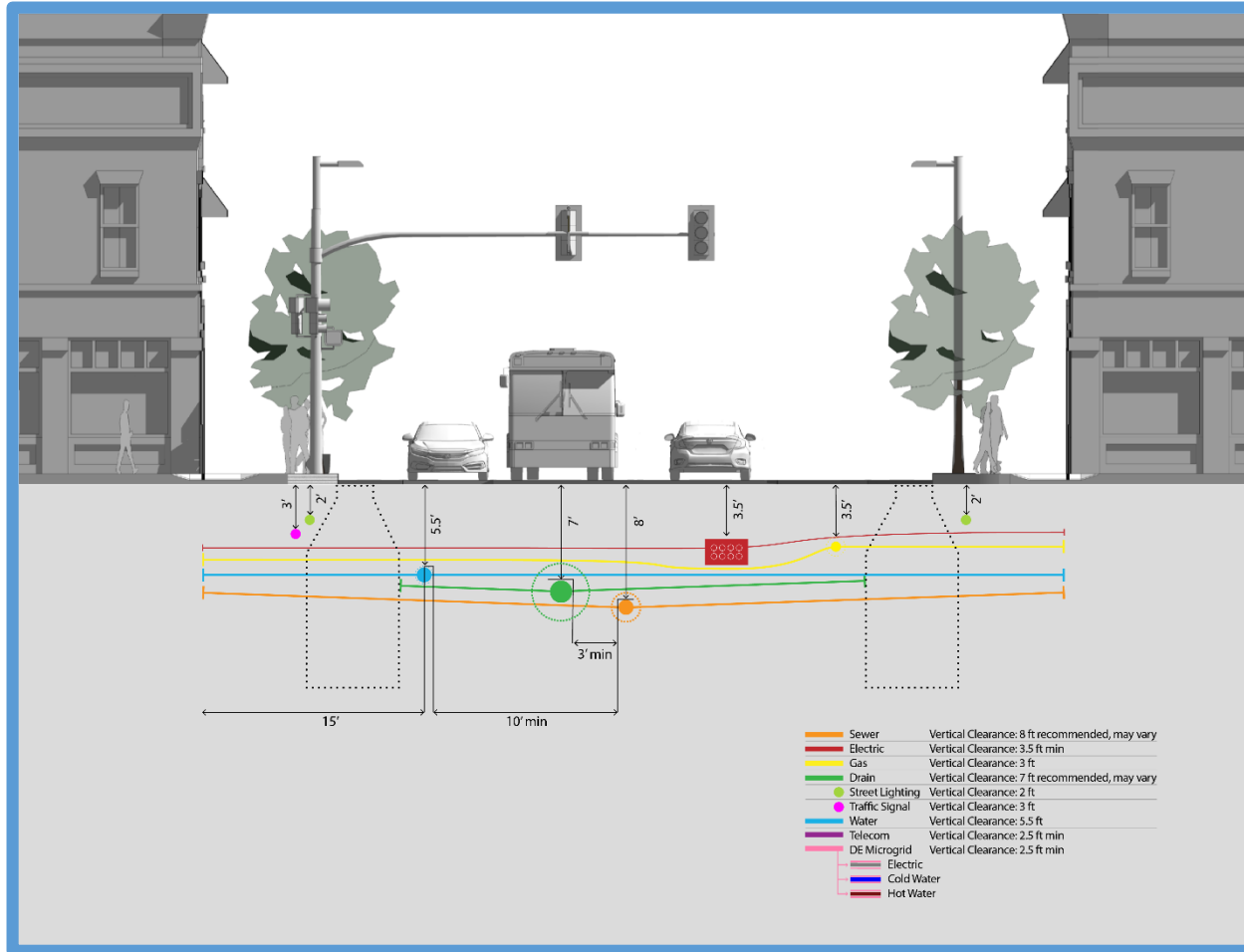
## SMART UTILITIES POLICY FOR ARTICLE 80

- Policy defining size thresholds and specifications of select Smart Utility Technologies for city-wide implementation

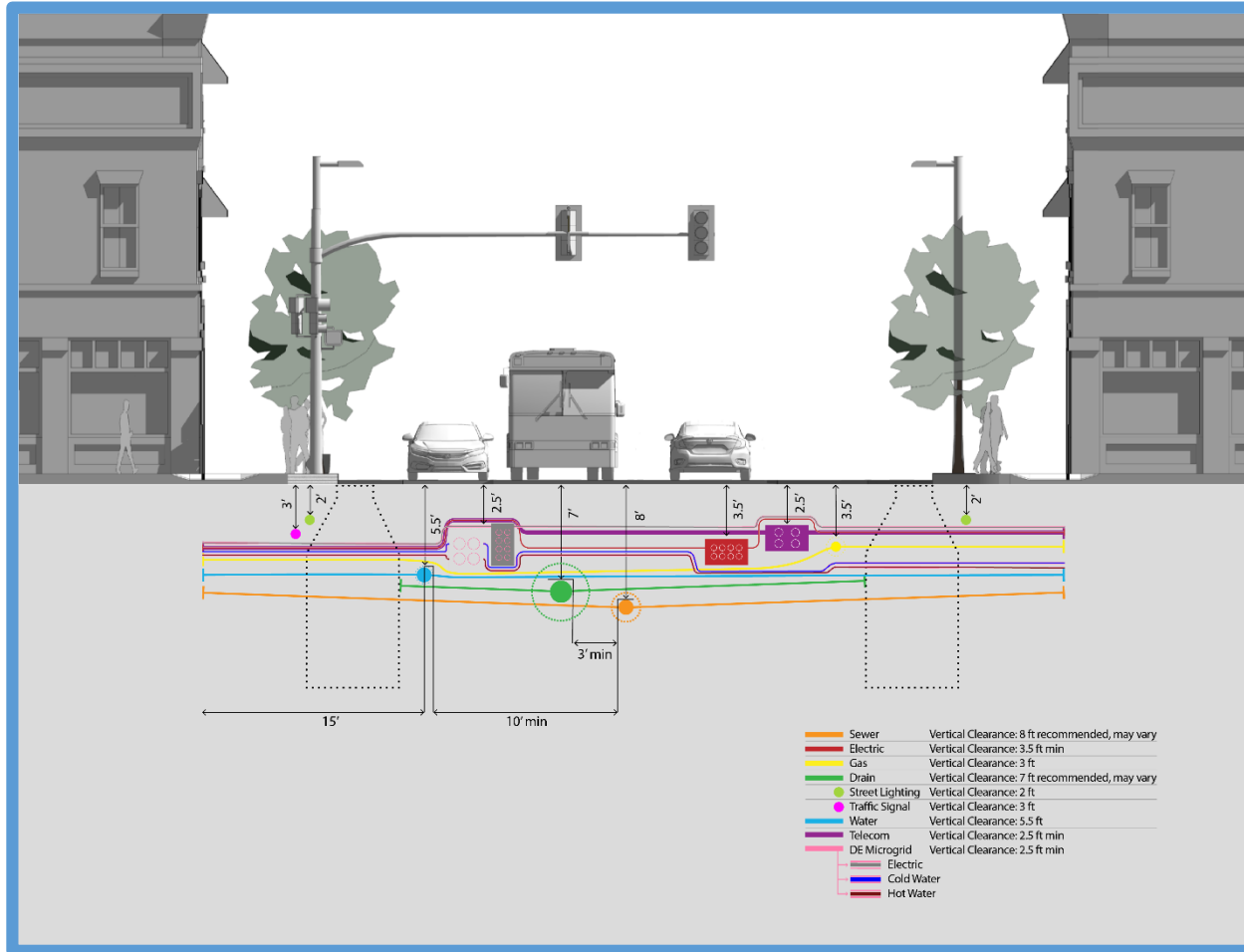
SMART UTILITIES POLICY FOR ARTICLE 80		
	Article 80 Size Threshold	Specifications
District Energy Microgrid	>1.5 million SF	Feasibility Assessment; if feasible, then Master Plan & District Energy Microgrid Ready design
Green Infrastructure	>100,000 SF	Install to retain 1.25" rainfall on impervious areas (Increase from 1" currently required by BWSC)
Adaptive Signal Tech.	All projects requiring signal installation or improvements	Install AST & related components into the traffic signal system network
Smart Street Lights	All Projects requiring street light installation or improvements	Install additional electrical connection & fiber optics at pole
Telecom Utilidor	>1.5M SF of Development, or >0.5 Miles of Roadway	Install Telecom Utilidor

# 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



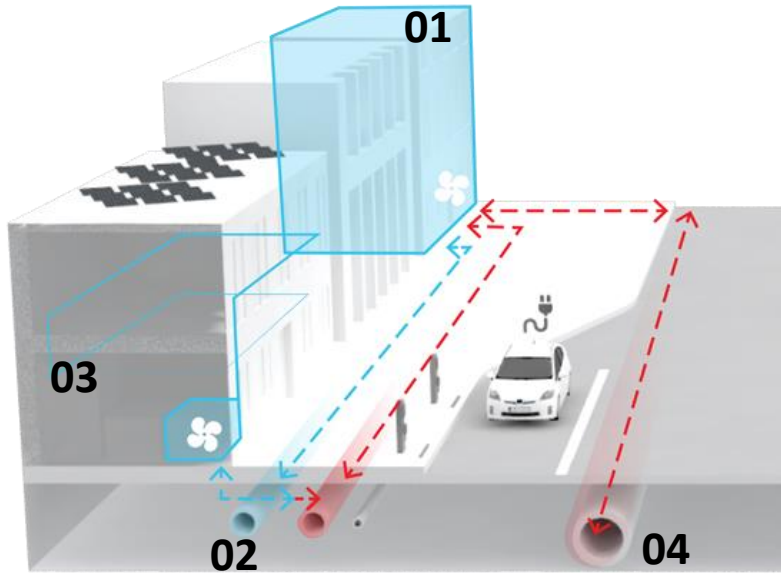
## Communications

### 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

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Solar / Battery / EV Microgrid	Water Reuse- Rainwater >1.5M SF of Development, or >0.5 Miles of Roadway Water Reuse- Grey water	Autonomous Vehicles Install Telecom Utilidor Public Wifi, Smart Sensors Telecom Utilidor

# PROCESS & STAKEHOLDER ENGAGEMENT

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### \*Stakeholders

Utilities  
Developers  
Technical Experts  
City Staff

## Policy Development

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Policy Drafts

Other Documents Drafts

BPDA and City Staff Review

Wider Developer Engagement

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

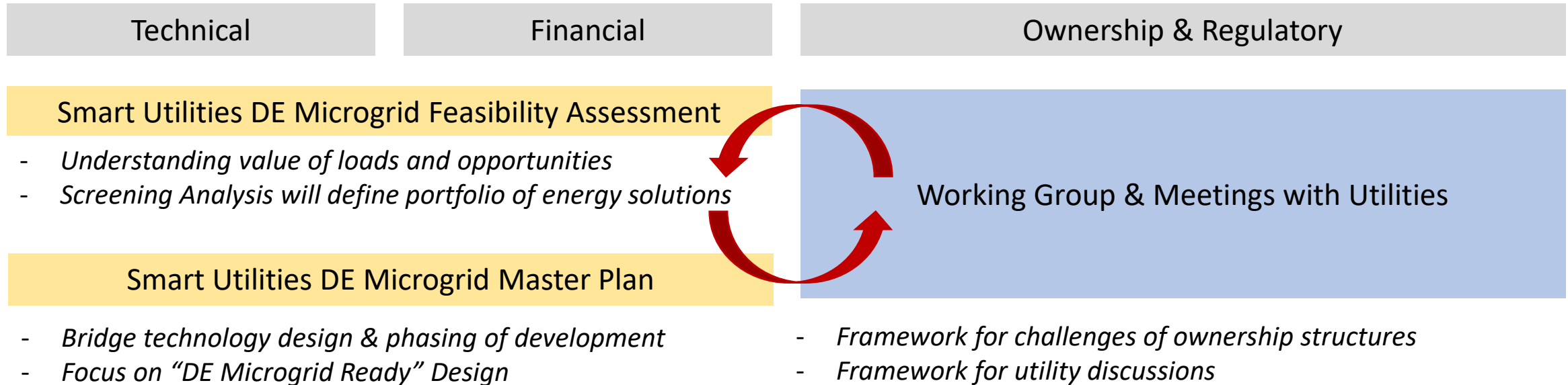
Other City  
Agencies/Depts.  
Standards

## PILOT POLICY





# DISTRICT ENERGY MICROGRID: DEFINING FEASIBILITY



# 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 )

# CASE STUDIES

## Case #1

- DE could be feasible but need to wait for anchor loads.
- Cogen at the building level not optimum
- Maximize rooftop solar
- District Energy Microgrid Ready Design (Smart Utilities was key to achieve this)

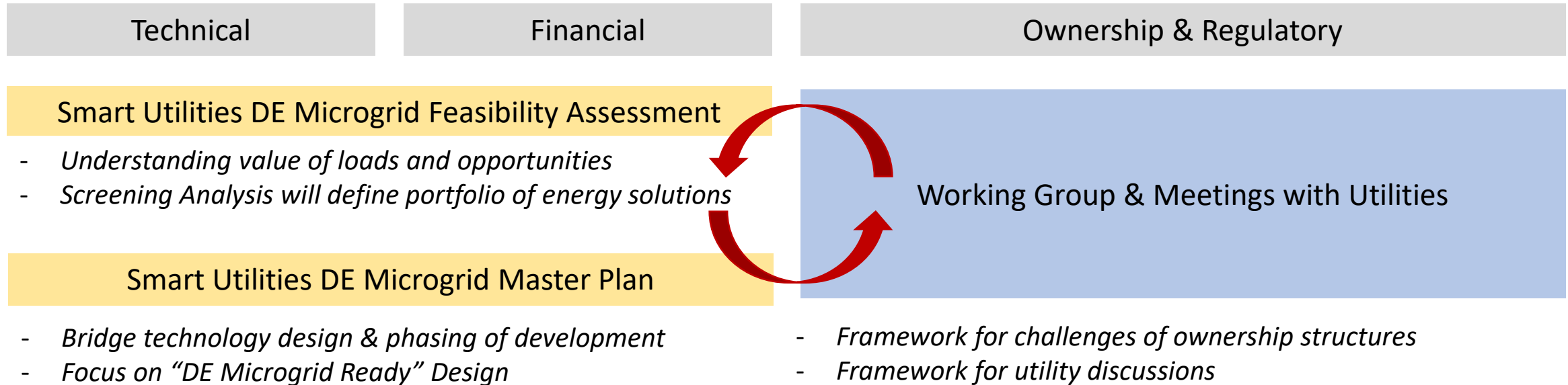
## Case #2

- Cogen at the building level feasible (biotech and R&D loads)
- Nanogrid: Able to island and provide resilience
- Plan to consider battery storage during later phases of development

## Case #3

- Cogen at the building level for house loads feasible
- District Energy Microgrid Ready Design to allow for tenant loads
- District Energy Microgrid Ready Design to allow for interconnection with future buildings

# DISTRICT ENERGY MICROGRID: DEFINING FEASIBILITY



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





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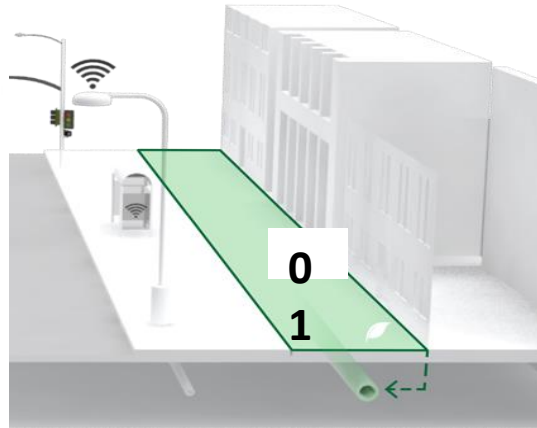
# APPENDIX



# GREEN INFRASTRUCTURE



GEORGETOWN CLIMATE CENTER  
A Leading Resource for State and Federal Policy

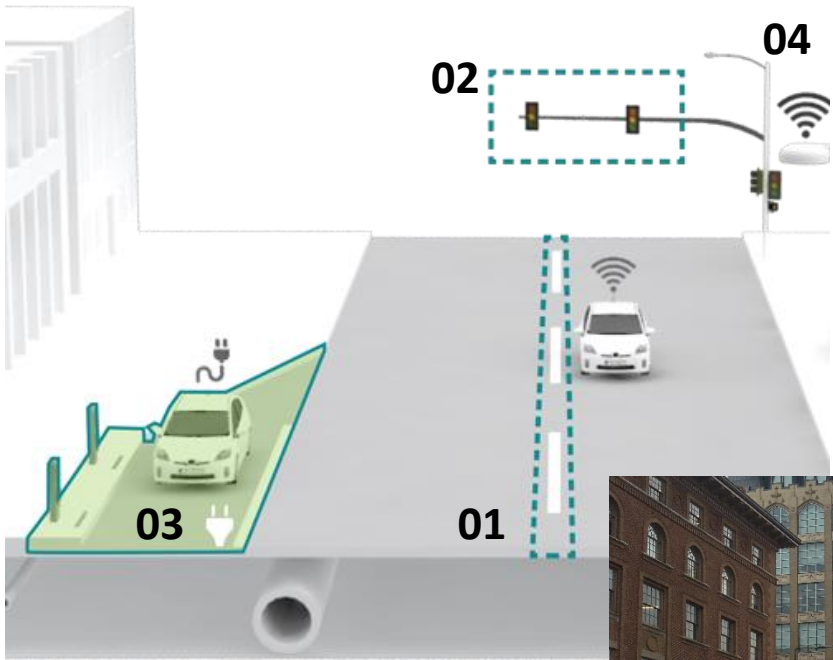


**01** Green Infrastructure/Permeable Pavement

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

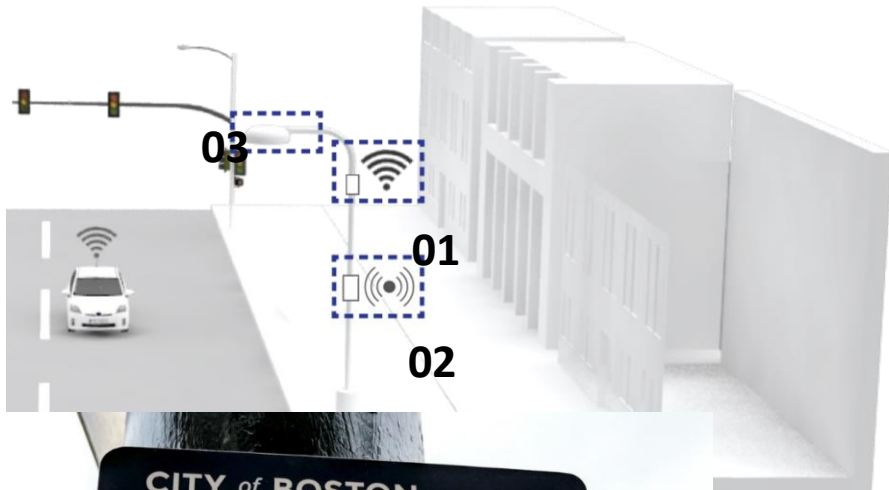




# SMART STREET LIGHTS

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>