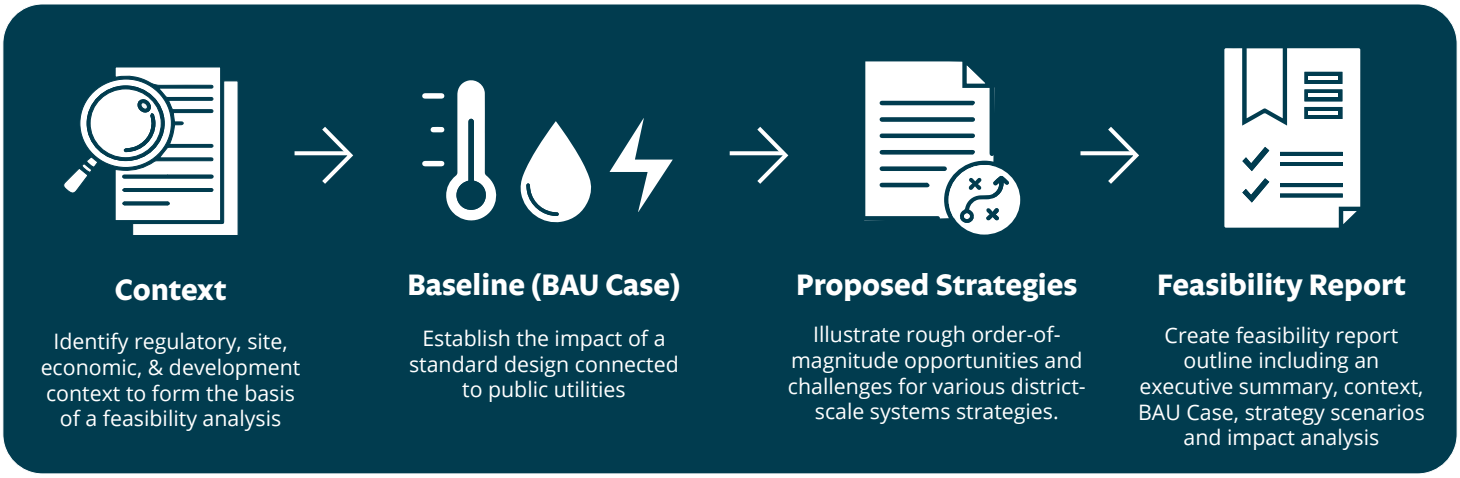
Advanced Energy Systems



Advanced Energy (AE) Systems are designed to utilize a set of innovative Distributed Energy Resources. AE Systems serve clusters of buildings through district thermal networks, microgrids, and/or grid interactive building technologies. The implementation of these technologies creates cost-effective, resilient, low-carbon energy systems and strategies.

Proponents of projects larger than 1.5 million square feet must carry out an Advanced Energy Systems Feasibility Assessment and provide an Advanced Energy Systems Master Plan. The Feasibility Assessment serves as a technical and economic evaluation of applicability, scope, and nature of an Advanced Energy System for an Article 80 project. An early feasibility assessment allows a project team to establish a project's most viable AE solution during initial design phases and is divided into two parts: Part 1 Context and Part 2 Advanced Feasibility Assessment. The tables below outline the desired content and deliverables for both phases. At the completion of each phase proponents will meet with the Smart Utilities team and key stakeholders to review the results of the findings.

Part 1 - Context : Information and Data Collection

Identify and document the regulatory, economic, site, and development context to form the basis of a feasibility analysis of a Advanced Energy System.

MTG-01 WITH BPDA

1. Hold an exploratory meeting with BPDA staff and relevant utility stakeholders to discuss constraints and highlight opportunities in the findings.

REGULATORY

DATA & NARRATIVE

1. Project applicability to related City of Boston goals, including:
   a. BERDO
   b. ZNC
   c. Urban heat island
   d. Resiliency
   e. other

2. The current ISO New England (ISO-NE) GHG factors as well as the anticipated GHG factors through 2050

3. Other regulatory requirements or exclusions that introduce an obstacle to the goals of this study

4. City of Boston requirements for potable and reclaimed water supply

SITE

DATA & NARRATIVE

Describe the measures required to overcome site/project-specific constraints, and categorize the measures as a challenge or an unsurmountable deal-breaker:

1. Utility capabilities for the future supply of natural gas or other low-carbon fuels

2. Utility requirements for future electric interconnection, including space & cost.

3. Capacity and condition of existing utilities

4. Net metering availability, if applicable

5. time limitations for utility upgrades or procurement of technologies

6. Floodplain boundaries, if applicable, extreme heat or cold, or other vulnerabilities related to recent impacts noted on the existing site plan

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ECONOMIC

DATA & NARRATIVE

1. Current and relevant utility rates for electricity, gas, steam, water, and any other available utilities.
   a. Include rate breakdown where applicable related to time-of-use, and normal v. stand-by.
   b. Assumptions for utility affordability related to owners and/or tenants.

2. The discount rate and escalation rate you will use in life-cycle cost analysis (LCCA).

3. The anticipated ownership model for the development, including responsibility of utility bills.

4. The cost of carbon penalties per ton per BERDO

5. Relevant federal, state or local incentives or grants available and related to the project and the goals of this study (e.g. MassSave)

6. The applicable Social Cost of Carbon [SC-CO2]. Include reference to US EPA values, White House Values, State of MA or another reference with description why the values are more relevant to the project.

DEVELOPMENT

DRAWINGS

general: north arrow and scale, street names

1. a site plan showing the site pre-development, including land use
   a. note incidents of natural disasters or other impacts to the site from the past 10 years

2. a preliminary site plan showing the proposed development, including:
   a. changes to land use
   b. existing utilities (e.g. elec, gas, water)
   c. opportunity zone, environmental justice zone, historic district, and other pertinent designations
   d. % increase/decrease in pervious cover
   e. % increase/decrease in # of trees
   f. adjacent properties including building footprints, GSF, use
   g. building parcels, and for each:
   - massing
   - indication of phased construction
     including timeline if applicable
   - gross square feet
   - use (e.g. office, multifamily, lab)
   h. other information about the intended building program that could impact the goals of this study

Part 2- Advanced Energy Feasibility Assessment: Purpose

1-2 Meetings with the Smart Utilities Team and key stakeholders. Review and discuss key deliverables and findings related to the techno economic study. The overall deliverables are finalized summary report are outlines below.

Baseline

Establish the impact of a standard design connected to public utilities

BUSINESS AS USUAL (BAU) CASE

DATA & NARRATIVE

1. Heating and cooling demands [BTU/hour per SF per year] per building use type, including inputs and assumptions
   a. The resulting combined totals and a description of the primary heating/cooling capacity for:
      - stane-alone buildings
      - a centralized utility plant
   b. An estimated utility cost for the stand-alone and centralized basline

2. Water balance [gal/year] including inputs and assumptions, that illustrates:
   a. Per building:
      - potable water requirement (e.g. drinking)
      - non-potable water use opportunity (e.g. irrigation, flushing, cooling tower makeup)
      - the quantity of rooftop rainwater, greywater, and blackwater available on site for reuse
   b. the resulting totals for the full development for potable water needs, non-potable water use opportunities, and rain/grey/blackwater available

3. On-site renewable energy production area [SF] available

4. Any special considerations required for emergency power

Proposed Strategies

Illustrate rough order-of-magnitude opportunities and challenges for various district-scale systems strategies. These strategies should support sustainable and equitable resource management in land use, water, energy, and carbon.

STRATEGY SCENARIOS

DATA & NARRATIVE

Develop conceptual design pathways for the strategies applicable to the development, and describe high-level pros and cons for each, including capital cost, operational cost,
energy/operational carbon, embodied carbon, potable water use, and schedule

1. Strategies include: district energy, low-temp loop, geothermal, sanitary sewer heat exchange, PV+battery, PV+microgrid, water collection and reuse, on-site blackwater heat
recovery, seawater thermal exchange, solar thermal, grid-responsive building controls

DRAWINGS

Provide a conceptual site plan sketch showing how each strategy would be connected within the site and to the city utilities, as applicable

MTG-02 WITH BPDA

Hold a meeting to discuss high-level pros and cons for all strategies to agree on selected options for feasibility study, as needed

1. Present the following:
   - existing site plan & preliminary development
   - key context related to economic parameters, regulatory constraints and physical system constraints
   - business as usual case
   - site plan sketches and strategy pathways for district-scale strategies

IMPACT ANALYSIS

DATA & NARRATIVE
For each of the strategies agreed at MTG-02 with BPDA, describe the following compared to the BAU Case

1. Sustainable & equitable resource mgmnt
   a. operational GHG/carbon emissions [metric] reductions per year through 2050
      - assume MA grid compliance
      - also indicate social cost of carbon
   b. embodied carbon considerations
      - related analysis is currently optional
   c. potable water use reduction [gallons per program type per year]
   d. land use improvements with reference to resiliency, urban heat island, opportunity/EJ zone, site adjancenties, biodiversity
   e. public health impacts including traffic, air quality, and acute industry and community impacts

2. Life cycle cost
   a. construction cost [$/SF per use type], including temporary utility needs
   b. operational costs: energy and water through 2050 [$/kWh per use use type]
   c. resulting 10-year and 20-year net present value (NPV) of each strategy [$]
3. City of Boston cross-walk
   a. synergies or trade-offs with related goals described for the development's Regulatory Context

MTG-03 WITH BPDA
Hold a meeting to discuss the findings of the impact analyis above, and formalize strategies to continue studying.

FEASIBILITY REPORT (FINAL DELIVERABLE)

REPORT OUTLINE
1. Executive Summary
   a. project owner, team, location, program, overview image and occupancy timeline
   b. key contextual issues or opportunities
   c. results of impact analysis and MTG-03

2. Context, incl. meeting actions

3. BAU Case

4. Strategy Scenarios, incl. meeting actions

5. Impact Analysis, incl. meeting actions

6. Appendix: 11x17 site plans, full meeting minutes, calculation back-up as applicable, other team references