01 – Energy & Environment

1. Summary

Harvard Medical School is regularly pursuing projects which enhance the usability of campus facilities as their needs change over time. The intent of the document is to seek all means necessary to reduce the impact these changes have on energy consumption, Green House Gas (GHG) emissions, the local environment and utility infrastructure. This document outlines both requirements and best practices for building design and selection of optimal building components with the intent of providing long term sustainable benefits. The focus is on energy efficiency, particularly for fossil-fuel based thermal and process energy, cooling load reductions and reduction in on-site fossil fuel consumption. The objectives are reduced operating and maintenance costs.

2. Related Sections
    a. Division 01 – Commissioning
    b. Division 22 – Plumbing
    c. Division 23 – HVAC
        i. Division 23M – Utility Metering
    d. Division 25 – Building Automation System (BAS)
    e. Division 26 – Electrical

3. Referenced Publications
    a. Harvard 2023 Sustainable Building Standards
    b. Massachusetts State Building Code (780 CMR)
    c. Massachusetts Specialized Stretch Energy Code (225 CMR 23.00)
    d. Mass DEP Regulation 310.CMR 7.76 - Prohibitions on the Use of Certain Hydrofluorocarbons
    e. International Energy Conservation Code (IECC)
    f. Energy Standard for Buildings Except Low Rise Residential Buildings (ASHRAE 90.1)
    g. Ventilation for Acceptable Indoor Air Quality (ASHRAE 62.1)

4. Objectives

Harvard University and Harvard Medical School are internationally recognized leaders in sustainable building and are committed to sustainability by minimizing energy consumption and GHG emissions. On every building project, whether it is a replacement of aging components, an existing building fit-out, a full building renovation or new construction project, the project manager shall follow the standards as they are laid out with the following goals:

a. Reduce energy consumption by at **least 15% compared** to baseline (pre-existing) conditions for capital renovation projects

b. Reduce potable water consumption by at **least 30% compared** to baseline (pre-existing) conditions for capital renovation projects

c. Reduce cooling load and chilled water demand from MATEP

d. Reduce operating and maintenance cost

e. Increase building indoor air quality, health and livability.

f. Reduce HMS carbon emissions to set HMS on the path to accomplish net zero emissions in 2050.

5. General Design Guidelines

a. Minimize building cooling load by using high performance building envelope components

b. All air handling units shall be designed with hydronic hot water heating in mind, do not distribute steam within the building for heating, hot water, cooking or other purposes excluding use of steam for sterilization or other laboratory needs.

c. All AHU/FCU coils shall be designed for a maximum of 140F hot water supply. Contact Facilities for additional technical details.

d. Choosing Energy Star rated electrical components including kitchen appliances, lighting, computers, laboratory equipment, etc.

e. Select unitary equipment with scheduling capability which can be programmed to operate at an occupied and unoccupied settings to allow for shut down or setbacks when not in use. This applies to autoclaves and sterilizers, cage washers, ducted biosafety cabinets, ducted fume hoods, kitchen appliances, and any other equipment with intermittent or cyclical mode of operation.

f. Select low-flow domestic water fixtures (**30% reduced flow compared to pre-existing)**.

g. Study the viability of providing renewable energy including Photo Voltaic and solar hot water heating if applicable to the project scope of work.

h. Study the viability of upgrading existing heat recovery systems with more efficient heat recovery systems using refrigerant or heat pump-based technology.

i. Strive to separate HVAC in laboratories from office, imaging, and computational spaces

j. Evaluate the capture and reuse of waste heat & water including excess heat from the server rooms

k. Consult Facilities for coordination related to climate resiliency initiatives and flood mitigation plans including but not limited to equipment location elevation, redundancy, etc.

l. Investigate the feasibility of pursuing net zero energy for Tier 1 projects.

6. Deliverables

a. The Massachusetts Specialized Stretch Energy code allows multiple compliance pathways. It should be set forth as to which code compliance path is being pursued for all design disciplines to follow and adhere to it for the life of the project. For all projects, project managers shall present documents for review at each design phase completion identifying all energy consuming components and their performance as it relates to current code compliance.

b. Provided alternates for energy consuming components which exceed current prescriptive efficiencies in the energy code.

c. Provide a list of components for review which do not directly consume energy but impact energy loads and consumption such as exterior walls, roofs, glazing and identify the code compliance performance and the proposed project performance. Provide alternates which exceed current code compliance focusing on reducing cooling loads.

d. All capital projects shall meet requirements detailed in the Harvard Sustainable Building Standards (SBS) document appropriate to the project's tier level and scope of work. Additionally, project managers shall complete and submit for review the appropriate deliverables as defined in the SBS applicable to the project's tier level. Table 1 below identifies the required deliverables for each project level.

    i. Integrated design requires the project team to collaborate through design charrettes. All team members are required to meet and discuss sustainability goals and determine how to achieve them. The team also needs to ensure the goals remain in the project all the way through to completion of the project.

    ii. Life-cycle costing is performed on major energy consuming equipment or systems to ensure over the expected life time that cost will not exceed those of other comparable equipment or systems. Life cycle costing considers initial construction costs, operation and maintenance costs, utility costs and incentive/ rebate costs, as well as cost of carbon emissions over the expected component life. A sample LCCA spreadsheet is available for download here

    iii. Energy modeling/analysis to establish target EUI and energy code compliance pathway. Energy modeling is performed to estimate building energy consumption of proposed building designs and compare it to a base code compliant building design. This is generally used for Tier 1 projects including new construction and gut-renovation of larger buildings. Energy Plus, Trace 700, Design Builder, etc. are commonly used energy modeling software tools

    iv. Prescriptive requirements are identified in the appropriate section of the selected code. Sections refer to envelope, mechanical, lighting, and water heaters, etc.

    v. Enhanced sub-metering and ongoing verification is a way to better understand where building energy is being consumed. The main building utility meter identifies the total energy consumed at the building level but not specifically by what end use (lighting, fans, pumps). Sub-meters allow for verification that the

building is operating as intended. Refer to HMS Utility Metering Standard for selection of appropriate metering technologies and applications.

vi. Closeout documentation/ OEM readiness ensures that all operation and maintenance documentation applicable to new building components is provided for use by building managers. This reference material is critical to maintain proper component operation or to address a malfunction.

vii. GHG analysis includes evaluation of annual Scope 1 and 2 emissions associated with the operation of newly constructed or renovated space/building. Scope 2 emissions will include utility induced emissions.

Table 1: Requirements by Project Tier Level

Tier	Integrated Design	Life Cycle Costing	Energy Modeling	Enhanced Cx	Prescriptive Requirements	Sub-Metering and Ongoing Verification	Closeout Documentation/ OEM Readiness	GHG Analysis
1	YES	YES	YES	YES	YES	YES	YES	YES
2	NO	Limited	Limited	Limited	NO	Limited	YES	Limited

7. Incentives and Rebates

a. The design consultants shall identify and provide an assessment of the potential incentives and rebates available from state and federal programs as well as local distribution utilities which could be available for energy efficient technologies and equipment.

b. Tax incentives and rebates provide funding to help offset the increased cost of installing energy efficient equipment and components. They reduce the simple payback that would otherwise make selecting higher performance equipment more difficult.

c. The AE team shall review the equipment/technology selection during design development phase to ensure that all selections are meeting the performance goals and are eligible to receive the incentives offered by the local utilities as well as other federal or state incentive programs

d. The utility personnel need to be notified of any potential rebate/incentive applications early, preferably during the schematic design phase. This will help to maximize the level of participation the utility can deliver.

End of Section