01 – Energy & Environment

1. Summary

    a. 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 the right building components with the intent of providing long term sustainable benefits. The focus is on energy efficiency and cooling load reductions but with that comes reduced operating and maintenance costs.

2. Related Sections

    a. Division 22 – Plumbing

    b. Division 23 – HVAC

    c. Division 26 – Electrical

3. Referenced Publications

    a. Harvard Green Building Standards

    b. Harvard Green Building Standards - Deliverables Checklist

    c. Massachusetts State Building Code (780 CMR)

    d. Massachusetts Stretch Energy Code (780 CMR Appendix 115.AA)

    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 61.2)

4. Objectives

    a. Harvard University and Harvard Medical School are internationally recognized leaders in green building and are committed to sustainability by minimizing energy consumption and GHG emissions. 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 make all reasonable efforts to follow the standards as they are laid out with the following goals:

i. Reducing energy consumption

ii. Reduce cooling load

iii. Reduced life-cycle cost

iv. Reduce operating and maintenance cost

v. Increase building livability.

5. Deliverables

a. The Massachusetts Energy and Stretch Energy codes allows for compliance with either IEEC or ASHRAE 90.1 both with Massachusetts amendments. 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. Energy consuming components should be selected which exceed the selected energy code by a minimum of 18%.

b. Provided alternates for energy consuming components which exceed current code compliance by at least 25%.

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

d. Identify and provide a list of eligible components and the potential incentives and rebates available.

e. Capital projects ($100,000+) shall meet requirements detailed in the Harvard Green Building Standards document per the project's Tier level. Additionally, project managers shall complete and submit for review the appropriate Harvard Green Building Standards – Deliverable Checklists applicable to the project's Tier level. Table 1 identifies the required deliverables for each Tier 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 the building components to ensure over the expected component life time that it won't cost more than another comparable component. Life cycle costing considers initial construction costs, operation and

maintenance costs, utility costs and incentive/ rebate costs over the expected component life.

iii. Energy modeling is performed to estimate building energy consumption of proposed building designs and compare it to a code compliant building design. This is generally used for larger building renovations or new constructions but can also be used for smaller scale projects.

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

v. Metering and ongoing verification is a way to better understand where building energy is being consumed. The building utility meter identifies the total energy consumed at the building but not specifically by what end use (lighting, fans, pumps). Meters installed per the requirements of the Harvard Green Building Standards document allows for verification that the building is operating as intended.

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.

Table 1

Include Tier definitions

Tier	Integrated Design	Life Cycle Costing	Energy Modeling/ GHG Calculations	Prescriptive Requirements	Metering and Ongoing Verification	Closeout Documentation/ OEM Readiness
1	YES	YES	YES	YES	YES	YES
2A	YES	YES	OPTIONAL	YES	YES	YES
2B	YES	YES	OPTIONAL	YES	YES	YES
2C	OPTIONAL	YES	OPTIONAL	YES	YES	YES
3	OPTIONAL	OPTIONAL	OPTIONAL	YES	YES	YES
4	OPTIONAL	NA	NA	NA	NA	NA

6. Minimum Design Criteria for All Projects

    a. For all new construction, renovation and replacement projects submitting building permits shall have energy consuming components which exceed current code compliance performance by 18% at minimum. This applies to such components as mechanical equipment and lighting.

    b. For all new construction, renovation and replacement projects submitting building permits shall have components which do not directly consume energy but impact energy consumption exceed current code compliance.

    c. Life cycle cost analysis shall be completed on all components to aid in the selection of the component which provides the greatest energy consumption savings and the lowest life cycle cost.

    d. Whole building energy modeling energy reduction percentages shall adhere to the Harvard Green Building Standards document. Add link

7. Commissioning

    a. All new work shall be fully commissioned to ensure as-designed operation. All new components shall be tested including control points, programming, and calibration of field devices shall be completed. Third-party commissioning eliminates conflicts of interest and provides the highest value to Harvard and is recommended.

    b. Commissioning team shall be involved throughout the project including the planning, designing and constructing stages.

8. Net-Zero

    a. Test the feasibility of pursing net zero for Tier 1 projects. Net zero is not required but it must be demonstrated the feasibility was evaluated as directed in the Harvard Green Building Standards document.

9. General Design Guidelines

    a. Minimize building loads especially those which reduce cooling such as at the exterior building envelope (walls, roofs, glazing), interior loads such as electrical equipment, computer, kitchen equipment, and lighting.

    b. Select low-flow domestic water fixtures.

    c. Select heating, ventilating and air conditioning equipment which optimizes efficiency. This includes, air handling equipment, air conditioning units, pumps, chillers, boilers and hot water heaters.

d. Select building elements that can be controlled to operate at an occupied setting and at an unoccupied setting to allow for shut down or setbacks for spaces when not in use.

e. Design ventilation to the requirements of ASHRAE 62.1.

f. Consider the viability of providing renewable energy (Photo Voltaic, solar hot water, wind).

g. Consider the viability of providing combined heat and power.

h. Consider continuous commissioning to ensure optimal ongoing building performance.

10. Component Design Guidelines

a. Reference the appropriate standard for the following components:

i. Air Handling Units

ii. Motors and Electrical Systems

iii. Chiller System

iv. Controls

v. General Temperature

vi. Lighting Systems

vii. Building Envelope

viii. Comfort Heating

ix. Plumbing Equipment and System

11. Incentives and Rebates

a. Incentives and rebates provide funding to help offset the increased cost of installing higher performance building components. Incentives and rebates reduce the simple payback that would otherwise make selecting higher performance components more difficult.

b. Incentives and rebates can come from local, state and federal funding sources in the form of direct payment or through tax breaks. Utility companies offer the most abundant and robust programs. All options shall be investigated.

c. All projects shall pursue utility rebates and incentives on any energy consuming components or components which don't directly consume energy but do impact energy consumption indirectly.

d. Electric and Natural Gas public utilities shall be notified of any potential projects early in the design preferably during the schematic design phase. This will help to maximize the level of participation the utility can deliver. This would also be a good opportunity to make design changes that would allow for greater participation in the available utility programs

e. Project managers shall review component selection at each design phase completion to ensure that all selections are meeting performance goals set forth at the beginning of the project and will be eligible to receive incentives and rebates. Pursuit of Any value enegineering should be done without sacrifice to energy savings goals.

End of Section