PART 1: GENERAL

1.01 RELATED SECTIONS

A. CU Standard 01008 – Energy Modeling Guidelines

1.02 BACKGROUND AND INTENT

A. Cornell University is a signatory to the American College and University Presidents Climate Commitment (PCC). By signing this document, Cornell has committed to reducing carbon emissions associated with campus energy use and transportation, with the ultimate goal of achieving a “carbon neutral” campus. Additional information regarding carbon neutrality goals can be obtained at http://www.sustainablecampus.cornell.edu/climate/.

B. As an element to our plan for achieving this goal, Cornell is looking to significantly reduce the energy use of buildings across campus. New buildings and major renovations are a specific focus of this effort.

C. Standard 01008 – Energy Modeling Guidelines provides specific energy-modeling requirements that are part of Cornell’s commitment to reduced energy use. The intent of this Section is to supplement that guidance with design standards as they relate to specific building systems or components.

1.03 DESIGN TO MINIMIZE OPERATING COST

A. Cornell designs most major structures for a 60 to 75 year life. Many structures are in excess of 100 years old. Cornell, as the owner and operator of those structures, bears the full lifetime operating costs, which, in present value terms, is many times the cost of the building.

B. In general, Cornell’s policy is to make sound capital investments during the design and construction of a structure so as to reduce the operating cost. Where the present value of the reduction in operating cost exceeds the amount of the construction cost increase, that design approach should be used to minimize the life-cycle operating cost. In performing life-cycle analysis, the design life of components or systems should never be less than the analysis period.

C. Because of the uncertainty of energy prices and the lifetime of typical components, life cycle costing for energy purposes should typically be done over a 20-year period, not 60 years. Contact Facilities Engineering for the current discount rates and the acceptable Rate of Interest/Return on Investment (ROI) to be used for analysis, as these values are adjusted regularly.
D. Simple payback can be used with flat energy costs to provide a quick check on applicability of energy saving measures. In general, Cornell desires improvements which meet the following simple payback criteria:

<table>
<thead>
<tr>
<th>Category</th>
<th>Examples</th>
<th>Minimum Simple Payback in Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passive</td>
<td>insulation, windows, lighting technology, passive solar, radiant floor</td>
<td>10 to 15</td>
</tr>
<tr>
<td>Active</td>
<td>heat recovery, efficiency upgrades, lower pressure drop devices</td>
<td>7 to 10</td>
</tr>
<tr>
<td>Active, higher maintenance</td>
<td>fume hood digital controls/occupancy sensors, daylight dimming, demand ventilation control</td>
<td>5 to 7</td>
</tr>
<tr>
<td>Risky, easily user affected/overridden</td>
<td>lighting occupancy sensors</td>
<td>3 to 5</td>
</tr>
</tbody>
</table>

E. The Architect and Engineer are expected to optimize the design for the lowest life-cycle cost before the design reaches completion of the construction document phase, utilizing the modeling efforts described in Section 01008 to determine energy usages. However, Cornell may also, at its discretion, direct designs to achieve even lower energy rates to meet Cornell policy requirements (see Section 01008), voluntary goals, grant objectives or similar the goals of the project funder or supporter, or to incorporate a value for energy-related emissions reductions. In general, the designer shall be responsible for providing the best available cost and energy data from which the Cornell Project Manager may coordinate important energy-related design selections.

F. The Engineer and Architect must work together to minimize life cycle costs due to energy use, and this effort shall be demonstrated in final reports at the end of each design phase. This includes the optimization of the building orientation, building envelope and fenestration systems to minimize losses/gains, use of natural light and window overhangs, passive solar design features to control and utilize solar gain, attention to materials selection, construction inspection, and commissioning. Integrate this reporting with modeling reports described in Standard 01008.
G. Significant project co-funding opportunities exist with the New York State Energy Research and Development Authority (NYSERDA at www.nyserda.org) for energy conservation features that reduce the use of electricity. The Owner’s project team and the Architect/Engineer must pursue this co-funding as appropriate for the project in consultation with the department of Energy & Sustainability. If such funding is pursued, reports shall be formatted to facilitate these funding needs.

1.04 ENERGY CODES

All buildings shall be designed to meet the following energy codes:

A. New York State Energy Conservation Construction Code.

B. New York State Building Code and referenced International Codes.


D. Ventilation for Acceptable Indoor Air Quality, ASHRAE 62 or current version. (Should a new ventilation standard be accepted, design to it.)

E. In areas where the codes contradict, use the more energy conserving code.

1.05 MODELING DURING DESIGN

A. The Engineer shall model all HVAC designs in order to provide energy information for life-cycle cost analysis as detailed in Standard 01008 – Energy Modeling Guidelines:

PART 2: SYSTEMS DESIGN

2.01 SYSTEMS SHOULD BE DESIGNED IN ACCORDANCE WITH THE FOLLOWING GUIDELINES:

A. Mechanical Systems

1. In all cases, an occupied/unoccupied mode selection shall be provided. This feature shall also be remotely controllable from the central Energy Management Control System (EMCS) through an override command. Occupancy sensors shall be used wherever possible to further automate the occupancy mode.

2. All thermostats shall provide for night setback/unoccupied mode with a user override pushbutton for an adjustable time period.
3. Variable air volume systems shall always be the minimum design without special approval. Non-laboratory systems shall be fully variable, and laboratory spaces shall, as a minimum, include a step change to unoccupied mode for the hood and the laboratory. Provide static pressure reset based on percent open of VAV boxes.

4. All general use spaces (large common office spaces, atria, gyms, teaching rooms, lobbies, halls, etc.) shall have demand controlled ventilation. These spaces shall also have a user override momentary pushbutton to turn on air systems for a two-hour period, with thermostat high and low temperature override to cycle fans during extreme conditions.

5. Equipment rooms shall not be cooled using chilled water without written approval from Energy & Sustainability. In addition, transformer rooms shall always be cooled with convection flow of outside air.

6. All building chilled water pumps, central station air handlers, and return fans shall be equipped with variable frequency A.C. drives.

7. All building hydronic heating pumps over 3 hp shall be equipped with variable frequency A.C. drives, regulating loop ΔP.

8. Three-way control valves shall not be used on either heating or cooling loops.

9. Four pipe fan coils will have control valves that are interlocked to prevent simultaneous heating and cooling. The interlock will result in a loss of temperature control, indicating a maintenance condition and forcing its correction. Fan coil unit fan switches shall always close the control valves when in the “off” position.

10. Unit heaters shall be equipped with automatic control valves to shut off the water/steam side during the summer. Control shall be via OAT (Outside Air Temperature) sensing.

11. Systems requiring 50°F or less wet bulb are a special energy concern. Consult Facilities Engineering for advice and approval.

12. All air-handling systems shall include economizer outside air cooling cycles. 100% outside air systems and return air systems over 10,000 CFM shall include air flow monitoring (supply, return, and outside air) and outside air flow control logic. In addition, provide an outside air dew point sensor to minimize the use of cooling and reheat on 100% outside air systems.

13. Use of reheat shall be minimized and, wherever possible, designs shall allow for reheat systems to shut off in summer.
14. Reheat, radiation, and preheat systems must be separate for all but the smallest systems.

15. Refrigeration systems for growth chambers, food storage, and cold storage must be remote air cooled with condensing units located in machine rooms utilizing louvers and propeller fans for outside air supply/exhaust. Do not use campus chilled water for this application without special approval, which requires the use of an isolating plate and frame heat exchanger.

16. Refrigeration systems for direct expansion systems shall utilize floating head pressure design and variable speed motor drives.

17. Laboratory space occupancy and hood proximity sensors shall be used to put laboratory spaces and hoods into unoccupied modes. All sensors shall be spaced as appropriate to provide adequate coverage. Failure modes and alarm of sensor failure shall be provided for in the design.

B. Electrical Systems

1. Transformers shall be sized so as not to require fan cooling under normal load.

2. Transformer rooms shall always be cooled with convection flow of outside air. Cooling using chilled water is not permissible.

3. Lighting design shall include all electronic ballasts and T8 lamps, multi-level switching, occupancy sensors in public and general spaces to go to an unoccupied safety level, or off. More efficient lighting systems may also be proposed for Owner review.

4. Lighting designers shall evaluate and work to include the use of diffuse day lighting controlled by manual or motorized shades, or light harvesting skylight and light tubes. Where possible, this should be augmented with light level controllers on electrical lighting systems.

5. Residence hall lighting systems should include ceiling mounted fluorescent fixtures where possible to minimize the need for student supplied (typically incandescent) fixtures. In all cases, halogen lighting is prohibited from residence halls, and a goal for the designers is to provide adequate low energy use lighting in the rooms so students will not need to utilize additional portable lighting for which efficiency may not be optimal.