New York University Design Standards:
Energy and Water Guidelines

1. Introduction

New construction and renovation at NYU shall be designed to meet or exceed Energy Performance Targets. Some strategies for meeting these goals are given here; however, the specific set of engineering and design techniques used will vary from project to project.

These guidelines, together with LEED and ENERGY STAR rating systems, will provide a measurable impact on building performance by promoting a whole-building approach to sustainability by recognizing performance in areas of human and environmental health, including water savings, energy efficiency, and indoor environmental quality.

2. Review Guidelines

This standard shall be utilized if the project is constructed with University funds or funds guaranteed by the University, contains more than ten thousand Square feet, and/or includes a heating, ventilation or air-conditioning system. For minor renovations these guidelines shall be utilized to the greatest extent possible to be consistent with the standards for the high performance certification. It is intended to meet the following New York University energy efficiency and environmental building goals:

I. To achieve the highest performance certification attainable when constructing or renovating buildings, where the increased cost for high-performance certification can be recouped from decreased operation costs.

II. Certification per the US Green Building Council's LEED design rating system (minimum Silver). Other rating systems, such as ENERGY STAR Target Finder (minimum 85) or Green Building Initiative's Green Globes rating system (minimum 2 Globes), may also be applicable.

III. To evaluate the infrastructure to ensure an efficient operating system if the project affects any component of the building infrastructure.

The following additional information is required at each stated phase of design.

A. Schematic Design

NYU utilizes an integrated design approach with all disciplines working together starting from conceptual design, to evaluate the energy performance of architectural design concepts (e.g.: orientation, massing, fenestration, treatment of façade, materials, insulation), mechanical and electrical design criteria and concepts to produce high performance buildings with low first costs and operating costs.

The A/E shall:

1. Achieve ENERGY STAR Target Finder score of 85 or greater. Incorporate

environmentally responsible and sustainable concepts and practices into the planning, design and construction, using the U.S. Green Building Council's LEED Rating system (Silver minimum) and ANSI/ASHRAE/IESNA Standard 90.1 latest edition as a general guideline. The goal is to exceed the ASHRAE energy standard for new construction by 30 percent and by 20 percent for major renovations. (Note: Renewable Energy Credits or other offsets are not to be included in these calculations.)

2. Use life-cycle cost and simple payback analysis for alternative energy saving design solutions, to achieve the highest energy efficiency and lowest energy consumption.

3. Incorporate the most energy-efficient materials, products, equipment and systems incorporate renewable energy technologies at the earliest possible stages of design.

4. Use energy sources with low environmental impact, including centrally supplied heating and cooling (NYU Central Plant supply preferred when feasible).

5. Produce a list of at minimum three energy savings design components that could get rebates for NYU. Cost analysis with and without these rebates shall be submitted.

6. Register the project with NYSERDA's New Construction Program, if the project is eligible.

7. Consider the project's impact on the utility infrastructure of the existing building and institution, and provide a list of all existing equipment that is affected by the project.

B. Design Development

The A/E shall provide:

1. ASHRAE 90.1 envelope calculations, if applicable

2. ENERGY STAR Target Finder Building rating index calculations (or other energy target tools such as LEED), if used;

3. All calculations used to predict building Energy Utilization Index, if ENERGY STAR rating method is not used;

4. A list of all major mechanical equipment and lighting systems with nameplate data and annual consumption prediction calculations attached.

5. Fine tuned original design strategies and methodologies. Energy performance shall be adjusted and evaluated using U.S. EPA's Target Finder or other approved systems as specified for each phase of design development.

During design development, a list of known equipment must be provided, so the HVAC system can be better defined and not based on watt per square foot. Equipment shall be documented for load (mechanical and electrical requirements) and be used to design per actual load.

3. System Requirements

A. Building Envelope

1. Prior to assessing the actual envelope components, the A/E shall consider the larger issues of building massing, orientation, and the overall program for each space within the building. While reviewing the building program, massing, and orientation options the A/E shall also begin to propose facade design solutions.

2. The A/E shall consider the use of operable windows, shading devices, sun shelves, motorized blinds, high performance glazing, premium insulation, and thermal mass, to mitigate building heat gain in the summer and heat loss in the winter while simultaneously allowing daylight and views for building occupants. In addition to the use of operable windows and mixed mode ventilation strategies, the envelope must address direct solar energy transfer.

3. ASHRAE 90.1 Envelope Performance Comparison: The national energy standard ASHRAE 90.1-2004 establishes minimum envelope performance by orientation and amount of glazing incorporated. Successful envelope solutions will exceed the requirements set forth in this standard by a minimum of 30% overall.

4. Design for low infiltration and highest practical insulation values. Detail envelope structural penetration, soffits, window and door openings, pipe, and conduit penetrations for low air infiltration and high weather resistance.

5. Specify low-E double or triple glazing with low shading coefficients and thermal breaks, high performance tint and medium reflective coating.

6. Provide solar shading of window units.

7. Limit building envelope fenestration to 25 percent of exposed perimeter surfaces.

8. Minimum average insulation R-values shall not be less than R-19 for walls and R50 for roofs.

9. Skylight systems, which are a part of roof assemblies, shall not exceed 5-percent of the gross roof area. Skylights shall be low-E double glazed with thermal break, performance tint and medium reflective coating.

10. Lobbies and primary entrances must have a double door vestibule (“airlock”), revolving doors, or other method to prevent loss of conditioned air.

B. Lighting and Control Requirements:

1. Design the electric lighting systems and components to minimize electric lighting energy use, while still meeting project requirements and high visual quality. Consider and apply the appropriate strategies:

2. Use high efficiency lamps and luminaries with electronic ballasts.

3. Any use of incandescent lamps must be approved by NYU.

4. Use controls to reduce energy use (e.g., dimmers, occupancy sensors, local light system control, BMS light system control and, as a last option, time clocks). Daylight harvesting shall be used in areas that receive sunlight.

    a. Appropriate rooms (less than 30' x 30', and where the light switch is direct line of sight to all areas of the room) shall use wall switch occupancy sensor lighting controls (Leviton ODS-10 or ODS-15). Larger rooms or rooms with non-rectangular floorplans shall use ceiling sensors.

    b. Classrooms and lecture halls with lighting control panels shall have occupancy controls as specified by the lighting control manufacturer.

5. Use low levels of ambient light with task lighting where appropriate. Direct/indirect lighting fixtures illuminate ceilings and walls, producing low-level ambient light that minimizes glare in computer rooms.

6. Where functional requirements permit, lighting design shall combine task and ambient lighting to reduce the high overall light levels.

7. Lighting shall have reasonably sized zones for granular control of lighting needed for low occupancy periods such as nights, holidays, during cleaning, etc. A whole floor should not need to be turned on for one person in their cubicle.

8. Designer shall minimize the type of ballasts, lamps, and fixtures used. When retrofits are performed on part of a building, fixtures shall match other modern fixtures in the building when possible.

9. Specific lighting technologies to be used:

    a. High efficiency T8 ballasts and bulbs. Philips bulbs, Advance or Universal ballasts. Bulbs are Philips F32T8/ADV835(or 841)/XEW/ALTO 25 Watt, F32T8/ADV835/EW/ALTO 28 Watt. High Output T5 bulbs are Philips F54T5/835 (or 841) HO/EA/ALTO 49 Watt.

    b. Sconces, downlights, highhats shall all be compact fluorescent style. Screw in (Litetronics is recommended) and plug in (Philips is recommended) types are acceptable.

    c. Dimmable lights shall be linear fluorescent or LED.

d. Dimmable compact fluorescent and incandescent lighting requires NYU approval.

e. Indoor use of quartz halogens, metal halides, and other incandescent or low efficacy bulbs and fixtures require NYU approval. Use low wattage replacements (ie Philips) for R30 Halogens, MR16 Halogens and many metal halides if incandescent lighting is specified.

f. Outdoor lighting shall be induction, fluorescent, sodium, or metal halide type and controlled by daylight sensor or astrological clock.

g. LEDs may be appropriate in areas where halogen bulbs of 20W or less are desired.

h. Under-cabinet and desk lighting shall be fluorescent (compact, T8, or T5).

i. Local overrides to lighting timers, occupancy sensors, or BMS control (for instance, in hallways and corridors for cleaning purposes) must include a timeout feature that will turn the lights off after not more than 60 minutes

j. During construction, all outdoor lighting must be controlled via timer or photocell to prevent daytime operation. All construction lighting shall be fluorescent type with suitable protection.

C. Mechanical System Requirements:

1. A/E shall use most efficient source of heating and cooling supply, for instance HTHW or CHW if available from the Central Plant. Chilled water from the Central Chilled Water Plant and Distribution System is the preferred means to provide heat rejection.

2. Microcogen or waste heat to electricity equipment shall be considered for locations over 100,000 square feet not connected to the Central Plant.

3. Design the building heating, ventilating and air conditioning (HVAC) system to minimize energy use, while maintaining standards for indoor air quality and occupant comfort. Consider and apply the appropriate strategies below:

a. Group occupancies and functions based on operating schedules and ventilation requirements to allow zoning of mechanical and electrical systems for minimum equipment and fixture operating hours.

b. In building air conditioning systems, make extensive use of economizer cooling (water side and/or air side) to use outside air instead of utilizing mechanical means to produce energy for cooling, whenever temperatures allow. Exceptions must be approved by NYU.

4. Air handling systems shall incorporate variable frequency drives to reduce fan energy and prolong motor life.

5. Provide heat recovery systems to reduce energy costs by tempering (heating

and/or cooling) ventilation air. This is mandatory on buildings receiving more than 50% outside air during normal operation, unless an alternate plan is approved by NYU.

6. HVAC systems shall be controlled through the campus wide Building Management System (BMS).

7. Each HVAC system must have an unoccupied mode sequence of controls, including set back temperatures.

8. Trend logging shall be enabled for BMS-connected equipment as specified on a per project basis by NYU. List of BMS-connected equipment shall be provided to NYU for approval.

9. BMS controlled Demand Control Ventilation (DCV) shall be used to modulate outside air intake according to mixed air temperature/enthalpy requirements, occupancy, CO_2 levels, and scheduled activities and operations. Use occupancy sensors and variable air volume distribution systems to minimize unnecessary heating or cooling.

10. Install permanent monitoring BMS connected systems that provide feedback on ventilation system performance to ensure that ventilation systems maintain design minimum ventilation requirements.

11. Do not use domestic water for heat rejection except as an emergency backup to another system.

12. CFC-based refrigerants shall not be used. HFCs and natural refrigerants are preferred over HCFCs.

13. Correctly size mechanical equipment by using energy modeling and actual equipment data to improve estimates of heat gain from laboratory equipment and other building heat loads.

14. Use BMS control systems for variable speed drives on pumps, fans, and compressors.

15. Where feasible, capture waste heat from server and UPS rooms for reuse (for instance, to heat incoming air or domestic hot water). Where feasible, capture waste heat from condenser loops for use to heat domestic hot water or for other purposes.

16. Telecommunications closets shall have the ability to have temperature control for their space only. This can be accomplished through small, efficient individual units, or granularity in larger building systems. Non critical areas must be able to set back their space conditioning setpoints while desired conditions inside telecom areas are maintained. Redundant systems are preferred.

17. Steam produced on site shall utilize a condensate return system.

18. Where feasible, condensate from Con Ed supplied steam shall be utilized for heating purposes (heat or preheat domestic hot water supply, preheat incoming air, convert some steam loops to hydronic heating, etc.) or for water purposes (boiler feed supply, HVAC makeup water, domestic water supply for flushing toilets, etc.)

19. All new equipment shall use high efficiency motors and variable speed drives.

    a. All motors must meet or exceed the NEMA© Premium Nominal Efficiencies as found at http://www.nyserda.org/programs/Existing_Facilities/pdfs/PQ%20Motors.pdfVFDs/Premium efficiency motors

    b. VFD speed must be automatically controlled by differential pressure, flow or temperature. VFDs must be equipped with a minimum of 3% impedance series reactor in its AC power input connection.

20. All new equipment (including transformers) and appliances not mentioned specifically elsewhere in these standards must meet EPA ENERGY STAR criteria if such criteria exist for that type of equipment.

21. Use efficient equipment to heat and supply service water to the building. When feasible, consider the use of tankless hot-water heating.

22. Boiler Criteria

    a. All boilers must have provision for natural gas fuel.

    b. In addition to natural gas, boilers above 100 HP must have provision for #2 fuel oil unless otherwise approved by NYU.

    c. Heating boilers must meet Annual Fuel Utilization Efficiency (AFUE) performance levels at CEE Tier 1 (90%), Tier 2 (92%), or Tier 3 (94%). Tier 2 or 3 is preferred. Additionally, the annual electricity use must be less than or equal to 2 percent of the total annual energy use.

    d. Boilers under 100 HP shall be condensing type when system conditions permit.

    e. Domestic use hot water heaters with ratings under 75,000 BTU/h must have an energy factor performance level of greater than 0.80.

    f. Any boiler not covered by the above guidelines shall be high-efficiency for its type/class (at least 80% of the highest available efficiency).

23. Chillers

    a. Air-cooled Chiller with Condenser (tons)
    ≥ 30 & ≤ 100: Full load: 9.8 EER, Part Load: 13.3 IPLV

    b. Water-cooled Chiller (Rotary Screw/Scroll) (tons)

≥ 30 & < 150: Full load: 0.72 kW/ton, IPLV: 0.55 kW/ton
≥ 150 & < 300: Full load: 0.64 kW/ton, IPLV: 0.45 kW/ton

c. Water-cooled Chiller (Centrifugal) (tons)
≥ 30 & < 150: Full load: 0.64 kW/ton, IPLV: 0.53 kW/ton
≥ 150 & < 300: Full load: 0.59 kW/ton, IPLV: 0.43 kW/ton

24. Misc HVAC equipment

a. PTAC and PTHPs (BTU/h)
≤ 7,000: 11.7 EER / 3.3 COP Heating
> 7,000 to ≤ 9,500: 11.3 EER / 3.2 COP Heating
> 9,500 to ≤ 15,000: 10.8 EER / 3.1 COP Heating
> 15,000: 9.6 EER / 3.0 COP Heating

b. Through-wall and window standalone AC units (BTU/h)
all sizes: 10.8 EER

c. Unitary HVAC and Split Air Systems (BTU/h)
≤ 65,000 (split system and single package): 14.0 SEER
> 65,000 to ≤ 135,000: 11.5 EER
> 135,000 to ≤ 240,000: 11.5 EER
> 240,000 to ≤ 760,000: 10.5 EER
> 760,000: 9.7 EER

d. Air-to-Air Heat Pump Systems (BTU/h)
≤ 65,000 (split system): 14.0 SEER/12 EER/8.5 HSPF
≤ 65,000 (single package): 14.0 SEER/11.6 EER/8.0 HSPF
> 65,000 to ≤ 135,000: 11.5 EER
> 135,000 to ≤ 240,000: 11.5 EER
> 240,000 to ≤ 760,000: 10.5 EER

e. Water Source Heat Pump Systems (BTU/h)
< 240,000: 14.0 EER/4.6 COP

f. In-room HVAC units must include networked occupancy sensor and control devices (Telkonet SmartEnergy; other manufacturers must be approved by NYU).

D. Kitchen Equipment and Appliances:

1. All mechanical equipment shall be controlled by the BMS.

2. Use dishwashers that use 10 gallons per cycle or less. Use commercial dishwashers that use 120 gallons per hour (conveyer type) or one gallon or less per rack (door type).

3. Pre-rinse spray valves must have a flow rate less than 1.6 gpm at 60 psi.

4. Refrigeration Requirements

a. Commercial Reach-in Refrigerators: meet or exceed CEE Tier 2 requirements

b. Commercial Solid-door Reach-in Freezer: meet or exceed CEE Tier 2 requirements

c. Air- or Water-cooled Commercial Ice Maker: meet or exceed CEE Tier 2 or Tier 3 requirements (Tier 3 preferred)

d. Residential refrigerators: must meet ENERGY STAR requirements

5. Commercial Kitchen Equipment Requirements

a. Electric Steamer (pressurized or pressure-less compartments): meet or exceed ENERGY STAR requirements

b. Commercial Combination Oven: maintain over 60% energy efficiency

c. Commercial Convection Oven: maintain over 70% energy efficiency

d. Commercial Electric Griddle (single or double sided): maintain over 70% energy efficiency

e. Commercial Electric Fryer (deep fat, open kettle, pressurized, or flat bottom): meet or exceed ENERGY STAR requirements

f. Commercial Kitchen Spray Valve: flow rate less than 1.6gpm at 60psi

g. Commercial Insulated Holding Cabinets: meet or exceed ENERGY STAR requirements

h. Commercial Washers: meet CEE Tier 1 standards (and modified energy factor >1.8 and water factor <7.5) or CEE Tier 2 standards (and modified energy factor >2.0 and water factor <6.0), Tier 2 preferred

i. Use demand control ventilation for kitchen exhaust hoods and makeup air units.

j. Use variable speed drives (VFDs) to control fan speed for ventilation hoods and kitchen makeup air units, instead of two speed on-off fan control.

k. When installing kitchen exhaust hoods, select a custom-designed hood that meets the specific exhaust airflow requirements needed by the facility. Selecting a properly sized hood will reduce the fan speed, reducing both energy use and cost.

l. Minimize the use of island hoods by locating exhaust hoods near walls for more efficient capture of exhaust.

E. Renewable Energy Sources:

1. Consider the use of renewable energy sources and supply systems to reduce the building's total energy load and minimize environmental impacts of burning fossil fuels such as air pollution and global warming.

2. Evaluate possibilities for the use of renewable energy (such as solar water heaters, geothermal heating and cooling systems, and solar walls).

3. Evaluate feasibility of geothermal systems.

4. Evaluate feasibility of a green roof. Consider base material even if plant material is provided at a later date.

F. Domestic Water Use:

1. Buildings shall use 20% less water than the water use baseline calculated from the requirements of the Energy Policy Act (EPACT) of 1992, or meet the requirements or LEED 2009 NC WE Prerequisite 1.

2. Use infrared faucet sensors and delayed action shut-off or automatic shut-off valves. Transformer powered and self-recharging units may be considered.

3. Use clothes washers that meet EPA ENERGY STAR requirements.

4. Breakroom sinks or other sinks used as sources of potable drinking water shall include water filtration.

5. Drinking water fountains shall include a filler tube suitable for water bottles..

6. Any exceptions to the following maximum flowrates for fixtures must be approved by NYU.

   a. Bathroom sinks: 0.5gpm

   b. Showerheads: 1.5gpm

   c. Residential kitchen sinks: 1.5gpm

   d. Urinals: 0.125gpf

   e. Flush Valve Toilets: 1.25gpf

   f. Tank Toilets (must be dual flush): meet USEPA WaterSense specification as shown at http://www.cwwa.ca/pdf_files/Map-Report-14th-Ed-05-2009.pdf and achieve a MaP Flush Performance of 1000.

G. Lab and Research Areas:

1. Implement "Laboratories for the 21 Century (Labs21)" guidelines (http://www.labs21century.gov/toolkit/design_guide.htm)

2. Employ variable geometry damper technology for fume stack discharge velocity control to reduce energy consumption.

3. Use physical and computational modeling to assess and reduce the impact of air effluents.

4. Eliminate the use of potable water for open loop cooling of laboratory equipment.

5. Water aspirators are prohibited (diaphragm pumps or similar efficient technology for creating low vacuum should be used).

6. Use energy-efficient laboratory systems and equipment such as high performance fume hoods, energy recovery devices, low-pressure drop-ventilation system design, and ENERGY STAR or other highly efficient refrigerators and freezers.

7. Reduce internal heat gain load design criteria for lab spaces and heavy equipment.

8. Heat recovery should be used.

9. VAV fume hoods shall be used.

4. Measurement and Verification

A. Each building electric service shall have an interval meters capable of reporting the entire load of the building, including volts and amps for each phase and power factor. Such data shall be reported on a 15-minute time averaged basis to the NYU campus data collection system.

B. Each building water service shall have a wireless automatic meter reader in conformance with DEP guidelines.

C. Each building connection to Central Plant supplied CHW or HTHW shall have a flow meter (Flexim) that reports BTUs to the BMS.

D. Renovated areas that are smaller than an entire building, but that belong entirely to a single school or department in a building occupied by multiple schools or departments, should have the electric service to that area submetered.

E. Metering and monitoring equipment shall be installed with sufficient granularity and trending to allow for continuous commissioning (outlined in FEMP guidelines, http://eber.ed.ornl.gov/commercialproducts/FEMP%20Continuous%20Cx%20Guidebook.pdf).