2015

COLGATE UNIVERSITY'S

GREEN BUILDING STANDARDS

Colgate University

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Introduction

Colgate University's Green Building Standards will provide guidelines for all future construction at Colgate, including new buildings, full renovations, remodeling, interior fit outs, equipment replacement, energy conservation projects and minor interior upgrades. As stated in Colgate University's 2014-2019 Strategic Plan, "*We are on track to be carbon neutral by our bicentennial in 2019. Campus planning and building design will incorporate sustainable practices from inception to implementation."* These standards will allow a consistent and coordinated design and construction process that is essential to meeting that key objective.

In a continuing effort to advance sustainability and achieve carbon neutrality by 2019 these standards will be updated and enhanced as new products and materials become available and design and construction practices allow the overall environmental impact of each new building to be reduced.. This is a living document.

These standards include the following steps:

1. Identify goals and objectives for each project.
2. Evaluate and inventory existing site conditions.
3. Perform energy modeling of options to meet project goals and objectives.
4. Make decisions based on data-driven results.
5. Update and refine energy modeling during design.
6. Perform Life Cycle Costing Analyses (LCCA) of system options for major projects.
7. Fine-tune decisions.
8. Develop expected performance outcomes during design and construction.
9. Measure and record results to identify success.
10. Provide adequate training for the building occupants and facilities staff in the use, operation and maintenance of the building systems to achieve the sustainability goals.

1. Goals and Objectives

Sustainability goals and objectives will be established for each project type, prior to the concept phase. As technology and best practices advance, goals and objectives will be updated. See Colgate's Owner's Project Requirements.

Design of internal offices and support spaces should utilize common meeting areas to maximize space efficiency and emphasize smaller offices wherever practical.

2. Design Process

The Project Design Process defines how sustainability goals are met, including required documentation such as Life Cycle Cost Analyses (LCCA) and energy modeling.

a. Project Types

Level I. New buildings and full building renovations that include major system upgrades and/or replacement.

Level II. Partial building interior fit outs that may or may not include system upgrades.

Level III. Small building upgrades including minor interior renovations, equipment replacement and energy conservation projects.

b. Integrated Design

The integrated design process involves all disciplines in project design and decision-making from the outset. Design charrettes and a fully integrated design process must be identified and followed. When applicable the integrated design process should include the full design team, the commissioning agent, contractors, LEED consultant, and Colgate representatives, including but not limited to, each of the trade shops, Ground's staff, building occupants, and the Sustainability Office. Project design charrettes shall be conducted as identified in the following table:

Colgate's design charrette and fully integrated design process.

Project Type	Schematic	Design Development	Construction Documents
Level I	At start	At start	At start
Level II	At start	N/A	At start
Level III	At start	N/A	At start

c. Meetings

Workshops and design meetings with client representatives must be planned and scheduled including:

a. Sustainability charrette and follow-up sustainability reviews at all design review meetings.
b. Life Cycle Cost Analysis (LCCA) workshop and follow-up reviews.
c. Design reviews.
d. Construction meetings.
e. Commissioning overview for contractor and subcontractor at project kick-off.

d. Documentation

A required list of documents to support the sustainable design and LCCA studies include:

a. Summary of sustainability goals.
b. Sustainability report by phase of how project will meet the sustainability goals.
c. Life Cycle Cost Analysis reports.
d. Initial and final energy models.
e. Construction reports including pre-bid, pre-construction, and pre-installation.
f. Final sustainability and commissioning reports.

e. Energy Modeling

Energy modeling is a pre-requisite to carrying out LCCA of comparative system studies and is required by project type as listed in the table below. A preliminary energy model must be developed during schematics to identify major project energy impacts from which subsequent modeling can evaluate energy performance of alternate solutions. The final energy model is completed at the end of Construction Documents.

Energy modeling at Colgate.

Project Type	Concepts	Schematics	Design Development	Construction Documents
Level I	As needed to support major design decisions	Preliminary model	Multiple analysis runs	Full design and base case comparison
Level II	N/A	As appropriate for project decisions	As appropriate for project decisions	As appropriate to estimate energy use and impact
Level III	N/A	N/A	N/A	N/A

f. Life Cycle Cost Analyses (LCCA)

Using Life Cycle Cost Analyses (LCCA) in the sustainable design and construction process (as identified in the LCCA & Value Engineering (VE) table below) will allow the life cycle costing of a building element or system to be used as part of the decision-making process. The LCCA process requires first cost, operating and maintenance costs and ultimately disposal and reuse costs.

Colgate's Life Cycle Cost Analyses (LCCA) and Value Engineering (VE) process.

Project Type	Concepts	Schematics	Design Development	Construction Documents
Level I	LCCA of major design options	LCCA of energy system options	VE	VE
Level II	LCCA of major design options	N/A	VE	VE
Level III	LCCA of major design options	N/A	N/A	N/A

Guidelines for the LCCA process will be established during documentation requirements and should include a list of viable green building options to be evaluated and the number of analyses to be performed. LCCA scope will vary depending on the project and whether the building is served from the Colgate's central energy plant. For stand-alone buildings a minimum of three (3) system options for building envelope, HVAC, electrical, renewable energy and water use should be evaluated for all Level I projects. LCCA should include energy and water escalation rates as well as estimated costs of carbon offsets. LCCA will look at 20-year impact on energy, maintenance, and operating costs as well as greenhouse gas emissions (GHG). See table below.

Life Cycle Cost Analysis at Colgate University.

Nos	System	First Cost	Annual Operating Cost	Maintenance Costs	Annual Cost Savings	Net Cost / Savings	Simple Payback	Reduced GHG Emissions (MTeCO2)	Potential Community Impact

g. Measurement and Verification

Measurement and verification (M&V) will track the energy use of equipment, individual systems, or the entire facility. Performance will be measured against projected values to:

i. Identify success and opportunities for increased efficiency.
ii. Track energy efficiency upgrades.
iii. Enable better decision-making.
iv. Track performance of older equipment to allow optimum return on investment (ROI) for replacement.

An M&V plan will be developed for each project, including the level of metering and sub-metering. Building performance will be measured through the Energy Management System (EMS) to efficiently

maintain and track performance of key building systems, particularly HVAC and lighting, as identified in the following table:

Metering and sub-metering at Colgate.

Project Type	Full Building	HVAC	Lighting	Plug Load	Water	Gas	Steam	Chilled Water
Level I	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Level II	N/A	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Level III	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

h. Benchmarking

All Level I projects will be required to achieve an ENERGY STAR® certification after one full year of operation. The design team will complete an ENERGY STAR® Target Finder profile to identify the required Energy Use Index (EUI) and Water Use Index (WUI) to achieve ENERGY STAR® certification, which will become a design goal for the project. The commissioning team will assist Colgate for the first-year of operation in uploading utility information into ENERGY STAR® Portfolio Manager and providing interim reviews at three (3) month intervals to assess building operating loads relative to the goal of ENERGY STAR® certification, and will recommend operating adjustments as necessary to meet the goal.

3. LEED Certification

Unless otherwise determined during project planning all major projects shall achieve at minimum a LEED Silver rating for all new construction and major renovations under LEED v4.0 or the latest adopted LEED standard.

Colgate Owner's Project Requirements

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1. Introduction

Colgate's Owner's Project Requirements (OPR) identifies functional requirements of the project and expectations of how the facility and its systems will be used and operated. The OPR is required for LEED certification of the project, but also serves three overarching and vital purposes:

a. Provides the design team with information necessary to develop the Basis of Design (BOD) during schematic design, which will serve as a "road map" for development of the design and construction documents.
b. Provides the commissioning (Cx) team with benchmarks to measure success and confirm that the building and systems as designed and constructed align with Colgate University's expectations and requirements.
c. In conjunction with the Basis of Design (BOD), operating and maintenance instructions and "As-Built" documents, the OPR provides the foundation for the Systems Manual (required by LEED) which informs the facility operators and users the basis for operating and maintaining new or renovated buildings.

Colgate along with the Commissioning (Cx) consultant will refine and augment the OPR through the design, construction and post-occupancy period of one-year following Substantial Completion of construction. As decisions are made during the life of the project, this document shall be updated to reflect the current requirements of the University.

2. Scope

This document focuses on the mechanical, energy and comfort systems that are included in the LEED commissioning process and on the sustainability requirements of the project. Other areas impacted by commissioning or commissioned systems are covered more broadly.

At a minimum these systems include:

a. Heating, ventilating & air conditioning (HVAC)
b. Lighting controls
c. Domestic hot water
d. Renewable energy sources
e. Building envelope
f. Site

This document does not include project requirements for non-commissioned systems including fire protection, structural, landscaping, civil, geotechnical, materials and furnishings and codes and references.

Design will consider best practices and emerging technologies that facilitate sustainable behavior by building occupants. For example, effective window and lighting controls, occupancy sensors, aerated faucets, and recycling infrastructure can minimize energy, water, and use of other valuable resources. Design that provides central services (copying, printing, coffee) will minimize duplication of appliances while also reducing infrastructure costs and maintenance. Designs that provide occupants with information about energy use and the ability to control its usage can motivate them to conserve energy.

3. Sustainability Goals

The Basis of Design (BOD)

The BOD shall establish specific plans and strategies for achieving sustainability goals, and the construction documents shall include requirements for LEED submittals and sustainable construction practices and techniques, including:

- √ Segregate collection and recycling of construction waste.
- √ Proper erosion and sedimentation control techniques.
- √ Procurement and use of low-VOC, regionally-available, rapidly renewable and high-recycled content materials.

4. LEED Certification

All new construction and major renovations shall achieve at minimum a LEED Silver rating (under the latest adopted LEED standard), meet the following criteria, and achieve the associated LEED points:

a. Reduce water use by 35% when compared to the current Energy Policy Act.

b. Optimize energy performance 30% better than the edition of ASHRAE 90.1 referenced in the LEED standard used for the project.

c. Meet the enhanced refrigerant management criteria in the LEED standard utilized for the project.

d. Implement a Measurement and Verification plan including individual sub-metering of all HVAC, lighting and plug loads, water, steam and chilled water, all tied to Colgate's Energy Management System and where beneficial to the Lucid Dashboard system.

e. Implement a Construction Waste Management plan to recycle at least 75% of construction waste.

f. Use at least 50% wood-based materials that are certified in accordance with the Forest Stewardship Council (FSC).

g. Implement an Indoor Air Quality (IAQ) management plan during construction in accordance with the LEED standard utilized for the project.

h. Meet all the low-emitting materials requirements in accordance with the LEED standard utilized for the project.

i. Utilize low-mercury content lamps that meet the requirements of the LEED standard utilized for the project.

5. Site Planning

Most capital projects involve exterior site work which impact sustainability goals and objectives. This includes:

a. Utilities
b. Storm water management
c. Landscaping, xeriscaping, native species, low-maintenance vegetation
d. Exterior lighting
e. Paving materials
f. Minimize parking at individual buildings. Use of remote faculty/staff lot and shuttle service

LCCA should be utilized to assess building siting, orientation, massing, water usage, landscaping and storm water management and should be included as part of the integrated design process.

6. Building Envelope

The exterior shall be designed to endure for at least 75 years. Selection of materials and detailing of envelope systems shall be performance-based to allow the building to withstand weather conditions typical of central New York; while also maintaining aesthetic consistency with the area of campus where the facility will be constructed.

Prevention of moisture intrusion is a high-priority goal applicable to all project team disciplines. There should be no evidence of water intrusion when tested in accordance with AAMA 501.2.

Solar transmission shall be controlled and designed in accordance with the latest applicable ASHRAE 90.1 Standard. Techniques should include high-performance low-e glazing, overhangs and external shading to minimize solar heat gain and maximize light transmittance for day lighting where functionally practical.

Roof shall be designed to control snow shedding and shall have a minimum reflectivity of 0.30 to reduce solar heat gain.

7. Energy Efficiency Goals

Colgate University is committed to carbon neutrality by 2019 as specified in the University's updated strategic plan. Specific, high-priority green building practices that will help us achieve this goal include:

a. Adopt a minimum overall energy efficiency goal of 30% better than ASHRAE 90.1 2007 (or latest 90.1 standard).
b. Incorporate strategies, measures, and systems to conserve energy, such as heat/enthalpy wheels, energy recovery units, "setback" modes, etc.
c. Utilize the Building Automation System and other controls to efficiently maintain and track performance of key building systems, particularly HVAC and lighting.
d. Connect new buildings and major renovations to Colgate's Energy Management System (EMS) and Lucid Dashboard permitting real-time monitoring of energy and water use by occupants and energy managers.
e. Achieve ENERGY STAR® certification for all new buildings and full building renovations.
f. Install Energy Star rated equipment (computers, electronic equipment, appliances etc.)
g. Utilize viewing screens within the facility to show real time and historical energy use and provide educational assistance for building systems and use.
h. Optimize variable-flow chilled water systems for maximum building and plant efficiency.
i. Incorporate solar energy techniques, strategies, and products.
j. Utilize high-efficiency long-lasting fixtures such as LED.
k. Incorporate occupancy sensors and daylight harvesting where appropriate.
l. Consider use of addressable (individually controllable fixtures) lighting control systems for energy efficiency and flexible control.

8. Thermal Comfort

Maintain comfort conditions at 68°F +/- 2° winter and 76°F +/- 2° summer

9. Acoustics

Maintain the following acoustical design goals using the Noise Criteria (NC) Method

a.	Private Offices	NC 30-35
b.	Conference Rooms	NC 25-30
c.	Open Plan Offices	NC 35-40
d.	Libraries	NC 25-30
e.	Corridors	NC 35-40
f.	Lecture Rooms and Classrooms	NC 25-30
g.	Cafeteria, food service	NC 40-45
h.	Work Rooms	NC 40-45

10. Indoor Environmental Air Quality (IEQ)

a. Utilize natural ventilation strategies wherever practical.
b. Utilize filter for outside air filtration that meet the latest adopted version of ASHRAE 52.2 for arresting particulates of 0.3 to 1.0 micrometer in size.
c. Utilize air side economizer cycle to maximize outside air to building.
d. To ensure acceptable IEQ at occupancy provide building flush out or IEQ testing.
e. Consider anti-microbial finishes on building hardware particularly at restrooms.
f. Use non-toxic products and low VOC paint.
g. Require non-smoking construction site.

11. Water Efficiency

a. Utilize low-flow fixtures throughout project to achieve a water use reduction of 35% compared to the Energy Policy Act of 1992 (or the latest adopted Act). 1 pint urinals, manual dual flush valves for toilets, metered faucets
b. Use native or adapted plants to eliminate irrigation requirements.
c. Install filtered hydration stations that serve as refillable bottle stations and drinking fountains. A minimum of one water station should be installed per floor for every new building and major renovation unless there is justification otherwise. This practice would reduce the overall purchase and consumption of bottled water on campus. Where appropriate, new buildings should also be outfitted with water softeners to reduce the effects of hard water on campus.

12. Finishes

a. Use rapidly-renewable, recycled, low-maintenance finishes for interior spaces.
b. Use Forest Stewardship Council (FSC) wood unless there is a compelling reason not to.

13. Waste Management

a. Appropriately place recycling stations throughout the facility to collect paper and paper products (such as cardboard, magazines, notebooks, etc.), plastic, glass, and metal. The recycling bins should be consistent throughout campus and be user-friendly in order to reduce contamination (e.g., the paper recycling bins should have a slot and the plastic, glass, and metal recycling bin should have a hole for bottles and cans).
b. Review composting or treatment of food waste (digestion or dehydration).
c. Use interactive dashboard displays or kiosks to increase education and awareness of recycling.
d. Use easy-to-see-and-read recycling signs.
e. Combine bottle fill/drinking fountains to allow use of refillable drinking containers minimum one on each floor.
f. Use high-efficiency hand dryers in bathrooms to reduce paper waste in every restroom.

14. Commissioning

Fundamental and Enhanced Commissioning shall be performed on all new building and major renovations. The Commissioning (Cx) consultant will be independent of the design and construction teams, and report directly to the University. The Cx will be responsible for:

a. Assistance in maintaining this OPR.
b. Peer review of the design and construction documents.
c. Development of the project-specific Cx specification.
d. Development of the project-specific Cx plan that will also be included in the project specifications.
e. Construction and acceptance phase commissioning and documentation.
f. Oversight of the Test and Balance Contractor contracted directly by Colgate.
g. Development of the facility's Systems Manual.
h. Post-occupancy commissioning, testing, and documentation.

It is anticipated that the following building systems will be commissioned:

a. HVAC systems
b. Lighting control systems
c. Domestic hot water systems
d. Renewable energy systems

The following items of particular interest to the University shall be addressed and verified by the Cx consultant throughout the term of service:

a. Utility meter accuracy and integration with the Building Automation System (BAS).
b. Measurement & Verification of energy usage, performance, and efficiency.

15. Construction

Inspection, testing, and commissioning culminate in a declaration of Substantial Completion by Colgate University. This date establishes both the beginning of the warranty period and commencement of operation and maintenance by the University.

Substantial completion and move-in of occupants and their personal belongings will not take place until all "punch-list" items are completed. Substantial completion shall also require sign off by the Cx that all commissioning testing has been completed excluding any opposite season testing.

16. Owner Training

Onsite training for the building owner including operators, maintenance staff, users and occupants shall include a description and overview of system operation and not just the components and equipment that comprise each system.

Training is ideally held in conjunction with commissioning and should include general orientation and reviews of the written Operations and Maintenance (O&M) instructions, relevant health and safety issues or concerns, operation in all possible modes, preventive maintenance, and common troubleshooting problems and solutions.

Occupant training for the users of the building shall be oriented on how to utilize appropriate common building elements, such as lighting controls and thermostats. This information shall also be included as part of the building Systems Manual.

Building systems that the facilities staff shall be trained on include:

a. HVAC systems
b. BAS controls
c. Electrical systems
d. Lighting controls
e. Other important systems that may be unique to any specific building.

Building systems that the *occupants/users* shall be trained on include:

a. Lighting controls
b. Adjustable thermostats
c. Window shading devices

Most training shall be completed prior to Substantial Completion, and all sessions shall be videotaped and converted to DVD format for the Owner's use.

17. Operation & Maintenance

Colgate's Facilities Department is responsible for maintenance and operation of the building and its systems, beginning on the date of Substantial Completion.

In addition to the Cx Plan, field reports, and test reports, a Systems Manual is completed as required for LEED E/A Credit 3 (Enhanced Commissioning). This manual provides the University with a single source of information and instructions for proper operation and maintenance of primary building systems. The Systems Manual is systems-oriented to provide operators with easy access to narrative and technically detailed reference material, descriptions, diagrams, schedules, and other information on building systems.

The Systems Manual is a living document, complied by the Cx from documentation developed by the owner, design team, contractors, and the Cx process. This document is then turned over for use and upkeep by building operators and future consultants and contractors throughout the building's life.

18. Green Office Program Information.

See Sustainability Office website at http://www.colgate.edu/distinctly-colgate/sustainability/for-faculty-and-staff.

19. Additional Sustainability and Carbon Neutrality Information.

See Sustainability Office website at www.colgate.edu/green.