Colorado College Facility Life-Cycle Design Guidelines for Sustainability

A. Design Goals for Sustainability

The design team should follow the Colorado College Campus Master Plan guidelines and processes. The strategic program states that the college serves as a "model of environmental stewardship and innovation by advancing both the study and the practice of sustainability." The college strives to reflect innovation in the application and evolution of sustainability practices related both to the built environment and the management of College resources.

1. The President's signing of the American College and University President's Climate Commitment pledge in April 2009 included the goal of achieving carbon neutrality by 2020. Achieving carbon neutrality by 2020 requires a three strategy approach.
    a. The first strategy is to reduce building energy use by **20%** through conservation measures to include improved building systems scheduling, sustainability education and energy usage awareness, and encouraging behavioral changes throughout the college community.
    b. The second strategy is to reduce energy usage by **30%** through maintenance and renovation of building structures, electrical systems, mechanical systems to improve energy efficiency; and investment in technological improvements to reduce energy usage.
    c. The third strategy is to purchase or produce all electric energy through renewable energy sources and provide supplement heating through renewable energy technologies. The college plans to reduce its carbon footprint by **50%** through producing enough energy through renewable resources to offset the carbon footprint in other sectors such as the use of natural gas for heating and college related travel.

    Opportunities for achieving energy and water use reductions should be identified by design and engineering professionals in every construction or renovation project and considered for implementation based on life-cycle cost savings, impact on reaching carbon neutrality, and the importance of demonstrating social responsibility by supporting the college core values and taking a leadership role in nurturing the ethic of environmental sustainability.
2. The College's April 2009 signing of the President's Climate Commitment required initiation of tangible actions to reduce greenhouse gases. The College agreed to **"**establish a policy that all new campus construction will be built to at least the U.S. Green Building Council's LEED Silver standard or equivalent". **The College has established a High Performance Building Design Criteria program which exceeds the LEED Silver minimum prescribed requirements in order to meet its long range sustainability strategies for achieving carbon neutrality.**
3. New buildings, additions to existing buildings, or existing building renovations should minimize building life-cycle costs, direct and indirect, relating to energy use, maintenance, waste disposal and occupant health & productivity. Life-cycle costs should be based on a "whole-building perspective", rather than from the perspective of individual building systems or components.
4. Minimize environmental impacts throughout the building life-cycle, including product manufacturing, construction activity, use/occupancy, and demolition or renovation/reuse.
5. Purchasing of goods and services from manufacturers and vendors shall comply with the Colorado College Sustainable Purchasing Guidelines.
6. Optimize indoor environmental air quality.

B. Design Process

1. The Project Design Team is to evaluate sustainable design opportunities and strategies appropriate for project program, site and budget.

2. **Building performance design standards**: All new construction and renovation projects are to follow the Colorado College Facility Design Guidelines Manual, Colorado College Facility Design Guidelines , which contains expected **High Performance Building Design** requirements for new construction and renovations. The College's **High Performance Building Design Criteria** exceeding LEED prescriptive requirements, customized to meet Colorado College's sustainability goals, is to be used on all new building construction and existing building renovation projects over $1 million in cost**. The highest feasible facility energy use reduction goals will be attained based on each project's available funding, each building's optimum performance design potential, and each building infrastructure system's conditions, etc. Colorado College Facilities Services will provide the project design team with project specific high performance building design criteria to be used to develop the project design intent documentation**. The College has achieved Net-Zero Energy/Net-Zero Carbon buildings and strives to maintain that level of building design performance whenever appropriate. The following table highlights the **minimum** construction performance targets for Colorado College:

Performance Goal	Goal Quantification
Total Energy Use	20 KBTU/SF/YR or less
Water Use – Building	2.4 Gal/Building SF/YR or less
Water Use – Irrigation	14 Gal/Turf SF/YR or less
Total Building Power Factor	Not less than 0.95 lagging at the utility meter
Indoor Air Quality	700 PPM CO^2 or less during occupied hours
Artificial Lighting	0.30 W/SF or less
Lighting Levels	35 FC in classrooms

Note that the energy usage goal represents total building load including plug loads, not just HVAC and lighting. Predicted energy use shall be tracked during design using modeling and will be confirmed using utility billing data. Likewise the water usage goal represents both building use and irrigation.

3. Do not make project funding decisions based on first costs only. Evaluate life-cycle costs of design alternatives to reduce long term operating and maintenance costs of major building systems. **Life-cycle costs** should be based on a "**whole-building perspective**", rather than from the perspective of individual building systems or components.
4. Evaluate use of **renewable energy sources** for electric use or supplementing heating requirements to help reduce the carbon footprint and achieve the goal of carbon neutrality by 2020.
5. Use energy simulation/modeling software on projects greater than $1 million cost where feasible and within available funding resources.
6. Life-cycle cost saving strategies used should have **maximum payback period of 5-15 years**, or contribute significantly to the 30% reduction of energy use or carbon footprint goal by 2020.
7. Architectural/Engineering consultants are to include the above services in the Professional Services Agreement.
8. Architects and Engineers selected for the project should demonstrate proficiency and experience in sustainable design. Consultants with these qualifications should be included in the **earliest programming and conceptual design phases** to help identify and evaluate **high performance design** opportunities beyond the minimum LEED Silver certification feasibility, or feasibility of higher energy design standards attainability.

C. Design Guidelines

1. Energy Use
   a) Integrate Buildings with the Site: Consider local climate & site influences on building energy use. Utilize "free" energy sources where feasible, such as solar energy, daylight, exterior temperature variations and winds.

b) Optimize Energy Performance: Select building envelope, mechanical and electrical systems for improved energy efficiency. Where applicable, research products in order to meet Colorado Springs Utilities efficiency requirements for utility rebate savings. Typical strategies & technologies:
    1) Building Envelope
        - Control & utilization of solar heat gain
        - Daylighting of interior spaces
        - High performance windows/glazing
        - Energy efficient window coverings
        - Optimized insulation values
        - Reduced air infiltration
    2) Mechanical Systems
        - High efficiency equipment
        - Direct Digital Control System (DDC) for HVAC
        - Occupancy sensors/CO2 monitoring
        - Occupancy sensors
        - Heat recovery systems
        - Economizer cycle cooling
        - Zoning of HVAC system based on building orientations & loads
        - Variable speed drives on motors and fans
        - Low flow plumbing fixtures
        - Time of day scheduling
        - Separate controls for individual spaces, where feasible
    3) Electrical Systems
        - High efficiency lighting fixtures (no incandescent)
        - Occupancy sensors
        - Daylight sensors
        - Separate ambient and task lighting
        - Lighting dimmers
    4) Energy and Water Metering
        - Every building or energy and water using facility should have sub meters monitoring energy and water use. Where possible high energy or water consuming operations within buildings or facilities should be sub-metered locally to identify, monitor, and control energy and water use.
c) CFC/HCFC/Halon Reduction: Avoid use of these products in HVAC refrigerants and fire suppression systems.
d) Building Systems Commissioning
    1) All projects shall implement a Commissioning plan, with the scope to be determined by the project team.
    2) Key mechanical & electrical systems are to go through a Commissioning process, which includes the following:
        - Inspection & testing for functional performance in accordance with project objectives & the Colorado College Facility Design & Construction Guidelines.
        - Documentation of criteria, inspections/testing & acceptance.
        - Training of Colorado College operations & maintenance staff.

3. Water Use
    a) New low flow water devices are required for new construction by current building codes. Opportunities for achieving water-use reductions should be identified in the course of routine maintenance improvements and renovation projects. Older water faucets typically having flows of approximately 2.5 gpm and should be replaced with 1.5 gpm or .5 gpm flow devices depending on the applications. Older toilets have flush volumes of approximately 3.5 to 4.5 gpf and should be replaced with dual-flush toilets, or 1.6 gpf toilets, which tend to be equivalent to the dual-flush toilet flows on average.
4. Building Materials
    a) Recycled Content Materials: Use materials with post-consumer or post-industrial recycled content where feasible. Common products with recycled content include structural steel,

aluminum windows, gypsum board, acoustical ceiling tiles, rubber floor tiles, carpeting, and toilet partitions.

b) Durable & Flexible Materials: Utilize components and systems which are durable and easy to maintain. Where feasible, use materials which provide flexibility for future changes and modifications to occur.
c) Renewable Materials: Consider use of products that are comprised of raw materials that are in abundant supply or come from renewable sources. When feasible, obtain wood products from suppliers certified as utilizing sustainable harvesting methods.
d) Local Materials: Use products produced regionally where possible.
e) Construction Waste Management: Contractors are to develop a plan for sorting, storing & recycling of waste materials on projects. A waste minimization specification is to be used as guidance for this work. All projects shall implement a Construction Waste Minimization Plan, with the scope to be determined by the project team. A minimum of 50% of construction waste is to be salvaged, recycled or otherwise diverted from landfill or incineration.
f) Recycling Facilities: Plan for convenient areas to be designed in new buildings and building renovations for sorting & storage of recyclable items by the building occupants.

3. Indoor Environmental Quality
   a) Design for Human Health: Consider environmental needs of people in terms of daylight, ventilation, exterior views and thermal/acoustic/visual comfort for interior spaces. A direct line of sight to exterior vision glazing from 90% of all regularly occupied spaces is a long term goal.
   b) Ventilation Requirements: Optimize the amount of fresh air provided to building spaces. Connect occupancy sensors & carbon dioxide monitors to HVAC systems, where feasible.
   c) Low Emitting Materials: Utilize materials which have low levels of volatile organic compound off-gassing. Minimum requirements for 45% of materials (by cost):
      - Adhesives & sealants: VOC content less than established limits.
      - Paints & coatings: VOC emissions that do not exceed Green Seal's Standard GS-11.
      - Carpet: Comply with CRI Green Label Plus Testing program.
      - Carpet cushion: Comply with CRI Green Label Testing program.
      - Composite panels: No added urea formaldehyde resins.
   d) Construction Air Quality Management: Protect ductwork and equipment from contamination during construction. At a minimum:
      - During construction, comply with SMACNA IAQ Guideline for Occupied Buildings Under Construction, 1995, Chapter 3.
      - Protect stored on-site or installed absorptive materials from moisture damage.
      - If air handlers are used during construction, filtration media with a MERV value of 8 are to be used at each return grille, per ASHRAE 52.2-1999.
      - Replace all filtration media immediately prior to occupancy.
      - Conduct a 2 week building flush-out with new filtration media with 100% outside air after construction ends & prior to occupancy. After flush out, replace filtration media.

      or

      - Conduct a baseline indoor air quality testing procedure to demonstrate that concentration of air contaminants are below specified levels. Meet the testing requirements listed in LEED IEQ Credit 3.

4. Site Work
   a) Building Siting and Landscaping: Use the Colorado College Campus Master Plan design guidelines as a guide for design decisions.
   b) Minimize Site Disturbance: Consider the impact of project on the surrounding ecosystem. Investigate methods to minimize impacts on natural habitats and watersheds.
   c) Stormwater Management: Limit off site storm water runoff and employ methods to increase on-site infiltration.
   d) Alternative Transportation: Provide site facilities to encourage pedestrian, bicycle and bus transport, where feasible.
   e) Light Pollution Reduction: Minimize site lighting levels & off-site light spillover/ glare, while providing for adequate levels for security and way finding.

f) Water Efficient Landscaping: Utilize drought resistant plant materials and low flow irrigation techniques, where feasible. Consider use of native plant species.
g) Erosion & Sedimentation Control: Employ techniques such as silt fencing, sediment traps/filters, topsoil stockpiling and slope stabilization to minimize erosion of soil during construction. At a minimum, comply with EPA Document No. 832/R-92-005 (1992) Stormwater Management for Construction Activities, Chapter 3: Sedimentation & Erosion Control.

D. References

General

- US Green Building Council- LEED Green Building Rating System, www.usgbc.org.
- Colorado College Campus Master Plan
- Colorado College Facility Design Guidelines
- Colorado College Sustainable Purchasing Guidelines
- American College and University President's Climate Commitment
- CC Goal to Achieve Carbon Neutrality by 2020

Energy Use

- ASHRAE Standard 90.1-1999 Energy Standard for Buildings except Low Rise Residential Buildings US DOE/EPA Energy Star Guidelines.

Building Materials

- EPA Comprehensive Guide for Procurement of Products Containing Recovered Materials; Recovered Materials Advisory Notice III; Final rule (1/19/00) 40 CFR Part 247.
- Forest Stewardship Council Guidelines.
- Triangle J Council of Governments, "Waste Spec"- Model Specification for Construction Waste Reduction.
- Green Seal Paints and Coatings Requirements- Paints (GS-11), First Edition, 5/20/1993.
- Carpet and Rug Institute Green Label Indoor Air Quality Test Program.

Indoor Environmental Quality

- ASHRAE 62-1999: Ventilation for Acceptable Air Quality.
- ASHRAE Standard 55-1992, Addenda 1995- Thermal Environment Conditions for Human Occupancy, Including ANSI/ASHRAE Addendum 55a-1995.
- Sheet Metal & Air Conditioning National Contractors Association (SMACNA) IAQ Guidelines for Occupied Buildings Under Construction, 1995.

Site Work

- EPA Storm water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.
- IESNA Recommended Practice Manual: Lighting for Exterior Environments (RP-33-99).