Creating a Climate-Friendly Campus

Vision:

CU will have a zero or positive net impact on the climate by the year 2025 by consistently reducing emissions, improving air quality and implementing sustainable habits and practices.

Background, Needs Statement:

In the original Blueprint for a Green Campus, the climate vision for the University of Colorado at Boulder was to "to meet the emission reduction targets of the Kyoto Protocol which would reduce CU's greenhouse gas emissions by seven percent below 1990 levels by 2010." This vision was based on the growing recognition and acceptance by the international community that global temperatures are increasing, and that the warming is connected to increases in anthropogenic greenhouse gas emissions. While it is uncertain what the impacts of global warming will be, there will likely be some detrimental and irreversible consequences to the earth's living systems and the global economy. Furthermore, lower-income populations are disproportionately affected by these impacts.

As a measure of progress towards the Kyoto emissions reductions targets, the university completed annual emissions inventories to track the carbon emissions equivalents of natural gas, electricity and transportation fuel purchases made by the institution. While emissions from 1990 to 2000 dropped to 5% below 1990 levels, recent inventories have shown increases in emissions despite decreases in electricity consumption. This is largely because the University has been using less natural gas (from the campus cogeneration power house) and more coal (from Xcel, the local utility) to meet energy needs. The switch is due to higher costs of natural costs, so it has been cheaper to buy energy from Xcel than it has been to produce energy on campus using natural gas. *(See Appendix A for the most recent GHG inventory.)*

For the revision of the 2000 Blueprint for A Green Campus, a climate task force was created to address the complexity of the University's impact on climate. The climate task force found the original 2000 climate vision to be too constrained, discussing only on greenhouse gases. This vision focuses on green house gas emission, life cycle costing, local air quality, human health and workplace productivity. This vision implies taking actions that limit the negative impact of CU's operations and facilities in such a way that the campus has an overall neutral or positive net impact on climate.

The topic of "climate" has been broken down into three sub-categories for clarity: *energy, green building* and *transportation.* We have established goals and action items for each of the sub-categories that will help the University of Colorado meet the vision of climate neutrality.

This document begins to map out a strategy for achieving the vision stated above, but a comprehensive plan should be created that includes each of the subtopics below. Some universities, such as Oberlin College, have hired consultants to develop a plan to achieve a similar vision. The University of Colorado could choose this option, or use on-campus resources, such as student seminars and team projects. This plan will determine the appropriate long-term allowances for the University's energy, building and transportation needs. These allowances must be offset in order for the University's net effect on the climate to be zero.

This chapter will work through each sub-category and present each with the following structure:

A. Goal Statement
B. Background, Trends
C. Current Programs And Accomplishments
D. Action Steps
E. Metrics
F. Future Planning/Research Needs (forthcoming)
G. Challenges
H. Links To Other Blueprint Chapters/Topics

The content of this chapter has been compiled from the work of the Climate Task Force, consisting of 20 members, distributed between students, faculty, staff, general interest community members, local business leaders, municipal government planners, and issue experts. Each subject was presented to the task force for discussion over the course of five meetings and document review correspondence. Individuals in the task force additionally provided research, documentation and links to supplemental information.

Energy

Goal Statement:

Achieve existing goal of 5%/sq. feet reduction in energy consumption under previous year (includes electricity, heating and cooling and starts at 2000 levels) and increase portion of energy consumption to a total of 25% from renewables by 2010. Begin using renewable energy for a portion of heating and cooling needs. As part of the comprehensive plan mentioned above, the University will determine the appropriate long-term levels of energy consumption and the offsetting thereof.

Background, Trends:

With fossil fuel energy costs soaring to record highs across the U.S., 2005 has been an exciting year for energy conservation and renewable energy policy. The 2005 Federal Energy Policy Act was signed into law, establishing generous new incentives for renewable energy technologies such as wind turbines and photovoltaics. This legislation also extended the critical Production Tax Credit for an additional two years that will allow corporations to make significant tax deductions for implementing renewable energy projects. At the state level, plans for the successful implementation of Colorado's Renewable Energy Portfolio Standard, Amendment 37, have progressed considerably. This legislation was passed into law in 2004 and will require that Colorado's largest electric utilities generate 10% of their energy from renewable technologies by 2010. The City of Boulder has made a commitment to reducing emissions by 7% below 1990 levels and is continuing to implement energy conservation and renewable energy strategies to meet these goals.

Colleges and Universities have continued to play an important role in promoting energy conservation and the utilization of renewable energy sources. Over 50 US schools already purchase some of their electricity from renewable sources, most often in the form of renewable energy credits[1] generated from wind turbines. The University of Pennsylvania buys 40,000 MWh of wind energy per year. This impressive effort makes the University the largest purchaser of renewable energies among all U.S. academic institutions and places it 14th among all public, private, and commercial institutions nationwide. Harvard purchases and generates over 20,000 MWh of renewable energy per year, which includes 3 MWh generated from an on-campus PV Solar Array. The University of California at Berkeley also installed a large PV solar array on its student union building, which generates enough electricity to power 60 single-family homes. Oberlin College is finalizing its plans to purchase and produce 60% of its energy needs from green energy sources. These projects were undertaken largely as a result of student led initiatives, but often benefited from considerable support from the universities' administrations.

Energy conservation initiatives have resulted in impressive electricity savings at many schools. Much of this effort has been directed towards facilities, ranging from retrofitting lighting systems to auditing heating and cooling systems. Schools such as the University of Buffalo, Harvard University, Tufts University, and the California State Universities have taken comprehensive approaches to their energy efficiency efforts by emphasizing energy use education within their campus communities. Students, faculty, and staff at these universities have been asked to turn

[1] Renewable energy credits are also known as renewable energy certificates, RECs or green tags. RECs represent the environmental benefits of purchasing renewable energy, but not the null energy.

off unused lighting and computers, purchase energy-efficient electronics, and reduce heating and cooling losses by closing windows and doors. The University of Buffalo estimates that its energy conservation program has resulted in savings in excess of $9 million annually and has prevented 63.4 million pounds of emissions of carbon dioxide, 140,000 pounds of sulfur dioxide and 214,000 pounds of nitrous oxide from being emitted.[2] The University of Pennsylvania reports that it was able to reduce the per square foot electricity needs of its buildings by 13% since FY 2000 as a result of extensive energy conservation programs. Oberlin College engaged their student community by organizing a dorm energy competition, in which residents compete for the greatest reduction in energy use over a two week period.

Many schools energy programs have been motivated by an explicit overarching commitment to reduce emissions of the greenhouse gases that contribute to global warming. The Tufts Climate Initiative is a pioneer in the field of climate change mitigation. In 1999, the University set the goal of meeting the requirements of the Kyoto protocol for greenhouse gas emissions. This goal called for a 7% reduction in greenhouse gas emissions below 1990 levels by 2012. However, the University reports that it expects to achieve a 30% reduction by 2012 thereby exceeding its original commitment. The California State University system recently enacted a comprehensive policy that will support LEED building certifications, new cogeneration facilities, extensive energy conservation efforts, and the installation of an unprecedented 10 MW of photovoltaic solar panels. The success of the student-run "RenewCSU" campaign establishes the university as one of the nation's leading academic institutions in efforts to stop global warming. Many schools, such as The University of California at Santa Barbara, have begun devising strategies to completely offset the emissions impact of their campuses. Oberlin College in Ohio has set the goal of climate neutrality by 2020. A campus could be deemed climate neutral if its net emissions impact is reduced to zero. Although no school has yet reached this goal, it remains an important future objective for many campus planners.

Here, at the University of Colorado at Boulder, Facilities Management, the Vice Chancellor for Administration and the Environmental Center would like to see campus continue to grow, while decreasing energy use. These three entities have worked together to create comprehensive approach to energy reduction. In 2001 the Vice Chancellor of Administration set the goal of stabilizing, then reducing energy use by 5% per square foot. Since then CU has consistently reduced electricity (and steam) consumption by roughly 2% per square foot each year and in 2004/2005 we achieved the goal of 5% for the first time. Therefore, we feel the 5% goal is still a good one because it is ambitious, yet attainable. For renewable energy, currently CU is offsetting roughly 7% of its electricity use with renewable energy credits ("RECs") from wind, with plans for another 8% in the upcoming years. A goal of 25% in five years makes sense because this is a quarter of the way towards the larger goal of being climate neutral in 2025. (Ideally, CU would be generating energy from renewable energy sources, and would not have to offset with RECs. However, RECs offer a good way for entities such as CU to support renewable energy when generating all or a portion of energy needs directly from renewable resources is not an option.)

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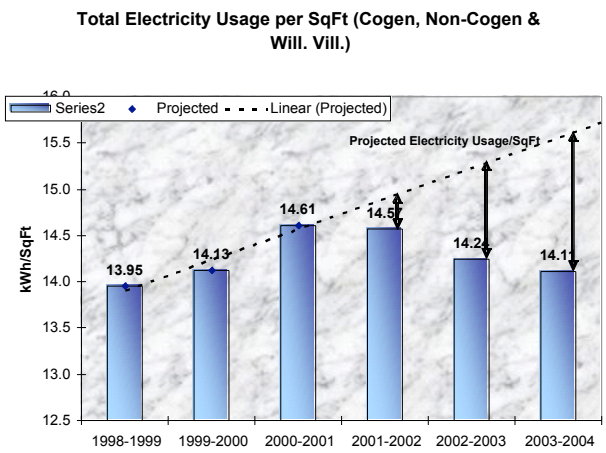
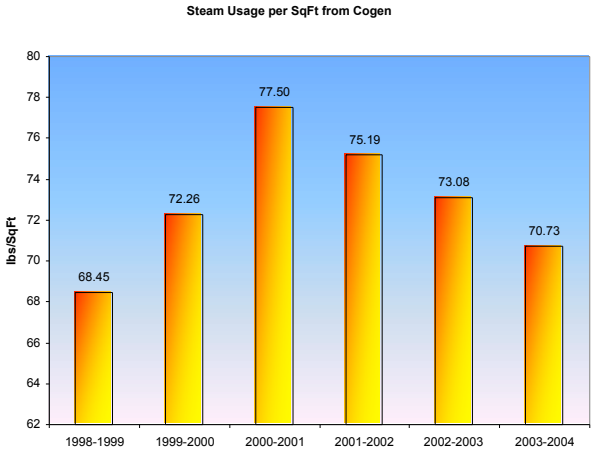
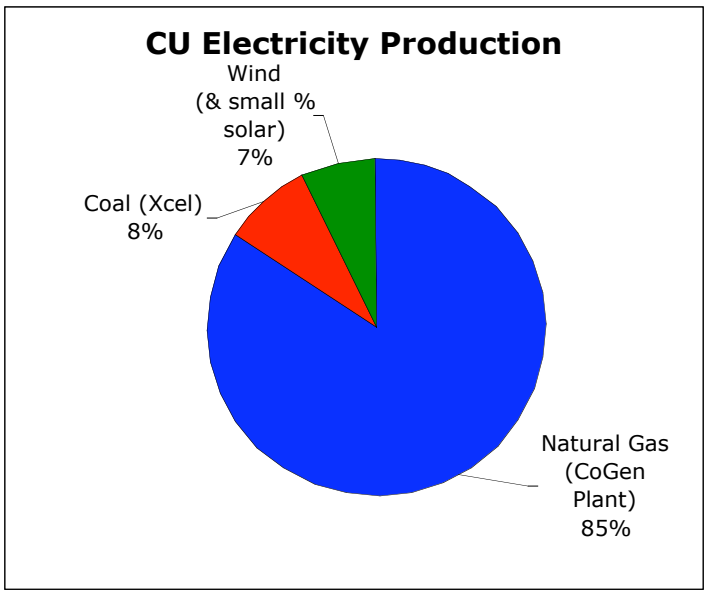
[2] http://www.nwf.org/campusecology/dspGreeningProjects.cfm?iID=4

Trends







*Note: the wind purchases were made through RECs, which offset electricity use on campus but do not replace the electricity source. Therefore, CU still needs to produce the same amount of electricity from Xcel and the CoGen plant. However, in order to get a sense of how much the offset is worth, without inflating actual electricity use, we subtracted 8.8 million kWh from the actual Co Gen numbers.

Current Programs and Accomplishments at CU:

*Energy Conservation Implementation Strategy – 2004 to 2005 (Appendix *)*

The strategy map in Appendix * is the current energy policy for the University, endorsed by the Vice Chancellor of Administration and the Campus Resource Conservation Committee. The strategy map outlines issues, strategies and specific tasks. The current campus goal is to stabilize, then reduce energy use by 5% per square foot. The Campus Energy Conservation Vision statements that accompany this goal and the strategy map include:

1) Support Academic Pursuits

2) Maximize Dollars for Education
3) Enhance Safe Environment
4) Promote Fiscal Responsibility
5) Reduce Waste and Emissions

Of noticeable absence in this strategy are any goals concerning renewable energy.

Master Plan

The current master plan for CU Boulder that was adopted by the Board of Regents in February 2000 recognizes the importance of reducing greenhouse gas emissions and improving energy efficiency. The following language addresses this:

- CU-Boulder should endeavor to minimize pollutants that degrade air quality and/or that contribute to worldwide environmental concerns such as the "greenhouse effect." (Section IV.D.1)
- Upgrade institutional fleet vehicles with new cleaner-burning diesel buses and (where feasible) with vehicles using innovative technologies for propulsion such as electric and hybrid-electric. (Section IV.D.1)
- Conserve energy to mitigate environmental impacts and to reduce costs. (Section IV.D.7)
- Environmental impacts associated with the acquisition, production, and distribution of campus utilities should be minimized. (Section IV.F.2)

The complete CU Boulder Campus Master Plan can be viewed online at http://www.colorado.edu/masterplan.

Student Government

The University of Colorado Student Union (UCSU) has passed several pieces of legislation supporting renewable energy and energy efficiency for campus. For example, in 2002 they passed a resolution urging the University to support the Kyoto Protocol goal of reducing campus emission by 7% below 1990 levels (Bill 56LCR02), in 2004 they passed a resolution supporting the continuation of the Energy Efficiency Fund (Bill 60LCB#14- see below for more information about the fund) and a resolution supporting the continued use of renewable energy on campus as well as the option to increase fees to support more renewable energy in Colorado (Bill 60LCR#13).

Renewable Energy Programs (supply)

Currently, most of campus energy comes from the in-house cogeneration power plant, which uses natural gas to produce electricity and steam (for heating and cooling). Campus also purchases energy from Xcel Energy, the local utility. The majority of electricity from Xcel is produced by using coal (70%) with the remainder coming largely from natural gas.

- However CU Boulder students are purchasing 8.8 million kilowatt hours (kWh) of wind to offset 100% of the electricity used in the three student-run buildings (University Memorial Center, Recreation Center and Wardenburg Health Center), with plans to purchase 100% for three new campus buildings and expansions.
- Students have also installed a 7.5 kW solar photovoltaic system on the UMC that will produce roughly 12,500 kWh of electricity each year. The solar system is accompanied

by a solar kiosk that displays the real time output of the panels, and displays links for more information about renewable energy and energy conservation efforts on campus.

- There are also small solar panels located at selected bus stops on campus power informational displays and the new bicycle station on campus was designed to be energy neutral.
- New renewable energy development on campus is also aided the energy efficiency fund (see below for more information) and Sustainable CU: Environmental Improvement Initiative referendum.
- In 2002, the student group CU Biodiesel began investigating and advocating biodiesel use on campus. For more information, read the *transportation section* below.
- CU-Boulder is also the proud home of the two time first place winner of the Solar Decathlon, an international competition hosted by the Department of Energy. Student teams compete to create a home that runs entirely on solar power in the most attractive, effective and energy efficient manner.[3] The CU team is made up of architecture and engineering students and took first place in the 2002 (inaugural), and 2005 event.

Academic Programs

The interim Chancellor Phil Distefano and other CU administrators have also stated that they would like to see CU become a leader in research for Sustainable Energy and potentially create a Center for Sustainable Energy at CU. There is currently a group of faculty members working to make this a reality.

Currently there are academic programs in Engineering, Environmental Studies, Business, Law, Architecture and others that have an energy focus, or courses that focus on energy issues. These departments house many programs including Engineers without Borders, the Environmental and Energy Study Institute (EESI), the Cooperative Institute for Research in Environmental Science (CIRES) and Climate Change Strategies (CCS) that have a research focus on climate, sustainable energy and energy efficiency spanning from local to international concerns.

Energy Education and Campus Efficiency (Demand)

The Environmental Center provides the outreach and education component to campus users (this effort is called "Generation Green"), the Resource Conservation Officer and Facilities Management work to make sure campus is running as efficiently as possible, and the Administration helps set campus policy concerning energy use.

Generation Green Education Campaign

Some of the techniques we have incorporated to date include:

- Creating electrical use posters for buildings that state what the cost for electricity was in the building for the each fiscal year, and how much air pollution that caused. (This idea was given to us from Walter Simpson at SUNY-Buffalo)
- Presentations for classes and departments on how to save energy.

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[3] See http://www.eere.energy.gov/solar_decathlon/about.html for more information.

- Stickers for light switches and computer monitors that say "When not in Use, Turn off the Juice!" have been placed campus wide.
- Ads in the registration handbook, Recreation Center handbook, local busses, during football games, in local papers and on the campus radio station with remembers of energy prices, environmental impact and tips on how to save energy.
- Distribution of the Environmental Center's "Guide to Saving Energy for Your Office" and "Guide to Saving Energy for Your Home" and Quick Tip flyers (for office, home, computer and lights).
- New campaigns each year to keep things fresh and exciting, including the yellow energy pledge card campaign and the Buff Energy Star Award program (see below for more information).

Pledge Card Campaign

As part of the Environmental Center's energy program and in collaboration with the Vice Chancellor of Administration and Facilities Management, the Environmental Center ran an energy pledge card campaign during fall semester 2003. The 'pledge' was to reduce personal energy use by 10% by taking the actions listed on the card (such as turning off unnecessary lights and enabling sleep mode on computers). For every card signed, the Vice Chancellor committed $5/card towards energy conservation and renewable energy projects on campus. Over 13,000 signatures were ultimately collected, over one third of the entire campus population. This generated $65,000 in funds. Specific projects funded by this campaign included adding motion sensors to large classrooms, insulating heat pipes and helping to fund the solar panels on the UMC.

Energy Efficiency Fund

In the spring of 2004, the University of Colorado Student Union ("UCSU") voted to create a new fund for energy efficiency and renewable energy projects in the three student run buildings on campus-Wardenburg, the University Memorial Center and the Recreational Center. The fund allocates $100,000 a year plus 35% of projected savings for each year to go towards capitol improvements for a minimum of 5 years. In the spring of 2005, the fund was included into the Environmental Center budget, and the Environmental Center is tasked with managing the fund. Some of the projects that we have implemented, or are in the process of implementing are: installing solar film in the UMC; upgrading the lighting in Wardenburg; and replacing the heat exchanger for the Clare Small Pool. Following is a summary of the Energy Efficiency projects funded in 2004-2005, projected savings, and goals for next year.

Campus Resource Conservation Officer

In 2001, Facilities Management created a new position focusing specifically on energy and resource conservation. In addition to partnering with the education campaign, below are some examples of projects completed or in progress by the Campus Resource Conservation Officer.

- Established new conservation website, www.colorado.edu/conservation. On this page you can find information on resource conservation efforts at CU-Boulder, including month to month energy use for all buildings on campus, information on the Campus Resource Conservation Committee, self-moderated building audits, conservation updates and news and more.

- Energy Audits for campus buildings.
- Applying solar film to selected windows.
- Insulating piping.
- Calibrating and replacing thermostats.
- Recommisioning buildings.
- Campus-wide lighting upgrade.
- Working with Pepsi to install energy saving technology to machines around campus.
- Installing office and classroom occupancy sensors.
- Installed new micro turbine at the Recreation Center.

Buff Energy Star Award

This year the Campus Resource Conservation Officer and the Environmental Center are also kicking off the "Buff Energy Star Award" program. This program seeks to showcase, recognize and reward buildings and building occupants that help the environment and the University budget by reducing energy.

There are four criteria that every building must meet in order to be nominated.

1) There must be at least a 5% reduction/sq. foot in energy use compared to the prior year.
2) There must be visible energy awareness posters and educational materials throughout the building
3) The building proctor or designee must complete an energy audit for the building with the campus Energy Conservation Officer
4) The building proctor or designee must take action on the findings of the audit.

The building winners receive a party in their building, a banner and educational materials, and recognition at the Annual Environment Award Ceremony.

Housing Department

In 2004, the Department of Housing signed a $6.2 million performance contract with Siemens, the Energy Service Company (ESCO). Energy and water savings will pay for this contract over the next ten years. Some of the conservation projects being implemented in Housing include:

- Lighting retrofits to replace all florescent lighting and all other light bulbs with longer lasting, energy efficient lights.
- Occupancy sensors that will switch off designated lights when it detects no movement or sound at each location. This system will be utilized in restrooms, offices, conference rooms, dining areas, and hallways.
- Steam system improvements

Energy Goal:

Achieve existing goal of 5%/sq. feet reduction in energy consumption annually (includes electricity, heating and cooling and is based on 2000 levels) and increase use of renewable energy to a total of 25% of electricity production by 2010.

Action Steps:

In addition to the current programs and policies at the university, the following are action steps identified to achieve the energy goal (see sidebar).

Supply-side actions:

- Purchase 100% wind generated electricity for all new buildings (or purchase RECs to offset electricity needs of these buildings). Students have traditionally taken the lead on renewable energy purchases, but with the cost of natural gas continuing to rise, the Administration may show interest in supporting renewable energy as well.
- Consider partial ownership or participation in a community owned wind farm or demonstration project if opportunity arises. This will allow for increased educational opportunities. Students, Facilities Management and campus Administration would likely all be involved in such a purchase.
- Exploit eased restrictions on ownership opportunities due to potential enterprise status of the University.
- Include option for all Residence Hall students to purchase wind to offset individual energy use in the halls. Also consider raising all Housing fees to purchase enough wind power (or green tags) to offset 100% of Housing's energy needs. This would likely be collaboration between the Housing Department and the Environmental Center.
- Identify and implement more solar projects (thermal and photovoltaic) on campus and evaluate other potential renewable projects, including biomass. Take advantage of rebates from Amendment 37 and other on campus funding options including Sustainable CU.
- Include solar vendors and manufacturers on standing order contractor lists to make installing solar on CU a smoother process.

Demand-side actions:

- Consider restructuring how energy use is paid for to create incentives for individuals and departments to reduce energy use. (Facilities Management)
- Achieve maximum LEED points for 'energy and atmosphere' for existing buildings and new buildings.
- Explore funding options:
    - Alumni interested in sustainability.
    - Campaigns to help fund capitol projects.
    - Take advantage of opportunities for performance contracting.
    - Take advantage of rebates from Xcel.
- Work with Procurement Services to create purchasing standards for campus that require energy efficiency (e.g. Energy Star) as a criteria/mandate for all office equipment.
- Consider implementing an internal carbon trading scheme for CU-Boulder, and possibly the four campus system. Also consider joining an external carbon trading market, such as the Chicago Climate Exchange. Work with the Business schools and other campus Departments that may have interest in this market based approach.
- Coordinate with the City of Boulder to ensure that CU strives to meet all City energy policies and takes advantage of shared resources.
- Continue to make sure all vending machines on campus have the newest energy saving technologies installed. (Facilities Management)
- Recommission all campus buildings (Facilities Management)
- Increase Outreach and Education (Environmental Center)
    - Create incentives for departments to decrease energy use.
    - Report energy trends back to campus on a regular basis
    - Increase education to faculty, staff and the administration.

    - Continue to work with building proctors to educate building users and identify energy saving projects. Hold proctors and building users accountable for energy use when possible.
    - Increase outreach to research and academic labs about being conscious of resource use.
- Consider using cost savings from energy saving projects to fund social equity programs or directly assist low-income populations.

Metrics:

The following metrics should be established to monitor our achievement towards the stated goals.

Metric:	Measurement Method:
Air Quality/Emissions	Air composition monitors (city and campus), emissions inventories
Overall trends (energy supply and demand)	Use utility information from power house and Xcel for annual reporting, regular data collection & compilation. Use tools provided by Energy Star and Clean Air Cool Planet to help with benchmarking.
Behavior patterns	Informal, commissioned surveys, Office of Planning, Budget & Analysis
Awareness/participation	Person counts at events, entry forms, reports to Conservation Hotline, surveys
Sustainable-purchasing options	Procurement services

Further Planning and Research Needs:

- Consider establishing the university as a Center for Renewable Energy Research, which opens access to grant funding and expertise. Expand and collaborate faculty and student research opportunities in this area. This also facilitates administrative support.
- Look into feasibility of new renewable energy options (other than solar and wind)
- Look into new energy efficiency technologies.
- Need for solid tracking methodologies to measure cost and quality benefits from energy efficiency and renewable energy programs and progress to date.
- Begin research on social and cultural benefits from energy conservation projects.

Challenges:

- Cost: The majority of energy production is currently coming from natural gas. Natural gas is cleaner than coal, which is better for the environment, but the price is much more unreliable and often more expensive. The University is therefore considering moving away from energy production at the power house (uses natural gas), and increasing the purchase of energy from Xcel (uses primarily coal). This decision would be based solely on cost, and would increase the University's emissions significantly. Renewable energy is also more expensive to purchase, so all support for renewable energy will mean an increase need for funds. To date, the students have taken on all costs for increased renewable energy on campus and there has been little support from the administration.
- Existing buildings: While campus building standards are relatively strong, most of the buildings on campus were built several decades ago and are not running as efficiently as they could be with current technologies.

- Academic Excellence: The main goal of the University is to promote academic excellence. Campus occupants must be allowed to use the resources they need in order to achieve their academic goals. This sometimes bumps heads with resource conservation efforts.
- Funding: Finding funding for energy efficiency and renewable energy projects continues to be a challenge. The State of Colorado has been in a financial crisis over the past few years, and consequently the University budget has been cut. Enrollment at CU has also decreased over the past year, which leads to less money coming into the University.
- Lack of knowledge among campus occupants: Even with current educational efforts, there is still a great deal of misunderstanding and lack of knowledge about individual and campus wide energy use and associated impacts.
- Connection to the end user: Under the current structure, department and building energy bills are paid by the general fund. This means that the end user has no incentive to save energy, because they do not directly pay the bill. Furthermore, savings from energy efficiency goes back to the general fund and is in a sense 'lost'.
- Capturing Savings: There is currently no way to capture savings from energy efficiency projects and invest them into more energy saving or renewable energy projects.
- Structural issues of in-house power plant bond: The power house needs to pay off its bond, therefore, when campus users decrease energy, the plant has to charge more on a per kWh and basis to pay off the bond.

Social Impacts

- As heating and electricity costs increase, low-income populations have a more difficult time responding. For example, efficiency improvements have high initial costs. Additionally increases in energy costs hit harder because they make up a larger portion of their household budget.
- Power plants are often located in low-income neighborhoods that have disproportionate exposure to emissions and other negative outputs.

Links to other Blueprint Chapters/Topics:

Energy is interconnected to many other campus sustainability issues, such as recycling, waste collection, purchasing, and water. This section briefly discusses the connection and refers to pertinent chapters elsewhere in the Blueprint.

- Recycling operations not only help reduce waste, they also save energy and resources. See the **Waste Reductions Chapter** for more information on campus recycling.
- In order to operate efficiently the campus needs to ensure that as purchases are made, buyers consider environmental impacts of the products as part of their decisions. This would include specifying energy efficient (e.g. Energy Star) office equipment. For more information about purchasing, see the **Purchasing Chapter**.
- Energy use and water use are directly linked in terms of heating and cooling, and impacts of energy use on water quality. See the **Water Chapter** for more information on campus water policy and trends.

Green Building

Goal Statement:

CU will strive to meet LEED Gold standards, and as a minimum meet LEED Silver standards for all campus buildings. A necessary component of this goal is the achievement of all campus buildings supplying 25% of their energy consumption from renewable sources, and 5% of their energy consumption on-site. In addition, CU will meet LABS-21 standards for all campus research laboratories.*

* LEED or equivalent green building standard. This applies to all mentions of LEED throughout this document.

Background, Trends:

The LEED (Leadership in Energy and Environmental Design) Green Building Rating System® is a voluntary, consensus-based national standard for developing high-performance, sustainable buildings. Members of the U.S. Green Building Council represent all segments of the building industry. LEED provides a complete framework for assessing building performance and meeting sustainability goals. Based on well-founded scientific standards, LEED emphasizes state of the art strategies for sustainable site development, water savings, energy efficiency, materials selection and indoor environmental quality. LEED recognizes achievements and promotes expertise in green building through a comprehensive system offering project certification, professional accreditation, training and practical resources.[4]

Laboratory facilities represent an ever-expanding growth opportunity for advanced, environmentally preferred, building technologies. The typical laboratory uses far more energy and water per square foot than the typical office building due to intensive ventilation requirements and other health and safety concerns. Because the requirements of laboratory facilities differ so dramatically from those of other buildings, a clear need exists for an initiative exclusively targeting these facilities. The primary guiding principle of the Labs21 program is that improving the energy efficiency and environmental performance of a laboratory requires examining the entire facility from a "whole building" perspective. Adopting this perspective allows laboratory owners to improve the efficiency of the entire facility, rather than focusing on specific laboratory components. As Labs21 participants understand, improving the efficiency of individual components without examining their relation to the entire system can eliminate opportunities to make other more significant efficiency improvements.[5]

The United States Green Building Council provides numerous case studies of some certified projects on their website. The case studies give an overview of the project including location, size of project, building type, and completion date. It also includes a narrative about the purpose of the building, environmental aspects in the design, information about the owner and occupants, and any specific programs incorporated into the building. These case studies are informative

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[4] U.S. Green Building Council. http://www.usgbc.org.

[5] U.S. Environmental Protection Agency, Labs21. http://www.labs21century.gov.

about the type of projects that have been completed, but do not include any post construction data like actual energy consumption, for example.[6]

A recent study by Gregory H. Kats and published by the Massachusetts Technology Collaborative states that the average cost premium for LEED Gold buildings is about 1.82% above a building that just meets typical energy codes. Since buildings on the CU campus are already designed well above codes, it reasons that the associated cost premium should be less than 1.82% (hence the 1% premium imbedded in the Capital Fee).

As green materials and construction methods have become mainstream, the costs of these services have decreased. Some professionals offer that you can build a high performance building with no cost premium at all. Again referencing Kats' study buildings that achieve LEED Gold use 37% less energy, with an additional 4% less if on-site renewable energy is used, and an additional 7% if green power is used for a total potential energy efficiency of 48% less than conventionally constructed buildings. Kats also states "financial benefits of green design are between $50 and $70 per square foot in a LEED building, over 10 times the additional cost associated with building green." If owners and clients are willing to shift their thinking to look at life cycle costs of a building as well as first costs, the long term financial benefits of building green will become more accepted.

The University of California system has led the country in green buildings for university settings. They were the first campus system to have a policy in place with respect to building standards. All construction on the UC campuses must meet LEED Silver certification. All new and renovated buildings must use 25% renewable energy and generate 10% of the building's energy use onsite.

At Middlebury College a Project Review Committee was created that hired a consultant to develop guidelines for "responsible" building. These guidelines were approved by the Trustees to direct each new building project. This is a different approach to green building standards in a campus setting because adapting known standards like LEED and Labs-21 to each individual campus allows for some flexibility when designing for a certain climate and choosing local materials.

Harvard initiated a Sustainable Building Program that built a database of products, suppliers, specifications, and construction waste management plans to facilitate a greener building process on their campus. Although not an official policy, the program seeks to educate tenants, clients, and contractors about green building practices. The Facilities Management department at Emory runs a LEED based program seeking certification for construction and renovation projects.

In the fall of 2004, CU students set the goal of achieving LEED gold and striving for LEED platinum certification on all UCSU building expansions, major renovations, and new buildings.[7] The campus as a whole should follow the students' initiative by achieving LEED Silver certification for all campus buildings. In addition, because many of these other buildings contain

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[6] Names on the list include Clemson University, University of Arkansas, Duke University, University of Michigan, University of Denver and Carnegie Mellon University.

[7] UCSU Bill: 61LCB#5 UCSU Green Building Standard, September 2, 2004. Authored by Eugene Pearson.

laboratories, and because labs are not included in the LEED building certification process, the additional LABS-21 criteria should apply. LABS-21 follows similar "green-building" criteria adapted specifically to research laboratories, which can often be energy intensive and more demanding than normal campus rooms and buildings.

While many new buildings already meet LEED certification, to achieve the maximum effect on climate-change, new campus construction and existing building renovation should strive to meet the highest LEED standards, exemplary of modern sustainability innovation.

There is some question as to the need to follow through with the complete LEED certification process, rather than meeting the "equivalent" specifications, without the explicit certification. In all, while this option would save a few thousand dollars and some hours of administration per project, the certification itself is necessary. Continuing the officiating process *with* LEED is necessary for a few reasons: it maintains the quality of the LEED seal on an international level; the extra administration on the university's behalf ensures the commitment and support of the campus population; it provides an independent evaluation of whether we are really meeting our goals.

Current Programs and Accomplishments at CU:

UCSU Capital Fee

In the fall of 2003 the administration proposed a student fee that would replace the lack of capital funding for four new academic building projects on the CU campus. The student government and the Environmental Center stepped in and insisted that if the students' money was to be used to fund capital projects, the buildings should be built to exceed typical campus standards. UCSU legislation requirements are that buildings will be designed and certified as LEED silver. Projects will attempt LEED gold certification, up to an additional cost of 1% of the total capital project cost.[8]

This fund is currently being used for the re-design and construction of the new Law School building and the ATLAS building. It will also be used to re-design and construct the Business School Addition and to partially fund the design and construction of a new Visual Arts Complex.

UCSU Construction Standards Bill

In the fall of 2004 UCSU passed a bill that establishes the LEED Gold standard as the minimum design requirement for all UCSU building expansions, major renovations, and new buildings. The bill also encourages design to the LEED Platinum standard. It further requires that all minor renovations and infrastructure improvements be designed with LEED standards in mind. The Environmental Center drafted a Small Remodel Checklist to be used by UCSU project managers so that minor renovations will be designed and constructed with LEED standards in mind. This policy only affects UCSU buildings that are operated by student fees.

UCSU Furniture Purchasing Bill

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[8] 60LCB#15 Capital Construction, April 15, 2004. Authored by Richard Murray and Brian Mason.

Also in the fall of 2004 USCU passed a bill that requires large furniture purchases for USCU buildings to consider environmental standards as well as cost effectiveness. The bill recommends some criteria for furniture purchases:

1) Wood fiber substrate material must be 100% recycled and 100% recyclable.
2) Water-based adhesives for laminates and fabrics.
3) Sugar-based sandblasting to be used in production.
4) Mastic Glue must not be used in any process of furniture production or completion.
5) Manufactured by a company that has fair and just labor practices.

The bill recognizes that the industry is rapidly changing and thus makes these recommendations instead of requirements, but the spirit of the bill will remain valid when considering cost effective furniture that meets environmental standards.

Master Plan

The current master plan for CU Boulder states that sustainability is part of long-term campus planning. The concepts of sustainable design and use of green building materials apply at all stages of the design process (program plans, architect selection, design, construction, and closeout). Many procedures and materials once considered safe, such as asbestos and lead paint, are now known to be potentially hazardous and green building practices and materials are being substituted.

The campus goal according to the master plan is to adopt improved building industry practices for sustainability and the use of safe materials. This goal can be achieved by:

- Selecting environmentally sensitive architects to design CU-Boulder buildings.
- Keeping up-to-date the provisions of adopted building codes and campus construction standards.
- Weighing the first-cost vs. longer-term payback when making important decisions.

Green Building Sub-Committee

In the fall of 2003 the Campus Environmental Council was formed. The council is composed of committees that research various environmental topics and report back their findings so that the council can then make informed recommendations to the administration as to how CU can continue to promote environmental issues. The Green Building Sub-Committee, composed of students, faculty, staff, and outside professionals, was charged with quantifying CU's campus building standards.

Part of this process involved researching other campus' existing policies, which are described in detail in the next section. Next the committee completed an analysis of an existing building, Benson Earth Sciences, by comparing its performance against LEED ratings. The result concluded that existing campus standards were LEED "certifiable" meaning that existing buildings on the campus could have achieved the lowest level of LEED certification.

The next step was to attempt to update the standards to produce LEED Silver buildings. In the summer of 2004, some of the standards were updated with green building requirements. Currently the committee is working with an outside consultant to completely update the campus building standards with LEED requirements in mind. The consultants will also host a Green Building Workshop for all campus project managers to educate them about the LEED rating system and help them to facilitate the certification process.

UMC LEED-EB Certification

A small team composed of a few staff from the Environmental Center, an outside consultant, and the building's staff is currently performing the necessary tasks to apply for LEED Existing Buildings certification for the University Memorial Center Addition on the CU campus. The team believes the UMC Addition, a green building pilot project on the campus that was completed in the fall of 2002, will achieve LEED-EB certification, possibly up to the Silver level or beyond. The design of the addition focused on four major areas:

- Recycled/Renewable Materials
- Energy and Resource Conservation
- Waste Reduction and Recovery
- Indoor Air Quality

The success of the UMC addition has helped promote green building on the CU campus.

Action Steps:

According to the goal, CU will *achieve* LEED Silver certification on all campus buildings, as a necessary step to achieve a broader climate goal as outlined at the beginning of this chapter. However, the actual meeting of this goal is rather simple; it is a matter of design and funding, with the legwork steps already clearly outlined by LEED and LABS-21. Therefore, listed below are *strategies* to more easily achieve LEED Silver certification for all campus buildings.

Green Building Goal

CU will strive to meet LEED Gold standards, and as a minimum meet LEED Silver standards for all campus buildings. A necessary component of this goal is the achievement of all campus buildings supplying 25% of their energy consumption from renewable sources, and 5% of their energy consumption on-site. In addition, CU will meet LABS-21 standards for all campus research laboratories.

Include LEED and LABS credit worksheets in appendix for reference.

- Obtain campus-wide support for LEED Silver standards and subsequently create policy requiring all campus buildings to meet this standard.
    - Educate campus population on the LEED organization and the standards they set forth.
    - Incorporate LEED standards in all building projects
- Mandate re-commissioning for all older existing building
- Facilitate collaboration between Building Systems Program (BSP), facilities management, funding organizations and others, incorporating on-campus fiscal, intellectual and administrative resources.
- Incorporate life cycle costs into building administration.
    - Study and advertise life cycle cost analyses.
- Quantify and incorporate human resource benefits of a green building.
- Increase outreach to building staff, create and promote healthy and clean behaviors that affect building operation and performance.
- Maintain an active awareness of green building performance on campus, including updates to the Boulder Campus Planning Commission, the Design Review Board, Facilities Management and other administrative departments.

Metrics:

The following metrics should be established to monitor our achievement towards the stated goals.

Target	Measurement Method:
Building report cards	Emissions inventories, waste inventories, consumption history.
Adoption of Green Building Policy	Creation of a campus wide policy, sustainability standards incorporated in building standards.
LEED/LABS Certification	Number of campus LEED certifications currently achieved.
Overall Building Sustainability	LEED NC/EB checklists, LABS-21 checklists
Building Energy Supply	Campus energy portfolio.

Challenges:

- The vast majority of campus buildings are very old existing buildings, where renovation and "green" retrofits are expensive and difficult.
- The LEED certification is costly, and can appear to be an artificial cost inflation.
- There is currently little focus on life cycle costs, where more expensive/durable renovations are removed from project plans because of little short-term benefit.
- Fiscal constraint often requires "band-aid" solutions, often in the category of sustainability.
- Green building improvements often require high up front investments that are out of reach of low income households.

Links to Other Blueprint Chapters/Topics:

This section briefly discusses the connection and refers to pertinent chapters elsewhere in the Blueprint.

- ***Energy***: energy consumption is integral to sustainable building design. Specific energy strategies are further discussed in the energy sub-section of this chapter.
- ***Transportation***: buildings require transportation to and from, both institutionally and privately; strategies to improve transportation planning around buildings is also addressed in the transportation sub-section of this chapter.
- ***Waste/Materials***: both during the construction and renovation of buildings, and during the normal operation of buildings, materials are consumed and waste is generated. The ***recycling/waste management*** chapter of this blueprint provides some excellent links to this topic.
- ***Purchasing***: similar to the waste link, is strongly relevant to the input side of the building operation. Check the ***purchasing*** chapter of this document for strategies on improving the purchasing stream for a building.

Transportation

Goal Statement:

Reduce CU's impact on the climate from transportation by: reducing traffic on campus particularly in SOV travel, improving and encouraging sustainable alternatives and supporting clean-fuel use for campus users. Limit or reduce SOV trips using 2000 levels. Convert 25% of university-owned fleets to high efficiency and alternatively-fueled vehicles and begin offsetting remaining emissions.

Background, Trends:

The University of Washington hosts nearly 60,000 students, faculty and staff on its 640-acre campus located in the urban setting of Seattle, Washington. The university's UPASS program is known as the most comprehensive of campus TDM programs nationwide and features unlimited access to regular bus transit routes, free carpool parking permits, subsidized vanpool fares, evening/night shuttle services, bicycle lockers, covered parking, emergency ride home, carsharing, merchant discounts and more. The program has been widely successful, with a weighted average of only 24% of campus travelers arriving by driving alone, with 36% arriving via transit.

One of the greatest success stories in transportation planning is from Stanford University, where 2 million square feet of new building space was added in the 1990's with no increase to peak period auto trips to campus. Faced with strict financial constraint, Stanford's transportation planning office began an economic study of transportation options for their campus. According to new construction rates, additional parking would have to sell for nearly 10 times the current rates, and the surrounding community posed strong opposition to increased traffic through their neighborhoods. The end result of their study found that it was cheaper to pay people not to drive than to provide parking for their vehicles. In 2004, people who chose not to drive to campus received $160 per year. This subsidy, in combination with improved alternative access to campus made it possible to grow without any increase in vehicle traffic.

The University of Montana is an excellent case of student initiative in bringing bicycling programs to the campus setting. Their zero-interest bicycle loan provided cooperatively by the campus credit union and the office of transportation is one of the first in the United States; up to 40 bicycles per year have been purchased through the program. They also began a bicycle checkout program that many universities, including the University of Colorado have mimicked. The program features sixty bicycles available for a three-day period at no charge to the students.

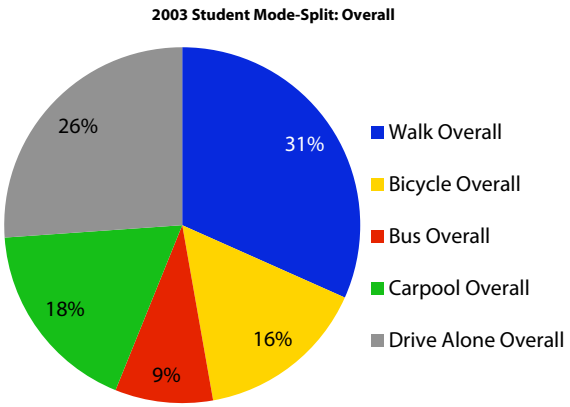
A more comprehensive table of universities and their TDM programs is provided in Appendix D.

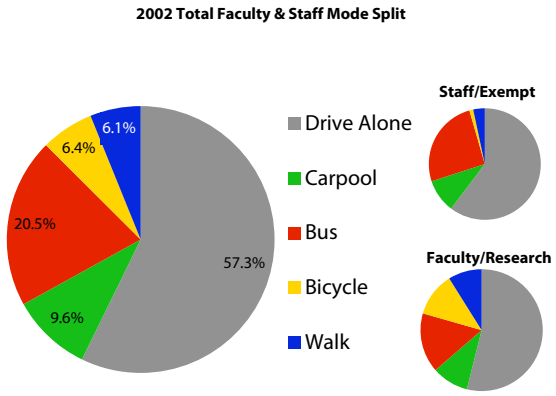
Of all the modes of transportation, single-occupancy-vehicle ("SOV") travel contributes the most to climate degradation on campus; therefore, reducing SOV use on campus is the primary component of the transportation goal. However, it is also important to address impacts of all modes of transportation and encourage the use of the most sustainable options, including bicycling, walking, busing and carpooling. For those vehicles on campus, using higher efficiency vehicles and cleaner fuels can further lessen CU's impact on climate. This includes the campus shuttle "Buff Bus", waste collection, facilities and contractor vehicles and campus-subsidized city and RTD busses.

An important feature of most alternative transportation programs is that they are *cost reducing*. This is primarily driven by the high cost of space and construction within the campus boundary. “Cornell University saved over $3 million by "getting students out of the car," and wound up saving 417,000 gallons of gas and preventing the emissions of 6.7 million pounds of carbon dioxide.”[9] Based on a study done at the University of Colorado, the university has avoided $4.7 million in transportation-related costs by implementing alternative and sustainable transportation programs.[10]

Trends:

The current parking supply is filled to capacity, which, combined with the high price of constructing new parking on campus[11], provides a strong incentive to divert single-occupant drivers into more sustainable modes. Campus demographics have shown that the student population is living an increasing distance from campus which adversely affects the percentage of students who walk and bicycle to campus; based on the Student Mode Split Over Time chart below, it appears these students are using the bus for their travel to campus.

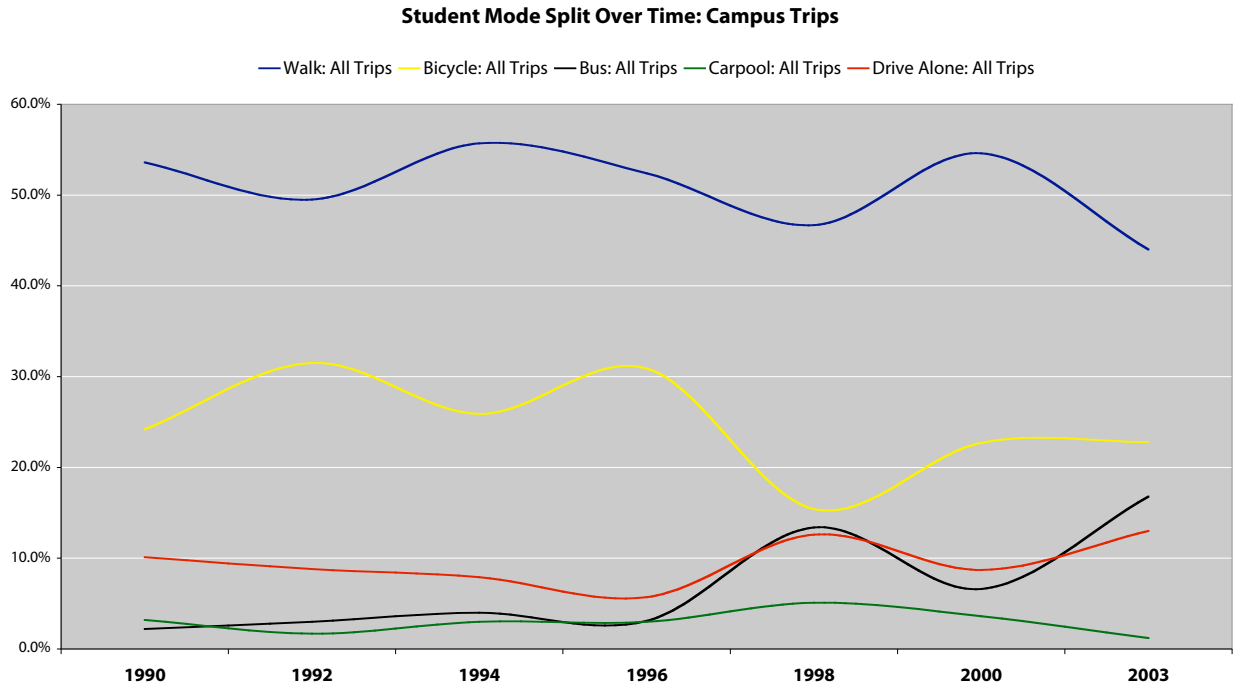


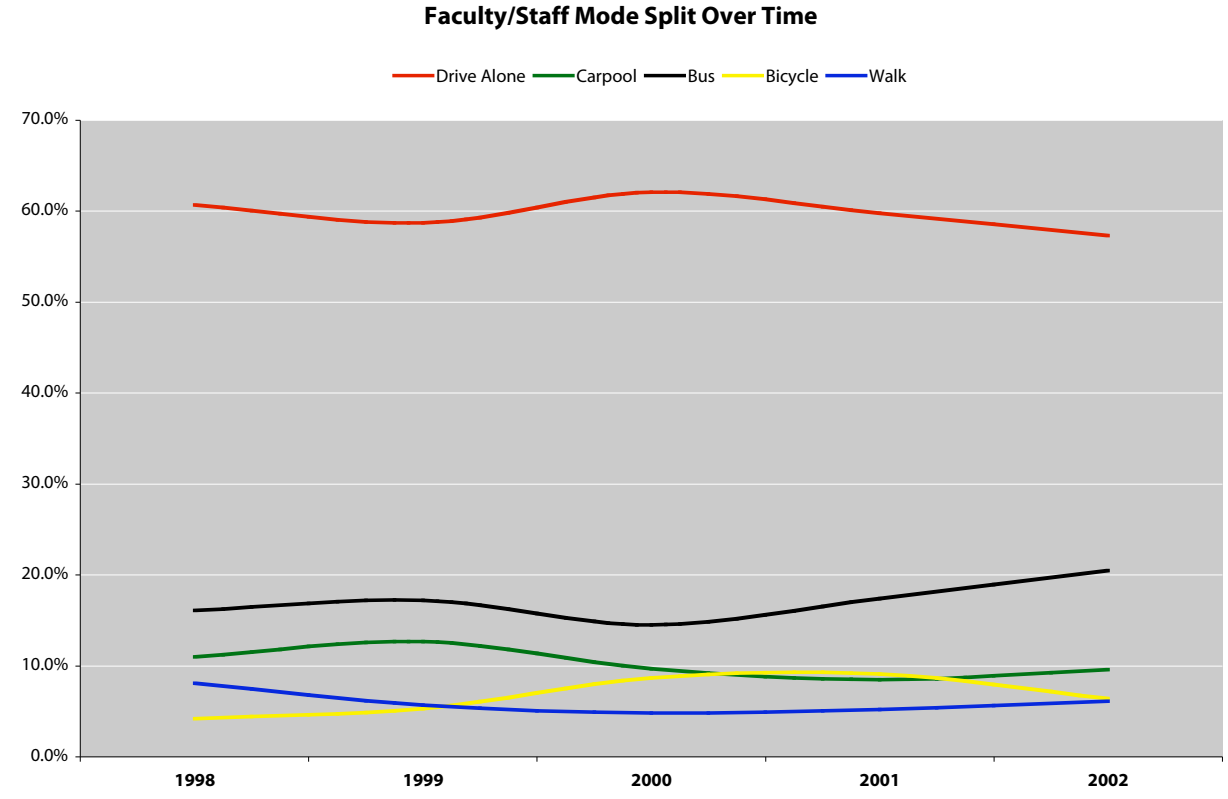


[9] National Wildlife Federation, “Green Investment, Green Return”. 1998. http://www.nwf.org.

[10] O’Connell, Ric and Will Toor, “Green Investment, Green Return, Measuring Sustainability at the University of Colorado, Boulder.” Copyright 2004, CU Environmental Center. http://ecenter.colorado.edu.

[11] According to the Existing Conditions Report provided by Parking and Transportation Services, the design, construction and financing cost of adding parking is $2,092 *per space* per year (the initial capital cost is approximately $20,000 per space). Reference: ucbparking.colorado.edu.





Current Programs and Accomplishments:

Transportation Master Plan

The division of Parking and Transportation Services has produced a Micro-Master Plan to complement the overall campus master plan. This document contains policy and goals similar to those of the blueprint:

- Continue to promote lower cost alternatives to parking such as transit, biking and walking – look at the alternatives and evaluate the cost/benefit. E.g. one new SOV (single occupant vehicle) in a structured parking space will cost 4-5 times as much to accommodate one as one EcoPass transit rider.
- "Right-size" campus fleets - promote and encourage small vehicle fleet use on an appropriately sized multi-use pathway system versus allowing vehicles of any size to have universal access.
- Establish regular and timely data collection and analysis periods (e.g. mode-share data) within and between agencies to improve planning capabilities.

The Transportation Master Plan can be viewed online at http://ucbparking.colorado.edu.

Master Plan

The 2000 CU Boulder campus master plan recognizes the importance of increasing alternate modes access to campus, but does not attempt to cap automobile trips to campus. The master plan assumes that the current modal split – that is, the percentage of trips that occur on buses vs. cars vs. bikes or walking – will not change. This means that, as campus grows, the number of car trips will also grow. In order to deal with this growth due to new construction and to replace existing parking lost to new construction, the plan calls for the construction of two new parking structures in the vicinity of the main campus – one next to the stadium and one in Grandview Terrace. The policies recommended in this section of the blueprint suggest that the net supply of parking should be *decreased* in order to achieve the desired impact on climate. The blueprint vision for transportation calls for a reduction in the SOV mode share, balanced by higher occupancy rates in autos and increases in the transit, bike and pedestrian mode shares.

The master plan does not include recommendations for improving fuel efficiency or emissions of the institutional fleet.

The following language in the master plan shows some support for expanding non-automobile access to campus:

- "Normally preferred modes of on-campus transportation are, in order: (1) walking, (2) bicycling, (3) transit, and lastly (4) driving. This encourages "environmentally friendly" transportation, meaning best use of land, minimizing air pollutants, and maximizing safety. A pedestrian-oriented environment for the heart of the campus enhances the total learning experience. Vehicular trips may be necessary for longer distances, time-urgent needs, and movement of materials." (Section IV.E.1.C)
- "The limited supply and increased cost of housing in Boulder has meant that more faculty, staff, and students live farther distances away from campus. Their commutes will become more and more time consuming as traffic congestion increases, reducing the availability of faculty to students. Consequently, CU-Boulder will increase its efforts to help ensure affordable, proximate housing." (Section IV.E.1.C)

- "Encourage better transit service for faculty and staff use with the intent of affecting the modal split to campus. Develop better data, combining both counts and surveys, for future modal split analysis." (Section IV.E.2.C)

The complete CU Boulder Campus Master Plan can be viewed online at http://www.colorado.edu/masterplan.

Public Transportation

Transit on campus has been the champion of CU's transportation program, with a consistently growing percentage of students using the bus for all trips. With the addition of the Stampede in 2002, students now ride 37 bus routes, locally and regionally. Ridership has increased over 600% since the creation of the student bus pass.

Bicycling

Transportation Goal:
Reduce CU's impact on the climate from transportation by: reducing traffic on campus particularly in SOV travel, improving and encouraging sustainable alternatives and supporting clean-fuel use.

In addition to transit, many new bicycle programs were introduced to the campus in the past two years. Those include a free cruiser checkout program for students, faculty and staff. There are 18 cruisers available for checkout between March and November. The program is a partnership between Parking and Transportation Services and the Environmental Center. To house this and other programs, in 2005 the Environmental Center built a permanent bicycle station to centralize bicycle facilities and information on campus. To facilitate efficient and safe bicycling across campus, the campus completed an east-west bicycle corridor that separates bicycles from vehicle and pedestrian traffic. A north-south corridor is being planned for 2006 – 2010 improvement.

Carpooling

Initiated by new building construction on campus and the LEED certification process, Parking and Transportation Services is investigating a pilot carpool incentive program that includes preferential parking, permitting and pricing. This program will begin Fall 2005.

PTS completed their Existing Conditions Report and Micro-Master Plan that realizes the cost and detrimental impact of SOV traffic on campus and paves the way for improving sustainable alternatives on campus. The existing conditions report also establishes a solid base for tracking and recording travel patterns by the campus community.

Action Steps:

- Create an attractive, campus-wide carpool permit incentive program to encourage drivers to campus to carpool. As new construction further constricts parking supply – already at maximum capacity – each carpool represents at least one individual who no longer needs a space. Increasing carpooling can be an excellent cost effective method of extending the effective parking supply. Parking and Transportation Services at CU offers carpool permits and will play an important role in future incentives programs.
- Improve bicycle programs. 71% of the student population and 48% of the faculty/staff population lives within four miles of campus; this distance represents the best bicycle catchment area. Bicycle program improvements aimed at increasing the bicycle mode share by attracting more to bicycle commuting include:

    - Increase attractiveness of bicycle registration.
    - Improve education about bicycle commuting – dispel myths about bicycle capacity (e.g., provide bicycle trailers) and cool weather cycling.
    - Install and monitor the use of multiple, pilot covered and secured bicycle parking facilities.

- Improve outreach, advertisement and education to increase awareness of sustainable transportation practices. In Boulder, where sustainable transportation options abound, lack of education and awareness is the primary roadblock to achieving positive decision-making. There exists a group at the Environmental Center that teaches sustainability topics to grade schools which may be helpful in developing and teaching sustainable transportation curricula.
    - Create a team of ambassadors that can communicate with campus, K-12 and community entities about transportation issues.
    - Focus on behavioral change.
- Improve our understanding of the travel behavior and demand of the campus population. This goes hand-in-hand with the above category. This can impact planning priorities and focus areas for campus improvement. It is an essential component of effective planning.
    - Improving tracking and surveying methodology.
    - Monitor distance to affordable housing; cooperate with Boulder County community to understand the causes and effects.
    - Review campus subsidized travel – both in-state and out – for greenhouse gas emissions, air pollution and green emissions to establish baselines. Plan means to encourage cost and emissions reductions through expanded Eco Pass use, video and teleconferencing, higher efficiency fleet vehicles and other means.
    - Review campus class schedules.
    - Study stress levels per mode (enjoyment of travel)
    - Improve/perform willingness-to-pay studies.
- Actively encourage healthier travel behavior – creating a car-free culture. The university setting is the introduction for many students to the independent lifestyle. Patterns set during the university years have a high likelihood of remaining through students' adulthood.
    - Consider a ban on campus parking permits for freshmen.
    - Work to dispel myths that further dependency on cars.
    - Consider a ban on campus parking permits for faculty, staff and students living within X distance (_ mile?) of the Main Campus perimeter.
- Maintain accessibility to campus for low-income populations.
- Consider distance learning, flexible scheduling and credit swapping. A few campuses across the nation have created programs allowing more flexibility in campus affiliates' travel patterns. Work-from-home, flexible work schedules or online-classes are examples of this. These options are unlikely to be instituted on a widespread level, but may incrementally improve mode-split.

- Provide rental car services for students. Jeffrey Tumlin of Nelson/Nygaard Associates showed in a recent study[12] that the majority of students require a vehicle only 3/4 of all weekends during the semester. Given this, it would be less expensive for students to rent a car during these times than to store their car on campus. Parking and Transportation Services is bringing a rental car agency to campus in fall of 2005 that will rent to persons 18 and up.
- Increase availability of sustainable purchasing options. Without options, students, faculty and staff are unable to make sustainable choices in transportation. Additionally, providing easy and cost-effective methods of purchasing available to institutions facilitates change to sustainable modes. This will involve cooperation with university Procurement Services.
    - Work with local distributors to promote hybrid and alternatively fueled vehicle use among campus affiliates.
    - Continue support of biodiesel initiatives.
    - Work with campus administration to purchase clean-fuel institutional vehicles.
    - Include HEV and AFV manufacturers in preferred vendor lists.
- Create incentives such as preferential parking for hybrid, high efficiency and biodiesel vehicles.
- Increase infrastructure to support HEV and AFV vehicles. This may include: charging posts at parking lots and biodiesel fueling facilities. Facilities Management is in charge of most construction projects, and will strongly influence the inclusion of these amenities.
- Inventory campus emissions –incorporate transportation profiles. This element is important in accurately assaying the impact of transportation on our climate. Possible emission reductions were calculated for the University of Vermont fleet vehicles under six scenarios for fleet upgrades. A similar analysis for CU can be made possible with accurate emissions inventories.
    - Develop academic project to monitor air quality trends within campus and analyze for traffic impact. Similar projects for other environmental air quality projects have been created out of engineering departments.
- Inventory campus fleet for EPA fuel economy ratings and develop an average fleet fuel economy rating to serve as the basis for planning to track and improve the fuel economy of the campus fleet.
- Begin offsetting transportation caused emissions.
    - Research offsetting strategies for those emissions.
    - Develop funding mechanisms to invest in those strategies.
- Ensure security for all modes on campus. The campus is responsible for ensuring the safe transport of its community. Without this assurance, the university cannot expect improvement outside of the vehicle.

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[12] "Can CU Grow Without Cars?" Will Toor. 1999.

- Separate modes in high-conflict areas, via multi-modal paths, on-street striping and corridor designation.
- Continue installation of traffic calming devices where necessary.
- Continue enforcement against theft

Metrics:

The following metrics should be established to monitor our achievement towards the stated goals.

Metric:	Goal:	Measurement Method:
Air Quality/Emissions	Overall	Air composition monitors, emissions inventories
Overall trends	Overall	Annual reporting, regular data collection & compilation
Behavior patterns (car-ownership, mode-split, housing distance, stress by mode, willingness to pay)	Overall	Informal, commissioned surveys, Office of Planning, Budget & Analysis
Security	Overall	Police records/conflicts, bike theft, injury, accidents
Number of carpools to campus	Reduce SOV traffic	Carpool permit sales
Cars on campus	Reduce SOV traffic	Permit sales, cordon counts
Rental car program existence/use	Improve/encourage alternatives	Rental activity
Distance learning/credit-swapping enrollment	Improve/encourage alternatives	Registrar records
Awareness/participation	Improve/encourage alternatives	Person counts at events, entry forms
Bicycling on campus	Improve/encourage alternatives	Bicycle registration, surveys, cordon counts
Clean-fuel ownership on campus (individually/institutionally)	Support clean-fuel use	Vehicle registration, university fleet, survey.
Sustainable-purchasing options	Support clean-fuel use	Procurement services
High efficiency (HEV) and alternative fuel vehicle (AFV) portion of CU Fleet	100% conversion to HEV and AFV fleet.	Facilities Management, Parking and Transportation Service

Further Planning and Research Needs:

The Environmental Center is considering developing a national online campus TDM database that will categorize TDM practices found at universities, then inventory a wide selection of universities ranging in demography and geography. The project will be most successful and visible as collaboration between universities contributing to the ongoing updating and funding of the database.

The Environmental Center should consider hosting one of the popular national TDM conferences at the University of Colorado at Boulder. This would help to bring expertise and knowledge to the campus to enhance internal TDM programs, as well as establish the center as a “hub” for transportation planning and research.

Research transportation issues surrounding low-income populations, including potential solutions for their well-being.

Challenges:

- There is a strong culture of car dependency on the CU-Boulder campus and beyond. Families purchase vehicles for students before they arrive on campus, and often support that vehicle dependency beyond graduation.
- Universities may have difficulty seeing the cost-savings benefits of sustainable transportation practices.
- Fiscal constraints for implementing new programs.
- There are many perceived security shortcomings to walking, bicycling and other alternatives to driving alone. These are often only *perceived* and not real; it should be the role of the university to increase real security while dispelling false perception based on myth.
- Permitting based upon actual parking costs is not often easy, because of the standardized market subsidization of vehicle parking throughout the nation.
- Effects of the housing market are presently driving campus affiliates farther from the campus, necessitating vehicular travel over pedestrian and bicycle. Changing these trends is costly and slow.
- Many state regulations reduce the flexibility of facilities departments on campus.
- Both private and university service vehicles need access to campus, however their increasing presence is causing pedestrian/bike/vehicle congestion/conflicts on campus.

Social Impacts:

- Low-income employees and students have less capability to purchase cars and thus face access difficulties.
- Due to the high cost of housing closer to the CU-Boulder campus, people with lower income are often forced to live farther away, causing longer commutes to work. Since transportation makes up a large proportion of their overall budget increases in fuel costs hit harder.

Links to other Blueprint topics:

Transportation is interconnected to many other campus sustainability issues, such as recycling, waste collection, purchasing, recreation services and more. This section briefly discusses the connection and refers to pertinent chapters elsewhere in the Blueprint.

- A significant component of increasing campus fleet efficiency and reducing hazardous emissions is the vehicle type. Natural gas, hybrid-electric, electric, gas, diesel, biodiesel and other fuel/propulsion systems all have varying emissions and fuel efficiencies, and most appropriate service vehicle applications. The most environmentally friendly and most practical vehicle for a job depends on matching the characteristics of the job with available vehicles. Contracts for service can often specify the type of vehicle used to provide a given service, whether it is trash hauling, campus transit, local auto rentals, or facilities maintenance. Refer to the **Purchasing** chapter for some general strategies and current policies on purchasing new campus vehicles.

- Almost all of campus operations have transportation needs. Working with campus departments and constituents to utilize cleaner vehicles and adopt healthy transportation practices can create positive change from the demand side of campus transportation.
- There are significant water quality issues associated with auto parking supply on campus. Hazardous run-off from vehicles and their emissions contaminates local water supply, posing a health risk to campus constituents, in-stream and downstream populations if not properly managed. There are two chapters in this blueprint that address water quality issues: **Water**, and **Creating a Safe and Healthy Campus**.

APPENDIX A: CO_2 Emissions Reporting Forms

Colorado Business Energy Partnership

CO2 Emissions Reporting Form

Name of company: *University of Colorado at Boulder*
Facility Address: 1540- 30th Street, RL-2, Room 355 Boulder, CO. 80309, Boulder Campus
Reporting Year: **FY 2003** (07/01/2002- 06/30/2003)
Contact Information:

Moe Tabrizi, Campus Energy Conservation Officer, 303-492-1425
Ghita Levenstein Carroll 303-492-3229, Environmental Center Program Coordinator
E-Mail: tabrizi@colorado.edu
E- Mail: ghita.levenstein@colorado.edu

Indirect Emissions – Purchased Electricity: # of kWh

(A) Reporting Year # of kWh, FY02-03	**(B) BaselineYear** #of kWh, FY01-02
+4,534,078 Non-Cogen purch. +5,658,640- 2,000,000 Wind Power/ Will.Vill purch. +6,230,317 Direct Housing +48,783,203 Cogen purch. -73,733,372 Sold by Cogen to Xcel	+4,211,815 Non-Cogen purch +5,805,334-2,000,000 Wind Power/ Will.Vill. purch. +7,002,677 Direct Housing +35,839,957 Cogen purch. -74,299,971 Sold by Cogen to Xcel

For reporting year: 22,131,956 lb Co2 (used 1.925 lb CO2/kWh for Xcel, 1.35 lb CO2/kWh for UCB Cogen)
For Baseline Year = -2,399,878.5 lb CO2

Direct On-site Emissions: Fuel Usage

Fuel Type	**(A) ReportingYear** FY02-03	**(B) BaselineYear** **FY01-02**
Natural Gas Usage (Therms)	19,087,870 Cogen+ 396,170 Will. Vill,+482,629 Non-Cogen +165,057 Direct Housing Purchase= 20,131,726	20,036,048+376,240+607,283+ 61,397= 21,080,968
Propane Usage (gal)	252	N/A
Fuel Oil #2 Usage (gal)	43,997	9417
Fuel Oil #6 Usage (gal)	N/A	N/A

Natural Gas: 20,131,726 therms x 11.71 lb CO2/therm = 235,742,511.5 lb CO2
Propane: 252gallons x 12.59 CO2/gal = 3172.7lb CO2
Fuel Oil #2: 43997 gallons x 22.60 lb CO2/gal = _994,332.2lb CO2
Fuel Oil #6: N/Agallons x 26.63 lb CO2/gal = N/Alb CO2

Total Direct on-site emissions for Reporting yr = 236,740,016 lb CO2
Total Direct on-site emissions for Baseline Yr = 247,070,959.5 lb CO2
Next: If you have more than one facility, use a separate form for each facility, or provide the data for each facility all on one spreadsheet using the Excel spreadsheet provided.

Transportation (Optional)

Fuel Type	**(A) ReportingYear** FY 02-03	**(B) BaselineYear FY 01-02**
Gasoline Usage (gallons)	25,717 *	25,499
Diesel Usage (gallons)	39,830	38,000 **
	* Includes gasoline for lawn mowers	** Estimated

For reporting year:
Gasoline: 25717gallons x 20.34 lb CO2/gal = 523,083.8lb CO2
Diesel: 39,830gallons x 22.60 lb CO2/gal = 900,158lb CO2
Transportation total for reporting Yr = 1,423,241.8 lb CO2
Transportation total for baseline yr = 1,377,449.7 lb CO2

Totals	**(A) ReportingYear** FY 02-03	**(B) BaselineYear** FY 01-02
Total CO2 Emissions (lb) (Sum of indirect, direct, and transportation emissions from above)	260,295,213.8	246,048,530.7
Option A. Indicator of Business Activity (e.g., total sq. ft., lb of product, dollars of sales) (optional – see item 4 of instructions.)	8,470,643 sq. ft	8,356,608 sq. ft
CO2 Emissions Intensity (e.g., lb CO2/thousand sq. ft.) (optional)	30.73 lb CO2/ sq. ft	29.44 lb CO2/sq.ft
Option B. Activity Index (ratio of the indicator chosen for the reporting year, to the quantity for the baseline year)	1.0137	1.0
Adjusted CO2 Emissions (total emissions divided by the activity index)	256,777,363.9	246,048,530.7

APPENDIX B: Transportation Programs Case Studies Table

Universities of all sizes and structures across the nation have developed transportation programs aimed at improving their impact on climate and establishing positive behavior trends in their community. The table below shows examples of campus leaders in the area of transportation.

Case Studies of Sustainable Transportation Goals & Practices[13]

Transportation Demand Management	
University	Programs
University of Washington – Seattle	UPASS - universal, fare-free transit access for all campus affiliates, options for occasional car trips to campus.
University of British Columbia	TREK - universal, unlimited 3-zone transit access for all students, all night transit service, carpool preferential parking, bicycle program, campus clean fuels, "Star TREKer" outreach program.
University of California-Davis	ATP - carpool reduced pricing & preferential locations, vanpools, discounted transit passes, discounted trainpool (using Amtrak), bicycle program (lockers, auctions, summer storage, repair shop...), transportation centers, campus shuttle.
University of North Carolina - Chapel Hill	Freshman parking ban, free local bus passes, free shuttle bus service between campuses, access to rail, campus car rental program, reduced parking supply in planning.
University of Montana – Missoula	Biodiesel campus bus, late-night bus service, bike checkout program, no-interest bike loans, carpooling web ride boards.
Cornell University	Parking permit pricing aimed at increasing alternatives, OmniRide – free transit access, RideShare – carpool incentives through pricing, Occasional Parker – 10 one-day parking permits free who do not own a permit, thirty-day trial period for permit holders.
University of New Hampshire	Office of Sustainability: yellow-bike cooperative – bike rentals, repairs; blue-bike – departmental bike program; fare-free transit access; preferential location carpool permits.
Stanford University	Slowly raise parking permit prices, pay faculty/staff not to drive, dramatically improve alternatives, such as bicycling, real-time transit info and rental cars for students.
Institutional Clean Fuels	
University	Programs
Emory University	33 CNG shuttle buses, 5 electric pickups, 2 electric carshares, 5 electric shuttles, preferred parking locations for electric, CNG, propane and/or hybrid vehicles.
University of California-Davis	27 CNG campus buses, considering biodiesel for rest of fleet, shifting towards hydrogen CNG, 126 (17%) sedans, vans, pickups run on alternative fuels, B20 is used in all biodiesel vehicles.
James Madison University	20% of fleet run on bi-fuel CNG, 5 electric passenger vehicles,
University of Texas – San Antonio	45 electric utility carts & micro ORV's.
University of New Hampshire	One CNG shuttle bus & two CNG Honda Civics, installing a fast-fill CNG station on campus, receiving CMAQ funding to make project happen.
University of Pittsburgh	20 CNG 15-passenger vans, retired in 2002.

[13] From "Transportation & Sustainable Campus Communities: Issues, Examples & Solutions." Toor, Will & Spenser Havlick. 2004. Washington: Island Press.

University of Colorado at Boulder	13 (100%) of campus shuttles run on biodiesel (B20) with one bus at B100, 11 mini vans/pickups, and 8 hybrid/electric vehicles.
University of Montana – Missoula	Biodiesel fueled campus shuttle bus, a biodiesel late-night bus, using B100 during good weather.
University of Vermont	5 (100%) campus buses run on biodiesel (B20), 5 CNG campus buses.
West Virginia University	Hosts a PRT transit system, featuring computer-guided vehicles traveling along a fixed track, customizable routing.

Appendix B: Energy Conservation Implementation Strategy – 2004-05

University of Colorado at Boulder – Environmental Policy

Issues

Laboratories are 5to10 times more energy intensive than offices or classrooms	Facilities & equipment could be more energy and water efficient	Funding has not been available for building system maintenance	Utilities generation and distribution systems should be more sustainable	Some campus lighting is excessive or unnecessary	Some campus constituents are not aware of the importance to conserve energy and water	Significant funds are needed to address conservation goals

Strategies

Audit laboratories to apply "Labs21" principles	Promote sustainable facilities and equipment	Conduct building system audits, prioritize & fund improvements	Maximize efficiency of traditional utilities generation & distribution. Support sustainability	Take advantage of recent illumination standards	Create fresh new campus conservation campaign annually	Seek task funding from multiple sources

Tasks

▪ Meet standard for fume hoods ▪ Enable power mgnt/equipmt ▪ Conserve water-install closed-loop cooling ▪ Manage energy use of autoclaves, & other lab equipment	▪ Favor efficient bldg systems for lower cost operations & maintenance ▪ Adopt LEED standards ▪ Buy Energy Star label ▪ Install water saver plumbing and fixtures	▪ Set thermostats 65-75° F ▪ Optimize Andover BAS system ▪ Recommis-sion bldg mech systems ▪ Add insulation	▪Use best practices in utility gen&dist ▪Measure + and - of constructing sub-station ▪Invest in emerging power generation technology ▪Support renewable applications ▪Manage and maintain steam traps	▪ Install occupancy sensors ▪ Evaluate LED as future standard ▪ Continue to delamp (exc safety) ▪ Continue TURN OFF JUICE stickers	▪ Provide cost monthly by building on website ▪ Engage proctors & occupants in campaign. Name ***Buff Energy Star Buildings*** ▪ Help to ensure environmentally aware CU graduates	▪ Identify and seek funding from multiple sources for specific projects and efforts