

Auraria Campus Climate Action Plan

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Prepared by:

Andy Pattison, AHEC Sustainability Officer &
The Auraria Campus Sustainability Council



**Auraria
Higher Education
Center**

Auraria Campus



**COMMUNITY
COLLEGE OF
DENVER**

University of Colorado Denver

The Auraria Campus Sustainability Council

Oswaldo Cervantes, UCD Student

Greg Cronin, UCD Professor of Biology

Laurel Dodds, UCD Director of Initiatives for the College of Liberal Arts & Sciences

Gudryn Doherty, CCD Dean of Math and Science

Lydia Hooper, UCD Student

Ismael Garcia, CCD Coordinator of New Student orientation Programs

Jason Janke, Metro State Professor of Earth and Atmospheric Sciences

Jill Jennings-Golich, AHEC Campus Planner

Rob Kardokus, CCD Student

James McDonough, CCD Executive Director of Performance Solutions

Rafael Moreno, UCD Professor of Geography & Environmental Science

Sean Nesbitt, Metro State Director of Facilities Planning & Space Management

Blaine Nickeson, AHEC Chief of Staff and Director of Communications & Campus Relations

Andy Pattison, AHEC Sustainability Officer

Dave Risser, CCD Professor of Energy

Jarrett Smith, UCD Sustainability Officer

Michelle Sprowl, Metro State Student and Chair of the SACAB Sustainable Campus Program

Virginia Till, UCD Student

David Turnquist, UCD Assistant Vice Chancellor for Facilities Management

Rich Wagner, Metro State Professor of Earth and Atmospheric Sciences

Tara Weachter, AHEC Tivoli Facilities Operations Director

Cary Weatherford, UCD Senior Institutional Planner

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Pete Bloomquist, UCD Energy Engineer

Pete Candelaria, AHEC Energy Manager

Abel Chavez, UCD Graduate Student

Andrew Duvall, UCD Graduate Student

Carl Meese, AHEC Planning & Support Services Coordinator

Scott Roen, UCD Manager of Engineering

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Executive Summary

The Auraria Campus, in downtown Denver, is home to the Community College of Denver, Metropolitan State College of Denver and the University of Colorado Denver. Auraria Higher Education Center (AHEC), a Colorado State agency, operates and maintains the campus on behalf of the three institutions. The Auraria Campus Sustainability Council (ACSC) and the AHEC Sustainability Officer have drafted this Climate Action Plan (CAP) to fulfill requirements under the American College and University President's Climate Commitment (ACUPCC), which was signed by the executives of all three institutions on campus, and includes goals established by the State of Colorado *Greening of State Government* Executive Order. AHEC and the three institutions consider this plan to be an evolving document that can and will be altered over time as the campus reassesses its future strategies and priorities.

While specifically focusing on issues related to campus greenhouse gas (GHG) emissions and emission reduction strategies, this document will also address campus sustainability programs and policies in general. The overarching goal of the ACSC is to create a campus that is more sustainable from the environmental, justice, resource, infrastructure, economic and livability perspectives. Creating a sustainable campus will not happen overnight, but the journey can be accomplished in a way that provides learning, service, research, and outreach opportunities for students, staff, and faculty.

Scope 1 GHG emissions are those directly occurring from sources owned or controlled by the campus, including on-campus stationary combustion of fossil fuels to heat, cool and light our buildings and the mobile combustion of fossil fuels by fleet vehicles. Scope 2 GHG emissions are indirect emissions generated in the production of electricity and heat by energy companies which are purchased and consumed by the campus. Scope 1 and 2 are the emissions of concern for the ACUPCC. Scopes 1 & 2 GHG emissions (natural gas, steam, and electricity use in campus buildings as well as gasoline and diesel use in the campus fleet) for the baseline year of FY07-08 totaled 40,463 metric tons (MT)-CO₂e.

Scope 3 GHG emissions are all the other indirect emissions that are "a consequence of the activities of the institution, but occur from sources not owned or controlled by the institution" such as commuting, waste disposal, fuel production, etc. These emissions are not covered by the ACUPCC, are not required to be included in the CAP, and vary widely in terms of what is being counted from institution to institution within the ACUPCC program.

Consistent with other state colleges and universities, and with the State of Colorado's Climate Action Plan, the Auraria Campus Sustainability Council and this CAP recommend the following goals for GHG campus Scope 1 & 2 GHG emissions reductions for the campus:

- By 2020 - 20% decrease from baseline
- By 2030 - 50% decrease from baseline
- By 2050 - 80% decrease from baseline

These campus emission reduction goals are absolute reductions, not normalized for growth, as compared to the baseline year of FY07-08. These goals will be implemented in four phases. The majority of emphasis will be placed on meeting the most immediate goals through 2020, Phases 1 & 2.

Making investments to reduce GHG production requires that AHEC and the campus institutions carefully weigh the social factors, and potentially mandated requirements for reducing GHG production, with our fiduciary responsibility as stewards of public funds. To ensure AHEC and the institutions balance these requirements, internal criteria should be established to guide investments focused on reducing GHG production, and they may be modified to meet the changing needs of the operating environment.

The three higher education institutions already have a great number of established programs at the undergraduate, graduate and professional levels that concern themselves with climate change and general sustainability curriculum and research. These programs offer dozens of educational paths and hundreds of courses to students that are related to sustainability and climate issues and are listed in detail in Appendix A of this document.

These documents contain three significant recommendations for future action:

1. Prior to the campus GHG inventory covering FY07-08 the utility consumption rates on this campus were not tracked in any comprehensive or meaningful way. This lack of historical data prevents any reliable comparisons over time, and makes projections of future use very difficult. The ACSC recommends that the campus develop a utility tracking system for future use.
2. The establishment of a revolving loan fund for sustainability related projects is highly recommended as this can be crucial to the long-term success of climate action related planning. In this case, savings from projects can be reinvested back into the loan and dispersed as projects are selected.
3. The ACSC recommends that AHEC prioritize all building energy efficiency projects on campus in order to reduce building energy use intensity and resulting Scope 1 & 2 GHG emissions. That said, focusing on these priorities should not result in a lack of progress towards maintaining and expanding other GHG emission reduction initiatives, including Scope 3 GHG emission reduction initiatives, and other sustainability related metrics.

Section 1: Climate Action Plan Overview

1.1: Introduction

The Auraria Campus, in downtown Denver, is home to the Community College of Denver, Metropolitan State College of Denver and the University of Colorado Denver. Auraria Higher Education Center (AHEC), a Colorado State agency, operates and maintains the campus on behalf of the three institutions. With over 40,000 students attending all three schools, and approximately 10,000 faculty and staff, the Auraria Campus is one of the largest urban campuses in the nation. The campus comprises 150 acres with most of its buildings built in the mid 1970s. Approximately 1 in 5 students in Colorado obtain their college degree from a school on the Auraria Campus and the campus is among the most ethnically diverse educational campuses in the state.

The Auraria Campus Sustainability Council (ACSC) and the AHEC Sustainability Officer have drafted this Climate Action Plan (CAP) to fulfill requirements under the American College and University President's Climate Commitment (ACUPCC), which was signed by the executives of all three institutions on campus in 2007. This CAP also includes goals established by the State of Colorado *Greening of State Government* Executive Order.

This CAP is being submitted to the ACUPCC by AHEC on the behalf of the Community College of Denver (CCD) and Metropolitan State College of Denver (Metro State). The University of Colorado Denver (UCD) has submitted a separate climate action plan to the ACUPCC and will attach a companion document summarizing this Auraria Campus CAP.

While specifically focusing on issues related to campus greenhouse gas (GHG) emissions and emission reduction strategies, this document will also address campus sustainability programs and policies in general. AHEC and the three institutions consider this plan to be an evolving document that can and will be altered over time as the campus reassesses its future strategies and priorities.

1.2: Institutional Context and History of Sustainability on Campus

American College and University President's Climate Commitment

The ACUPCC, signed by the executives of all three institutions on campus in the spring of 2007 states: "We believe that colleges and universities that exert leadership in addressing climate change will stabilize and reduce their long-term energy costs, attract excellent students and faculty, attract new sources of funding, and increase the support of alumni and local communities."

The ACUPCC requires each signatory institution to complete a comprehensive GHG inventory each even-numbered year and a climate action plan (CAP) each odd-numbered year.

The campus' first GHG inventory accounted for FY07-08 and was completed in January 2008. It was coordinated by an undergraduate student in the UCD Center for Sustainable Urban Infrastructure and revised in February 2010 by the AHEC Sustainability Officer, also a PhD student in the same program. This document is the first Auraria Campus climate action plan, completed in August 2010 as AHEC was granted an extension from the original December 2009 deadline. The next GHG inventory will be completed by December 2010 and an updated CAP will be completed by December 2011.

Additionally, the ACPUCC calls upon signatories to create institutional structures to drive the development of these documents and the requisite planning. In January 2010, AHEC hired a Sustainability Officer, to work on behalf of CCD and Metro State, who formed a voluntary committee of AHEC staff as well as faculty, staff and students from all three campus institutions to serve as the institutional structures mentioned above. This committee is currently called the Auraria Campus Sustainability Council (ACSC) and meets monthly to work together to inform this document as well as other sustainability and climate-related projects and policies on campus. AHEC leadership should consider formally institutionalizing this committee and developing any requisite materials such as bylaws.

In addition to the ACUPCC, another institutional context to consider is that campus climate action planning fits within the development principles of the Auraria Campus Master Plan of 2007. The Master Plan serves as a framework to guide campus growth in the next two decades and explicitly lists “sustainable planning and design” as an essential development principle.

It is essential, however, to mention that the concept of sustainability had progressed on this campus prior to the three institutional executives signing the ACUPCC or the 2007 Campus Master Plan.

The Campus Clean Energy Fee and the Sustainable Campus Program

In the spring of 2004 a student-initiated “Clean Energy Fee” was successfully approved by the Auraria Campus student body. This student fee was created for the explicit purpose of “purchasing clean renewable electrical power for the Auraria Campus from August 23, 2004 through May 12, 2007”. The fee was administered by a subcommittee of the Student Advisory Committee to the Auraria Board (SACAB). SACAB is a tri-institutional student government body with two elected representatives from each of the institutions. SACAB representatives, along with other students on campus, with support from AHEC staff were successful in leveraging the fee in order to make the Auraria Campus a leader across the state and the nation in the use of renewable energy. SACAB is a tri-institutional student government body with two elected representatives from each of the institutions.

Approximately 45% of campus electricity was offset for 2004-2007 through a wind power Renewable Energy Credit¹ agreement which at the time ranked the campus 20th nationally among higher education institutions participating in the Environmental Protection Agency’s Green Power Partnership. Additionally, approximately 25 individual small scale solar panels were purchased and installed in order to power the lights for all campus maps, campus Americans with Disabilities Act signage, and campus flagpoles.

¹ Renewable Energy Credits will be discussed in depth later in this report

The success of the Clean Energy Program was the impetus of student support for a more comprehensive Sustainable Campus Program. A clean energy portfolio is an essential aspect of a sustainable campus, but SACAB endeavored to further integrate principles of sustainability across numerous aspects of facilities management. Working together with leadership, faculty and staff at each institution as well as AHEC administrators, SACAB expanded the Clean Energy Fee program in order to create a more comprehensive and durable Sustainable Campus Program.

The Sustainable Campus Program (SCP) was designed to remain a student-run subcommittee of SACAB and to use student fee money in order to support “initiatives designed to reduce the campus’ dependence on fossil fuels and reduce the ecological impact of the Auraria Campus”. It does this by funding various sustainability projects, falling into five basic categories: 1) renewable energy, 2) energy efficiency of campus buildings, 3) campus recycling programs, 4) reducing per capita water use, and 5) the marketing of these efforts through educational programs.

The SCP fee was overwhelmingly approved by the student body in April 2007 in one of the highest voter turnouts in the campus’ history. The SCP went into effect in January 2008 and will sunset December 2011. This program has been remarkably successful not only in working to achieve its stated mission to “reduce the campus’ dependence on fossil fuels and reduce the ecological impact of the Auraria Campus” but also as a model of a productive and effective partnership between students and campus administrators. Numerous successes of the SCP related to energy and water efficiency projects, as well as recycling programs, are detailed below.

In addition to the student-led campaign to reapprove the SCP for an additional four years currently underway, some faculty and staff have begun conversations regarding having an additional “opt-in” or an “opt-out” program for faculty and staff to contribute \$5 per semester to the SCP as well. A program of this type would have to be approved by faculty governance groups and the governance boards of the institutions. Faculty outreach efforts regarding this idea are also currently underway.

1.3: Statement of Campus Sustainability Policy

As written by the faculty, staff and students of the Auraria Campus Sustainability Council

As mentioned, the Auraria campus is one of the largest urban campuses in the United States and home to three autonomous institutions: the Community College of Denver (CCD), Metropolitan State College of Denver (Metro State), and the University of Colorado Denver (UCD). While each institution has its own sustainability plan, the tri-institutional Auraria Campus Sustainability Council (ACSC) of the Auraria Higher Education Center (AHEC) is charged with coordinating efforts for the entire campus, creating its own initiatives and capitalizing on synergisms and efficiencies among the three institutions.

The overarching goal of ACSC is to create a campus that is more sustainable from the environmental, justice, resource, infrastructure, economic, and livability perspectives. Creating a sustainable campus will not happen overnight, but the journey can be accomplished in a way that provides learning, service, research, and outreach opportunities for students, staff, and faculty. The Auraria Campus has an opportunity to be a leader in sustainability by demonstrating to Colorado and the world that a sustainable campus should be a vibrant, engaged, and excellent location for the higher education experience.

Many of the sustainability initiatives detailed in this CAP require capital costs, but make economic sense when long-term savings are considered. AHEC and the three institutions should establish (or help establish) a fund that supports sustainability initiatives on the Auraria Campus, with savings from projects used to replenish the fund. Currently, most sustainability initiatives have been student-funded. When costs are reduced by sustainability initiatives, savings should be re-invested into other sustainability initiatives. The Auraria Campus should also encourage faculty and staff to make their workplace more sustainable by educating the population on simple things they can do to cut down energy usage (turning off lights when leaving the room, turning off one's computer, etc.) and creating mechanisms by which they can contribute to sustainability initiatives in a coordinated manner.

The ACSC would especially like to note that the concept of “equity” is joined with the concepts of “environment” and “economics” to form the “Three Es” of sustainability. While the second and third concepts are often easier to grasp and integrate into the administration of companies and agencies at many scales, the “equity” concept is often addressed to a significantly lesser degree. The socio-economic concerns and social justice concerns inherent within this crucial aspect of sustainability should always be considered when AHEC and the institutions are developing climate and sustainability projects and programs, as well as all campus activities in general.

Section 2: Greenhouse Gas Emissions

2.1: Greenhouse Gas Emissions Scopes

Greenhouse Gas (GHG) emissions are divided into three scopes. Scope 1 GHG emissions are those directly occurring from sources owned or controlled by the campus, including on-campus stationary combustion of fossil fuels to heat, cool and light our buildings and the mobile combustion of fossil fuels by fleet vehicles. Scope 2 GHG emissions are indirect emissions generated in the production of electricity and heat by energy companies which is purchased and consumed by the campus. Scope 1 and 2 are the emissions of concern for the ACUPCC.

Scope 3 GHG emissions are all the other indirect emissions that are "a consequence of the activities of the institution, but occur from sources not owned or controlled by the institution" such as commuting, waste disposal, fuel production, etc. These emissions are not covered by the ACUPCC, are not required to be included in the CAP, and vary widely in terms of what is being counted from institution to institution within the ACUPCC program.

All of these emissions are quantified in MT-CO₂e (metric tons of CO₂ equivalents).

2.2: Campus GHG Emissions Inventory, Scopes 1 & 2

Scopes 1 & 2 GHG emissions (natural gas, steam, and electricity use in campus buildings as well as gasoline and diesel use in the campus fleet) for the baseline year of FY07-08 totaled 40,463 MT-CO₂e.

Of that total:

- 32,347 MT-CO₂e or 80% resulted from electricity use
- 4,554 MT-CO₂e or 11% resulted from steam use (building heating)
- 3,298 MT-CO₂e or 8% resulted from building natural gas use (building heating)
- 264 MT-CO₂e or 1% resulted from vehicle gasoline and diesel use

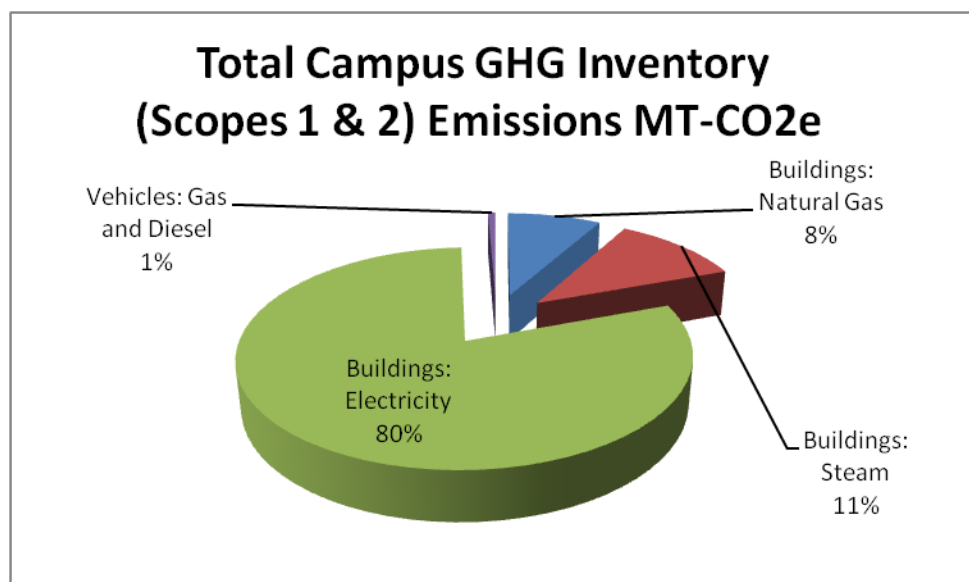


Figure 1: Total Campus GHG Inventory (Scope 1 & 2) Emissions MT-CO₂e

In 2007 SACAB's Clean Energy Fee, a student-initiated and student-led committee, purchased enough renewable energy credits (RECs) to offset approximately 45% of campus electricity use through a "Green-e" certified program for three years. Wind RECs represent a financial investment in wind power generation off-campus and allows the campus to claim the environmental benefits of the project funded by the purchase during the time of the agreement.

2.3: Renewable Energy Credits and GHG Offsets

Renewable Energy Credits (RECs) were conceived as a compliance-tracking policy tool in order to account for mandated renewable energy production programs such as Colorado's State Renewable Portfolio Standard (RPS), which mandates that prescribed portions of the state's electricity be produced by renewable sources such as wind and solar. RECs are therefore employed as an exchangeable certificate demonstrating compliance (creation of renewable energy generation) by an entity. By definition, a REC represents a unit of electricity such as a kilowatt hour of wind electricity generated under certain criteria such as time period and location.

In contrast, GHG offsets are a policy tool used as a component of emissions trading programs such as "cap-and-trade". For instance: emissions from facilities in certain regions can potentially be placed under a "cap" and a number of permits (or allowances) corresponding to the cap are determined and then distributed based on historic trends of emissions. GHG emissions from facilities under the cap are measured (as we have done for the Auraria Campus) and participants then trade amongst themselves to ensure each has enough permits to match respective monitored emissions within the context of a cap that decreases over time. In addition to permits, GHG offsets may be traded and used as an alternative for compliance. GHG offsets are gained by measuring the extent of GHG emissions that are avoided due to a certain project such as energy efficiency retrofitting or switching traditional energy uses toward renewable energy uses. By definition, an offset is a project-based activity that reduces emissions on-site or off-site relative to an agreed baseline.

In sum, both RECs and GHG offsets are two examples of policy tools that can be used in voluntary GHG emission reduction programs such as the ACUPCC. The degree to which they can and should be relied upon and used however is dependent on a host of factors, including verifiability of emission reductions, permanence of emission avoidance, and the prospect of "double counting". The use of RECs GHG offsets, as part of voluntary GHG emission reduction programs such as the ACUPCC, is therefore the subject of great

ambiguity and debate. For example, the Auraria Campus community could decide to count the RECs as a 45% reduction of Scope GHG 2 emissions resulting from electricity use for the campus.

According to the ACUPCC:

“In the absence of precise criteria for these initiatives, conflicting interpretations have emerged on a range of questions including which environmental commodities should be applied to reduce emissions. Included in the diversity of opinion on this debate are a number of nuanced and seductive arguments that suggest under certain circumstances RECs can be considered or even converted to emission reductions and are thus appropriate to meet voluntary climate objectives...Using established GHG accounting techniques, a commodity’s applicability to meet climate objectives can be demonstrated through a clear standardized process. GHG offsets are the product of methodical GHG accounting rules singularly designed to prove the resulting commodities represent additional emission reductions. The same cannot be said for RECs. As they are designed for a fundamentally different purpose (i.e., tracking renewable energy production), RECs do not apply standardized GHG accounting and, unlike GHG offsets, do not include criteria to ensure the renewable projects from which they derive result in emission reductions against an accepted baseline”. Tim Stumhofer, ACUPCC Newsletter June 3, 2010.

The RECs purchased by the Clean Energy Fee are “Green-e Certified” and thus verified at the highest standard in the nation. Many higher education institutions have elected to use REC purchases to help make carbon reductions, but it is important to recognize that making direct reductions, through energy efficiency projects for instance, are long-term investments that will reduce operating costs, as opposed to paying for RECs.

It is also important to note that in July 2009 the SCP entered into a new three-year wind REC purchase agreement (also Green-e certified) which now offsets 100% of campus electricity use. This change will be reflected in future campus greenhouse gas emission inventories and climate action plans.

Given the reasons discussed above, it is the opinion of the ACSC that since RECs do not represent direct offsets of emissions or direct reductions in energy use on campus, these RECs should not be applied directly towards the Auraria Campus' GHG emission reduction goals. In other words, these RECs will not be counted as GHG emission reductions. That said, the REC investment represents a significant statement of Auraria Campus' commitment to sustainability and should be part of any relevant comprehensive strategy and messaging.

2.4: Auraria Campus GHG Emissions by Institution

In a February 2010 meeting between AHEC staff and the Chief Financial Officers (CFOs) of the three institutions, the CFOs discussed they wanted emissions divided amongst the three schools based on the amount of space the schools occupy on campus. It was also noted that off-campus leased space used by CCD and Metro State would not be included in the 2008 greenhouse gas (GHG) inventory or 2009 climate action plan (CAP) due to complications arising from the control of energy use and payments on those facilities but the ACSC and the AHEC Sustainability officer recommend that staff from the respective higher education institutions should work to include these in future ACUPCC reports.

Space classified to AHEC is totaled and then allocated to the three institutions based on the square footage of space each institution occupies outright. General assignment classrooms were included in the AHEC space totals. Library space was allocated based on the funding model used for the building and was divided up by allocating 7.4% of the space to CCD, 44.1% of the space to Metro State, and 48.5% to UC Denver.

Using this methodology, the breakdown of space is as follows for 2007-2008, with a total amount of room area of 1,981,145 and gross square footage of 2,133,091. This methodology will be used in future years to allocate greenhouse gas emissions to the respective institutions with a focus on Scope 1 & 2 GHG emissions as these are the emissions for which the institutions are required to create reduction targets and detailed climate reduction plans (both short-term and long-term) as signatories of the ACUPCC. The

total amount of Scope 1 & 2 GHG emissions for FY07-08 was 40,463 metric tons of CO₂ equivalents (MT-CO₂e).

1. CCD – 14.6% or 311,431 sq ft = 5,908 MT-CO₂e
2. Metro State – 53% or 1,130,538 sq ft = 21,445 MT-CO₂e
3. UC Denver – 32.4% or 691,121 sq ft = 13,110 MT-CO₂e

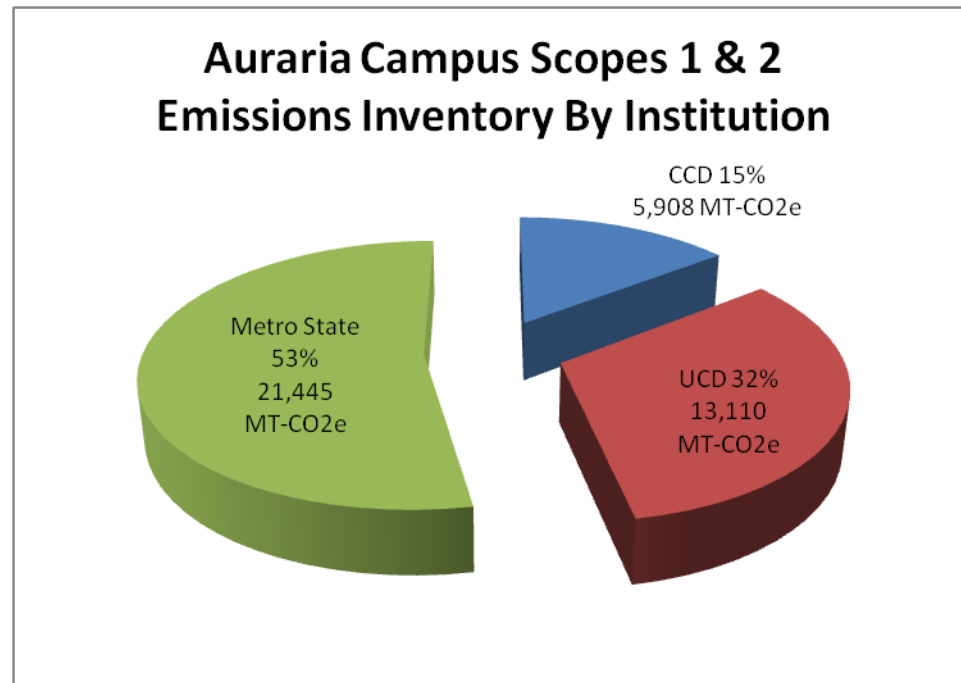


Figure 2: Auraria Campus Scope 1 & 2 GHG Emissions by Institution

It is important to reiterate here that these numbers do not include off-campus GHG emission causing activities. Each institution is a signatory to the ACUPCC while AHEC is not; therefore each institution may in the future include off-campus activities in GHG inventories and climate action planning efforts. For the 07-08 emissions inventory and corresponding CAP (e.g. this document), it was determined that emissions would be considered related only to activities on the Auraria Campus and divided amongst the three institutions. Institutional leadership and campus administrators should continue to work towards determining the degree to which the GHG inventories and Climate Action Plans should be submitted individually including these off-campus activities (as is the case with UCD) or simply as an Auraria Campus.

Additionally, the question regarding the extent to which these relative emission percentages allocated to each institution will be used, if at all, remains to be answered within the context of the creation of GHG emission reduction initiatives' funding mechanisms.

2.5: Utility and GHG Emissions Tracking and Projections

Prior to the campus GHG inventory covering FY07-08 the utility consumption rates on this campus were not tracked in any comprehensive or meaningful way. This lack of historical data prevents any reliable comparisons over time, and makes projections of future use very difficult. The ACSC recommends that the campus develop a utility tracking system for future use.

Normalizing for Growth

The Auraria Campus has and will continue to add a number of buildings to accommodate growth in academic and research programs. For example, in the baseline year of FY07-08 the campus buildings gross square footage was 2,133,091 gross square feet (GSF), for FY08-09 it was 2,148,812 GSF and for FY09-10 the campus had 2,349,731 GSF, an increase of 10% in two years. For this reason, reducing total aggregate energy use on campus will be much more difficult, but by examining the ratio of total campus building energy use in kilo British Thermal Units (kBtu), which is 1,000 Btus, a standard unit of energy, to total campus building GSF we can make more meaningful comparisons. This ratio is called the Energy Use Index (EUI).

The aggregated campus EUI for the baseline year of FY07-08 is 117 kBtu/gsf. This value is slightly below the 2003 national average of 120 EUI for a college/university campus². As another point of reference: UC Denver's weighted average EUI for FY08-09 was 227 kBtu/gsf and their individual buildings range from 63 kBtu/gsf for strictly office space, to 450 kBtu/gsf for high intensity research space (these numbers reflect space that UC Denver

² Commercial Building Energy Consumption Survey (CBECS), conducted in 2003 is gathered from the Dept. of Energy's Energy Information Administration (EIA)

has individual control over in Denver and Aurora, space that is outside the Auraria Campus).

The Auraria Campus is currently unable to calculate a EUI for each building due to the fact that the electricity, gas, and steam are not individually metered at every campus building.

Section 3: GHG Emissions Targets & Phasing

3.1: Auraria Campus Climate Reduction Goals

Consistent with other state colleges and universities, and with the State of Colorado's Climate Action Plan, the Auraria Campus Sustainability Council and this CAP recommends the following goals for GHG campus Scope 1 & 2 GHG emissions reductions for the campus:

- By 2020 - 20% decrease from baseline
- By 2030 - 50% decrease from baseline
- By 2050 - 80% decrease from baseline

These campus emission reduction goals are absolute reductions, not normalized for growth, as compared to the baseline year of FY07-08. These goals will be implemented in four phases. The majority of emphasis will be placed on meeting the most immediate goals through 2020, Phases 1 & 2. Later phases will be conceptualized to a finer degree as future funding and technology allow. The phases are detailed below and followed by additional explanation of the emission reduction initiatives already completed or in process as well as potential future emission reduction strategies.

Phase 1 (2010 - 2012):

As a state higher education agency, AHEC and the three institutions are supposed to comply with the Governor's Executive Order on the Greening of State Government which outlines reduction goals to be attained by June 30, 2012 using FY05-06 as the baseline year. Given the aforementioned lack of accurate historical record of utility use, AHEC will use FY07-08 as the baseline year. The reduction goals include:

- a) 20% reduction in energy consumption as measured by EUI (10% if energy performance contracting is not feasible).
- b) 20% reduction in paper use
- c) 10% reduction in water consumption
- d) 25% reduction in petroleum use - excluding vehicles used for law enforcement, emergency response, road maintenance (including snow removal), and highway construction

Energy

As mentioned, the aggregated campus Energy Use Index (EUI) for the baseline year of FY07-08 is 117 kBtu/gsf. To achieve the goals in the Governor's Executive Order, the campus must then reduce this to 93.6 kBtu/gsf by June 30, 2012 if the campus moves forward with energy performance contracting, or 105.3 kBtu/gsf by June 30, 2012 if energy performance contracting is not feasible. It is worth mentioning that this energy reduction goal differs from the other goals, because it is measured by EUI and is not measured as an absolute reduction.

Table 1: Campus Building Energy Use (kBTUs) and Emissions (MT-CO₂e) FY07-08

	Electricity	Natural Gas	Steam	Total
Usage	40,433,156 kWh	583,030 Therms	54,218,000 lbs	
kBtus	137,958,000	58,303,000	54,218,000	250,479,000
MT-CO ₂ e	32,347	3,298	4,554	40,199

Progress is currently being made towards achieving the energy consumption goal of 10-20%, and it is possible the campus will reach this goal. Specific projects will be discussed below in the *"Completed and Ongoing Scope 1 & 2 GHG Emission Reduction Initiatives"*.

As mentioned earlier however, AHEC must develop institutional structures to collect, verify and track energy consumption patterns campus wide. It is important to note that significant progress in energy efficiency will be required to achieve the goals listed above.

Paper

No information regarding a baseline amount of paper use or reductions were available for the Auraria Campus due to the complexity of three institutions and decentralized procurement systems. It is worth mentioning many other Colorado state agencies and higher education institutions are facing the same problem.

Water

FY07-08 annual campus water use was 62,278,000 gallons. To reach the 10% reduction goal, the campus must reduce water use by 6,227,800 gallons annually. Approximately half of this water use reduction goal is projected to be achieved with a campus wide SCP funded toilet, urinal and faucet retrofit project currently underway. This project is detailed below in the “*Scope 3 GHG Emission Reduction Initiatives*” section.

Petroleum

FY07-08 annual petroleum use for AHEC’s fleet was 26,099 gallons of gasoline and 2,196 gallons of diesel. In terms of the petroleum use reduction goals for the Executive Order, AHEC would have limited requirements given the exemptions for “law enforcement, emergency response, road maintenance (including snow removal)” as these needs make up virtually all of AHEC’s fleet needs. That said, the ACSC suggests that AHEC consider alternative fuel vehicles such as hybrids in future purchases. Other potential petroleum use reduction initiatives are discussed below.

Phase 2 (2012 - 2020): Energy Efficiency, Conservation and Small to Medium Scale Renewables.

Currently, all campus maps, ADA signs, and flagpoles are lit with individual solar powered lights. The ACSC feels that the further integration of small to medium scale renewable energy projects on campus is a priority.

Plans are currently underway to implement a solar energy (photo-voltaic) generation project of as yet unprecedented scale on campus in the coming year. Other future ideas

include a solar powered recharge station for students to be able to charge their cell phone, laptops and other devices.

Small building and ground mounted wind power generation projects are also a possibility on campus, as well as geothermal power generation. These kinds of projects can and will have explicit and significant educational components that will help the students on this campus learn as they lead. Creative partnerships between campus community members and outside entities should be aggressively pursued to insure these kinds of projects become a reality.

Additionally, building energy efficiency projects should be considered a priority path towards reducing campus GHG emissions as buildings are the largest consumer of energy. Pursuing these projects in a comprehensive way on this campus is essential to ensuring that Auraria can achieve the stated 20% reduction in GHG emissions from the baseline year by 2020.

Phase 3 (2020 - 2030): Large-Scale Renewables

The ACSC recommends that AHEC and the institutions look towards partnering with outside entities to develop large renewable energy projects on the campus. Companies and organizations such as Xcel Energy, the City and County of Denver, the Governor's Energy Office and a host of private solar providers are some examples of groups that could partner with the campus. The extensive surface area of the campus roofs represents an opportunity to install a great deal of solar energy production units. Also, as mentioned earlier, so called "urban wind turbines" should also be considered atop and along the sides of campus buildings and, as technologies advance, these projects can increase in scale.

Phase 4 (2030 - 2050): New and Emerging Technologies

Given the vast amount of uncertainties, and the degree to which this phase will rely on future developments in the energy generation and storage technology sector to achieve the stated GHG emission reduction goal, it is the recommendation of the ACSC that AHEC focus on meeting the goals outlined in the first three phases for now.

3.2 : Completed & Ongoing Scope 1 & 2 GHG Emission Reduction Initiatives to Reach 2020 Goal

Since the baseline year of FY07-08, AHEC has begun realizing some energy use and GHG reductions from a number of projects related to energy and water efficiency. This has and will continue to result in an anticipated reduction of 718 MT-CO₂e annually below the Scope 1 & 2 GHG emissions during the baseline year (FY07-08) totaling 40,463 MT-CO₂e, representing a reduction of 1.8%. The various projects are detailed below.

Lighting Projects

This past year the student fee based SCP sponsored an energy efficiency project which replaced old metal halide fixtures with new energy efficient fixtures in the Physical Education (PE) building. This lighting retrofit project is expected to reduce Auraria Campus annual electricity use by approximately 75,000 Kwh, which corresponds to a reduction of 60 MT-CO₂e of GHG emissions annually from the baseline year. This project will also save AHEC \$117,000 in utility costs over 10 years, and is projected to have a payback timeline of less than 3 years.

A similar but non-SCP funded lighting retrofit project in the Tivoli Auraria Parking Structure (TAPS) will reduce campus annual electricity use by an additional 350,000 Kwh, corresponding to an additional reduction of 280 MT-CO₂e of GHG emissions annually. Together, these lighting projects will reduce campus annual electricity use by 1% from the baseline year.

Steam Projects

Through an extensive steam trap replacement project, AHEC has projected campus steam use will be reduced by approximately 4,500,000 lbs annually (8% of campus use) resulting in a reduction of 378 MT-CO₂e of GHG emissions annually from the baseline year.

The New Science Building

The new award-winning Science Building on campus was built to LEED Gold standards. This investment in modern building energy and water efficiency standards is projected to reduce the building's utility costs by 30%, compared to typical building standards, which should help lower campus EUI. That said, given that this is an increase in operated space on campus over the baseline, this new science building will increase the electricity demand on campus by approximately 6,000,000 kWh annually.

3.3: Potential Additional Scope 1 & 2 GHG Emission Reduction Initiatives to Complete 2020 Goal

In general, energy efficiency upgrade projects such as those listed above, as well as designing all future buildings to LEED standards (similar to the new science building) will reduce the energy use intensity (EUI) on campus, which is a measure of the amount of energy per square foot of buildings on campus. Focusing on reducing this number is the most effective way to reduce Scope 1 and 2 GHG emissions.

In addition to designing more efficient buildings and retrofitting existing ones, another aspect of reducing building EUI is related to human behavior. The SCP has recently purchased thousands of stickers for light switches that remind students, faculty and staff to “turn off the lights when not in use”. These stickers will potentially lead to electricity reductions of 1-5% campus wide³. This behavioral conservation campaign will be paired with a planned “Green Office Audit” program and a “Student Green Living Guide” currently being launched as a partnership between the SCP, the UCD Sustainability Minor and the campus chapter of the Colorado Public Interest Research Group (CoPIRG).

Additionally, the operation and maintenance of campus buildings in a more efficient manner can help AHEC reduce energy demands and corresponding GHG emissions. The SCP recently sponsored the purchase of a direct digital control (DDC) system for the

³ U.S. Department of Energy: <http://www.energy.gov/>

campus which will modernize AHEC Facilities Management's ability to monitor and make adjustments to the energy use in individual buildings on campus.

Keeping in mind the importance of reducing GHG emissions from campus buildings, GHG emissions resulting from the AHEC vehicle fleet represents 1% of Scope 1 & 2 GHG emissions. While these emissions represent a very small percentage, they can still be reduced by planning for a smaller and more efficient fleet as time moves on. Whenever possible, electric or hybrid vehicles should be purchased instead of gasoline or diesel vehicles. Electric vehicles, in addition to being more efficient than internal combustion engines, produce no exhaust and are much quieter, which are also significant factors to consider as many AHEC vehicles share walkways with pedestrians. An electric vehicle consumes no energy when it is idling.

Similarly, electric power tools should also be given a priority over gasoline versions. They too are quieter, cleaner, and more efficient.

Events on campus, sponsored by either on or off-campus entities also contribute to campus Scope 1 and 2 GHG emissions. The Solarator™ used at the Auraria Campus Sustainability Fair in the spring of 2010 to power the entertainment stage instead of a typical gasoline powered generator, demonstrates that clean, solar energy can be used to power remote work sites. It is this kind of renewable energy that should be used to meet campus energy needs.

Investing in more energy efficient appliances is another strategy that can be employed to reduce the EUI on campus. For example, by replacing computers on campus with a "Thin Client" system, which UCD is currently doing on and off-campus, is expected to reduce energy needs for computers by 90%, in addition to offering a host of information technology related benefits. The other institutions should explore whether this is a possibility, at a minimum in their computer labs, since computers stay on all day whether in use or not. These efforts could be paired with potential data center audit resources

currently being offered free of charge through the Environmental Protection Agency's Energy Star program.

In general, AHEC, the institutions, and the students will choose how the remaining emissions will be reduced from a number of options suggested by AHEC Facilities Management and the ACSC. Costs, benefits, and feasibility are being studied for these options. These options include: solar photovoltaic, passive solar hot water, purchased Wind Power, geothermal power, and carbon offset projects such as the Colorado Carbon Fund. As stated earlier, most campus buildings were designed and built before there was an emphasis on energy efficiency. Significant energy savings could be achieved through better insulation, efficient HVAC, motion-detecting light switches, and community education. These possibilities and more could be addressed with an investment into a robust energy audit and the creation of partnerships with energy services companies.

A final factor in reducing campus Scope 2 GHG emissions (one not controlled by AHEC or the institutions) is the extent to which Xcel reduces the GHG intensity of the electric grid powering the campus. In other words, the electricity used by the campus may emit less MT-CO₂ per unit of energy based on changes made by Xcel at the regional level. Currently, based on the composition of Xcel's fuel mix, a carbon dioxide equivalent of 0.8 kilograms is currently emitted per kilowatt hour of electricity used by the campus. This is referred to as the emission factor. With Colorado's ambitious renewable portfolio standard and increased use of wind and solar power generation, as well integration of the pilot "Smart Grid" programs, the emission factor used to calculate Auraria's GHG inventory will decrease over time. Currently Xcel is projecting that the GHG intensity of the grid will be reduced by 15-20% by 2020⁴. This would decrease the campus' Scope 2 GHG emissions.

3.4: Scope 3 GHG Emissions

The campus Scope 3 GHG emissions, or those emissions associated with the purpose of the

⁴http://www.xcelenergy.com/Colorado/Company/About_Energy_and_Rates/Resource%20and%20Renewable%20Energy%20Plans/Pages/2007_Colorado_Resource_Plan.aspx

Campus but outside of the campus's direct financial control, totaled 21,625 MT-CO₂e in FY07-08. These emissions represent 35% of the total campus emissions but, as mentioned, Scope 3 GHG emissions fall outside the reduction requirements of the ACUPCC. Of the total Scope 3 GHG emissions, virtually all of it is personal automobile commuting and the rest lies in materials such as water, fuel, and waste. See figures 3 and 4 below. Scope 3 GHG emissions are more difficult to calculate than Scopes 1 and 2. For instance, given the complexity of four different institutions with different internal procedures the campus is not able to track airline miles for campus related activities or able to determine with certainty how many miles the commuting population drives to and from the campus.

Currently, the emissions resulting from campus waste and recycling programs is listed as a negative number, indicating a carbon offset. This is due to the fact that diverting waste from the landfill into recycling streams can reduce the GHG emissions from this sector. This was the guidance given to the students and faculty who completed AHEC's 2008 GHG by the Environmental Protection Agency's "Waste Reduction Model"⁵. It is important to note that this methodology has been revised since then and an updated methodology will be used for the next Auraria GHG inventory.

While Scope 3 GHG emissions are outside the requirements of the ACUPCC mandated emissions to be reduced, addressing these emissions is an important aspect of a comprehensive campus sustainability program. AHEC and the institutions have developed and will continue to develop programs that will address Scope 3 GHG emissions, such as in introducing more commuter options, water efficiency projects, more efficient procurement processes and additional waste reduction initiatives such as a composting program.

⁵ http://epa.gov/climatechange/wycd/waste/calculators/Warm_home.html

Sector/use	Community-Wide Annual Material / Energy flows (MFA)	Data Source for MFA	GHG Emission Factor (EF)	EF Data Source	Total GHG Emitted = MFA x EF
Waste & Recycling	MSW: ~1291 tons, Mixed Recyclables, etc:~166 tons, E-waste: ~6.3 tons	AHEC	MSW: ~ -0.3 kg-CO ₂ e/ton, Mixed Recyclables: ~ -3.1 kg-CO ₂ e/ton, E-waste: ~ -1.7 kg-CO ₂ e/ton	EPA WARM / DRC	negative 899 MT-CO₂e
Commuter Fuel Use (P2W)	By Automobile: 2,812,843 gallons	AHEC	Gasoline: 9.3 kg-CO ₂ e/gallon	REET	22,428 MT-CO ₂ e
	By Public Transit: 62,321,196 PMT	CDPHE / ICLEI	Public Transit: 0.3 kg-CO ₂ e/PMT	WRI	
AHEC Fuel Production (W2P)	Gasoline: 26,099 gallons	AHEC	Gasoline: 2.5 kg-CO ₂ e/gal	REET	69 MT-CO ₂ e
	Diesel: 2,196 gallons	AHEC	Diesel/Jet Fuel 2 kg-CO ₂ e/gal	REET	
Water	62,278,000 gallons	Denver Water	0.00044 kg-CO ₂ e/gallon		27 MT-CO ₂ e
TOTAL Scope 3					21,625 MT-CO₂e

Figure 3: Auraria Campus Scope 3 GHG Emissions by Source

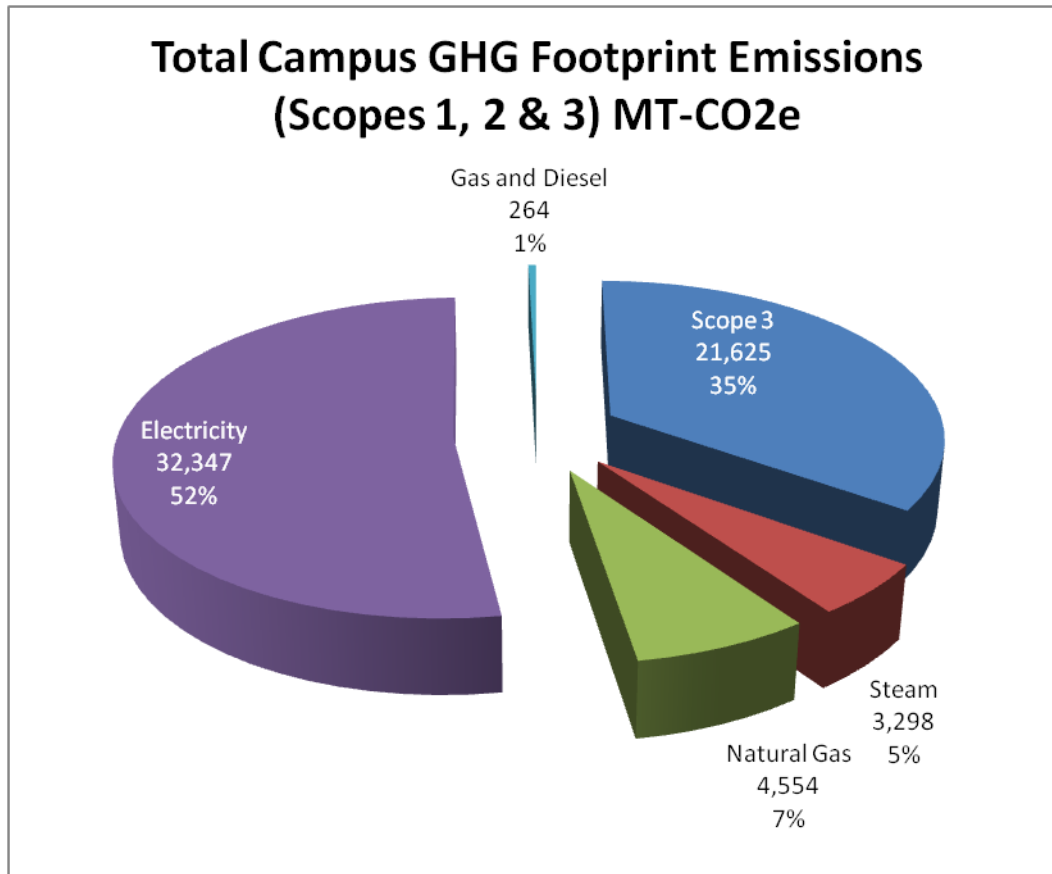


Figure 4: Total Campus GHG Footprint Emissions (Scopes 1, 2 & 3) MT-CO₂e

3.5: Scope 3 GHG Emission Reduction Initiatives

Transportation

As stated earlier, virtually all of the campus Scope 3 GHG emissions are the result of personal commuting by students, faculty and staff. To encourage the use of public transportation all students are provided a heavily discounted transit pass (via the Regional Transportation District – RTD – Denver’s transit provider) as part of their tuition and fees. Surveys have shown that approximately 30% of students report using the bus or light rail system “often” and another 30% report using it “very often”. It should be noted that the students have to vote every year to approve the RTD student transit pass. Faculty and staff have access to a discounted monthly transit pass known as the “ecopass” and approximately 900 faculty and staff (23%) take advantage of this program each year.

Public transportation information is also provided in the student center to facilitate students learning about how to use the transit system in the Denver region. These efforts will continue and will be paired with complimentary programs in the future to increase the use of public transportation, especially in the context of increased parking demand and decreasing parking supply on campus. Also, as part of the LEED Gold new Science Building, some preferential parking spaces have been dedicated for low-emitting vehicles such as hybrids.

Additionally, bike racks are located throughout the campus and many faculty, staff and students ride to campus or bring their bike to campus combined with RTD commuting. These efforts can be paired with future explorations and efforts towards including the Auraria Campus as part of the new “B-Cycle” share program offered by the City and County of Denver.

Waste and Recycling

While commuting represents virtually all of the campus’ Scope 3 GHG emissions, other initiatives have begun to reduce emissions from waste on campus. Since the completion of the GHG inventory, a comprehensive recycling program was launched on campus thanks to a partnership between the SCP and AHEC Facilities Management. In the baseline year, approximately 13% of campus waste was recycled and projections indicate that the launch of this new program will increase the amount recycled to over 30%. This will reduce the GHG emissions associated with campus waste sent to the landfill.

Water

The Auraria Campus is also now a leader in water efficiency. By replacing over 300 toilets, over 150 urinals and 250 faucets across campus, Auraria is now saving nearly 3 million gallons of water annually, representing approximately a 5% reduction in campus water use. This project was made possible with the cooperation of the SCP, AHEC Facilities Management and Denver Water (which donated all of the toilets, urinals and faucets). In addition to saving precious water resources, this project will save Auraria approximately \$15,260 annually. While the GHG emissions reduced through water efforts are extremely

modest, reducing water use on campus is an essential aspect of campus wise sustainability efforts, especially in a dry climate such as Colorado.

3.6: Potential Additional Scope 3 GHG Emission Reduction Initiatives

Transportation

As the use of online courses increases at the institutions, there will potentially be a reduction of GHG emissions due to faculty and students who do not commute to campus for those courses. Currently, all three institutions are making progress towards increasing the number of courses that are offered online. Forward-looking institutions do not need to focus on just “bricks and mortar” (buildings) to meet enrollment increases and program expansion. The efficient, appropriate and effective use of technology to deliver programs can and should be employed as part of a comprehensive plan to meet the educational needs of students.

Waste and Recycling

Current efforts to reduce Scope 3 GHG emissions through waste and recycling program such as those listed above should continue and can be paired with potential future efforts such as compost program and an expanded electronic waste program on the campus. Also, food vendors on campus use primarily disposable packaging, utensils, and plates. Aside from paper bags, most of these disposables are made from non-degradable, non-renewable materials such as plastic and foil. Auraria Campus should encourage or require food vendors and caterers to reduce packaging materials, to use non-disposable plates and utensils, or use disposable products made of degradable or recyclable materials. These materials need to be composted or recycled and removed from the land-fill stream.

Vending machines dispense products that are designed for one-time use. Effort needs to be made to increase the amount of materials that make it into the recycle stream, and decrease the materials in the land-fill stream. Many campus citizens do not have means to grow their own food. Instead, most food travels about 2000 miles before being consumed. The vegetation on campus is currently inedible. The Auraria Campus population should work to convert areas of turf and ornamental raised beds to gardens and beds of edible

vegetation. These areas could be used to teach campus citizens how to garden, and would produce food that could be eaten locally.

Another potential waste reduction related effort is the EPA's "WasteWise" program, a campus based recycling program currently being implemented in other Colorado college campuses.

Water

In order to build on the tremendous success already achieved through the SCP and AHEC's efforts in water efficiency projects, a broader view should be examined. A cursory look at the aerial image shows that the majority of the Auraria Campus is impervious surfaces. Impervious surfaces contribute to flooding by directing precipitation directly into streams with little retention of water, thereby limiting the amount of water that infiltrates the ground and recharges aquifers. The campus currently has retention ponds and a small portion of one parking lot made of permeable concrete, but much more could be done to improve campus handling of storm water. Improvements could be made by (1) increasing the use of permeable concrete for sidewalks and parking lots, (2) replacing impermeable blacktop and concrete with vegetated areas, (3) creating green roofs, (4) capturing rainwater to use for irrigation, or (5) creating an urban wetland (a wetland would provide additional ecosystem services).

Of the surfaces that allow water to infiltrate, the vast majority is covered with turf grass. Auraria Campus uses over 62 million gallons of water annually for irrigation and sanitation. Water used for irrigation could be reduced by replacing turf grasses with drought-tolerant native plants. Such natural xeriscaping uses considerably less water, educates the campus community about native plants, and provides habitat for urban wildlife. Irrigation that does take place could be done using grey water or recycled water which Denver Water is currently providing through a purple pipe system. Though this system does not currently feed the campus, it would be extended though at the campus' cost. One relatively easy project to consider would be the installation of rain sensors on the irrigation system. This

would prevent the irrigation system from operating when the ground is being saturated with rain water.

Other

There are efforts underway to potentially bring a community garden to the Auraria. This potential garden may perhaps be able to work in conjunction with the compost program proposal. These efforts could not only reduce campus waste heading to the landfill but also potentially provide affordable food for the community, valuable sustainability-related aspect of the program, as well as an opportunity for students, faculty and staff to be involved in a community-designed project.

Section 4: Guidelines for Investing in GHG Emission

Reduction Initiatives

4.1: Balancing Investments in GHG Emission Reductions

Making investments to reduce GHG production requires that AHEC and the institutions carefully weigh the social factors and potentially mandated requirements for reducing GHG production with our fiduciary responsibility as stewards of public funds. To ensure AHEC and the institutions balance these requirements, internal criteria should be established to guide investments focused on reducing GHG production, and they may be modified to meet the changing needs of the operating environment.

A first step to doing this would be to conduct an in-depth energy audit on campus. This will help administrators identify the so called “low hanging fruit” (projects with short paybacks periods and significant potential energy savings) as well as projects that may be more costly but also provide energy efficiency improvements. This comprehensive energy audit will also help AHEC gain a better understanding of the larger context of energy consumption patterns campus wide which will in turn give leadership and staff the ability to benefit from the economies of scale inherent in more comprehensive and long-term energy management planning.

The guidelines for investments in GHG reductions are based on financial criteria and total GHG reduction. The first criterion is the payback period of the initiative. Generally speaking, initiatives with a payback period of 10 years or less are considered financially viable. Projects with an estimated payback greater than 10 years will be considered if they offer significant benefits to the campus as a whole. Life cycle costs and benefits will be included in the calculations in order to account for cost savings over the entire lifecycle of the systems replaced as part of a project. In addition to financial evaluation criteria, operational criteria can be used to guide investment decisions. Given the complexity of building projects that improve the reliability and predictability of building systems or increase operational efficiencies, projects that work to improve systems or efficiencies will also be evaluated favorably.

4.2: Funding Mechanisms

Various funding opportunities exist for GHG reduction projects both from within and outside the campus. Internal funding could continue to come from the Sustainable Campus Program or potentially from a fund set up and contributed to by all institutions meant to fund projects that reduce Scope 1 and 2 GHG emissions. Projects would be reviewed by Facilities Management staff and then a decision on what to fund could be made by the Chief Financial Officers (CFO) committee.

External funding could come from local, state and federal grant funding programs such as the Governor's Energy Office which currently has a number of relevant grants programs, many being funded with the American Recovery and Reinvestment Act of 2009 and specifically targeting energy efficiency projects on public buildings. Another example of a source of potential future funding or partnership is the City and County of Denver's Greenprint Denver program.

Private contributions and venture capital groups should also be considered potential partners in the future. Additionally, the campus' electric provider, Xcel Energy, offers many

rebate projects the campus could participate in as energy audits are done and equipment is replaced.

The establishment of a revolving fund for sustainability related projects is highly recommended as this can be crucial to the long-term success of climate action related planning. In this case, savings from projects can be reinvested back into the loan and dispersed as projects are selected. Should such a fund be established, procedures for identifying, review and prioritization of projects should be developed, with financial oversight provided by the Chief Financial Officers (CFO) committee.

Section 5: Academic and Research Programs

5.1: Three Institutions

The three higher education institutions already have a great number of established programs at the undergraduate, graduate and professional levels that concern themselves with climate change and general sustainability curriculum and research. These programs offer dozens of educational paths and hundreds of courses to students that are related to sustainability and climate issues.

Additionally, there is a large number of sustainability and climate related research centers housed at the three institutions, some with a national reputation for cutting edge research in the field. Examples include:

- The UCD Center for Sustainable Urban Infrastructure Systems
- Metro State's Center for Math, Science & Environmental Education
- CCD's Sustainable Urban Living Academy - currently in development

These centers provide faculty and students alike with the institutional support to collaborate on research projects at the local, regional, national and international scope. Many of these centers are explicitly inter-disciplinary and/or cross-disciplinary in nature, allowing for a diverse group of faculty and students to collaboratively address "real world" problems related to sustainability and climate change.

Given the vast number of programs, courses and research centers offered by the three campus institutions a comprehensive list has been included in Appendix A of this Climate Action Plan.

Conclusion

In terms of determining a hard date for carbon neutrality as required by the ACUPCC, the ACSC recommends that climate action planning prioritize the immediate and near future policies and projects in order to continue to change our climate trajectory downward. A focus on the stated goals for 2020 is recommended. More robust decisions and ambitious plans will be made at times of more certainty and will include future development in energy technology. Plus, as the institutions continue to see increasing enrollments; new buildings will continue to be added to the campus, thus contributing to overall campus energy usage and emissions, therefore EUI reductions of over 20% will be required in the future. It is important that the campus focus on reducing the energy usage of existing buildings and ensuring that new buildings are built to a high standard of energy efficiency.

In the meantime, the ACSC recommends that AHEC prioritize all building energy efficiency projects on campus in order to reduce building energy use intensity and resulting Scope 1 & 2 GHG emissions. Projects on the campus' controlled maintenance submittal to the state should be reviewed for how these projects will reduce energy usage. Those projects that will most effectively and efficiently decrease the amount of energy being consumed could be prioritized in the hopes that they secure funding in the coming years. This will insure that appropriate progress towards achieving the campus climate reduction goals for 2020 will be made. That said, focusing on these priorities should not result in a lack of progress towards maintaining and expanding other GHG emission reduction initiatives, including Scope 3 GHG emission reduction initiatives, and other sustainability related metrics.

Appendix A: Auraria Campus Sustainability Related Academic and Research Programs

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Part 2: Metropolitan State College of Denver, page 2

Part 3: University of Colorado Denver, page 8

Part 1: Community College of Denver

Renewable Energy Overview Course:

Residential Energy Auditor Training: The course provides a CCD certificate and prepares students to take the national certification test and earn industry-recognized BPI credential.

Non-credit “Green From the Ground Up” Green Advantage: Preparation courses, primarily for construction trades people and non-credit training courses for those interested in Green Building concepts: construction industry, architects, interior designers, realtors, general public, etc. July 2010.

In Development:

CCD Sustainable Urban Living Academy: Designed to: 1) integrate disparate activities related to sustainable living and provide hands-on, experiential learning; foster community building through interaction, 2) address the unique training/education/employment/business/community needs of the inner-urban area in emerging sustainable living industries, 3) address and satisfy the Denver community’s widespread commitment to and demand for sustainable living and “green” lifestyle products/services/knowledge, 4) encourage participation of women & minorities in emerging industries, 5) develop a new community resource that integrates sustainable living practices with community college credit/ non-credit curriculum, and 6) foster grass roots economic/ workforce development.

A Green Showcase Training Facility: **A hands-on learning lab** designed to support CCD’s Renewable Energy/Building Energy Efficiency training programs.

Part 2: Metropolitan State College of Denver

Art Department

ART 4223 - Community-Based Design

This course challenges students to formulate design solutions that function to create positive change in a given social environment. By assessing the narrative history of people, places, events and issues that are regionally accessible, students create highly conceptual solutions that respond to social and cultural concerns within local communities.

Department of Biology

BIO 1010 - Ecology for Non-Majors

This one-semester course familiarizes the student with the fundamentals of general ecology.

Classical concepts of ecology and modern environmental pressures are brought together to stimulate discussion of present environmental problems. This course does not apply toward a biology major or minor.

BIO 3550 - Urban Ecology

An analysis is made of the urban ecosystem and the factors involved: water, transportation, solid wastes, energy, land, political institutions, economics, social patterns, communications, recreation, shelter, nutrition, and population. Field trips to key environmental locations in the greater metropolitan Denver area and field trip reports are required.

BIO 4230 - Issues in Conservation Biology

Students will explore issues in conservation biology. This area of biology applies the fields of ecology, evolution, biogeography, population genetics, economics, sociology, anthropology, philosophy and other disciplines to address the global problems of declining biodiversity of species and ecosystems. Two field trips during the scheduled course time will highlight conservation issues on a local level.

Chemistry Department

CHE 3890 - Science and Public Policy: Variable Topics

This course provides a working familiarity with the technical issues that influence major public policy decisions. Policy issues and relevant technologies and their interactions are discussed. Course content varies according to current topics, such as health, environment, and energy. This course may be repeated under different topics.

Department of Earth & Atmospheric Sciences

Bachelor's of Science in Environmental Science – concentrations in environmental geology, water quality, environmental geology, ecological restoration and environmental chemistry

Bachelor's of Science in Land Use – environment and resources

Minor Degrees in: Environmental Science and Environmental Studies

ENV 1200 - Introduction to Environmental Science

This course is an introduction to the study of the physical environment and some of the major related issues and problems. The areas of concern include the nature of the environment, climatic factors, agriculture, solid and hazardous waste site location, global environmental hazards, land use, water resources, and energy and mineral resources, as well as environmental ethics and management and decision making.

ENV 1400 - World Resources

This course provides a survey of the physical resources of the world, including water, soil, vegetation, energy, and minerals. This course includes an analysis of geographic occurrence, extraction, appraisal, utilization, historic changes, and environmental issues.

ENV 3400 - Water Resources

This course presents an analysis of water as a major resource. It includes the study of the hydrologic cycle, competing water uses, current water problems, and approaches to water management. The relationship of water to land use is examined in terms of dams, watersheds, water laws, pollution, and flood control.

ENV 4200 - Environmental Policy and Planning

This course provides an overview of environmental policy and major environmental laws in the U.S. The major statutes are analyzed in terms of purpose, scope, implementation, compliance requirements, and impact on land use. Case studies are examined in a planning context.

ENV 4500 Environmental Biogeochemistry

A practical and quantitative treatment of soil-water-plant processes affecting chemical reactivity, transformation, retention, and bioavailability is provided. The course covers the primary areas of biogeochemistry: (I) a description of inorganic and organic soil components, (II) complex equilibria in soil solutions, and (III) specific adsorption phenomena at the solid-water interface, (IV) ion exchange and dissolution/precipitation of solid phases, (V) computer modeling of chemical speciation.

ENV 4970 - Environmental Field Studies

This course is a senior-level capstone course for land use and environmental science majors that will address current local environmental issues in Colorado through site visits and field techniques. Topics covered include: Denver air quality, water quality, sustainability, and waste disposal. Field trips will be taken to local environmental sites and agencies. (Senior Experience)

GEG 1920 - Concepts and Connections in Geography

This course will cover basic concepts and themes of geography as well as the primary division of the discipline. Topics include major world regions and the interconnections between them, the geography of human activities, physical geography, and human interaction with the environment. Basic geographic tools, methodologies, and theories are used as keys to understanding past, present, and future events in the world. The region of the Middle East will be used to demonstrate relationships between physical and human geography and resource development. (General Studies–Level II, Social Sciences) (GT-SC2)

GEG 3600 - Urban Geography

This course examines theories of urban development and factors that affect urbanization, such as demographic change, annexation, zoning, and infrastructure development. Models of urban land use are examined in the context

GEG 3630 - Transportation Planning and Land Use

This course is an analysis of transportation systems as they relate to other types of land use. Transportation networks are examined in terms of types, patterns, and densities. Consideration is given to alternative transportation systems as they relate to energy savings, pollution prevention, and the reduction of congestion.

GEG 4610 - Urban and Regional Planning

This course examines theories of urban development and factors that affect urbanization, such as demographic change, annexation, zoning, and infrastructure development. Models of urban land use are examined in the context

GEG 4620 - Residential Land Use Patterns

This course examines spatial patterns of urban growth, factors that affect housing, the role of nonprofit developers in the current housing market, as well as theories that explain the

residential mosaic of North American cities. It includes an analysis of current housing trends as well as the housing types, densities, patterns and geographic distribution, as well as the interrelationships with other aspects of the urban environment, including infrastructure.

MTR 1400 - Weather and Climate

This course introduces the fundamental physical processes in the atmosphere-heat and energy, temperature, pressure, wind, clouds, precipitation, and stability. These concepts provide the basis for understanding weather systems such as thunderstorms, tornadoes, and hurricanes. These processes are also applied to climatic patterns and the impacts of human activity on weather and climate, such as air pollution and climate change. This course does not apply toward a meteorology major or minor.

MTR 3100 - Air Pollution

This course examines the causes and control of air pollution. Topics include pollutant sources and sinks, regional and global-scale pollution problems, monitoring and sampling techniques, regulatory control, meteorological influences, and indoor air quality.

Department of Economics

ECO 3450 - Environmental Economics

An economic analysis of the causes and consequences of environmental degradation and of public policy measures designed to preserve, protect, and enhance human environments.

Department of Engineering Technology

CET 3320 - Environmental Impact Statements

This course is a study of the physical and legal requirements of the environmental impact assessment process. Students will learn to do information research and prepare a draft environmental impact statement.

CET 3330 - Environmental Technology Processes

This course covers chemistry basics, acid-base reactions, biochemical processes and reactions.

Also included is an overview of water and wastewater process. The course introduces basic laboratory tests and introduces bacteria and microbes in waste treatment processes.

EET 3430 - Power Generation Using Renewable Energies

This is an introductory course in electrical power generation that examines various types of renewable energy sources. While examining many developing technologies, the course concentrates on the design and application of photovoltaic and wind electrical generation. It examines conventional synchronous and induction machines, as well as modern doubly-fed induction machines and their application in wind generation. It also provides an introduction to inverter technology and methods of interfacing renewable energy power plants with the electrical power grid.

MET 3050 - Heat Power

This energy conversion course combines lecture and laboratory for the manufacturing and industrial student. Emphasis is given to real processes, compression, expansion, heat transfer and to safety and efficiency of engines (stationary and mobile).

MET 4280 - Advanced Energy Technology

Global energy flows, sources, and uses of energy are studied. Biological energy and ecosystems are introduced from the viewpoint of the engineering technologist. Energy-related environment problems including air and thermal pollution plus radioactivity are treated.

Department of Health Professions

HCM 3652 - Environmental Issues in Public Health

This course highlights the role of public health in environmental issues, bioterrorism, and general public safety. Critical issues identified in this course relate to basic life support matters such as pure water, clean air and hazardous waste disposal; and the impact of uncontrolled population growth on the environment, natural resource shortages and global warming. The evolving role of public health in the post 9/11 world will also be covered.

Department of History

HIS 3880 - American Environmental History

This course will examine the interactions between humans and plants and animals in North America from pre-Columbian times to the present, as well as U.S. attitudes toward landscapes, cities, and natural phenomena.

Department of Hospitality, Tourism and Events

HTE 2860 - Sustainable Tourism

This course examines the theoretical and applied dimensions of sustainable tourism. Using national and international case studies, the course identifies the relationships among

tourism activities, cultural issues, ecological systems, political agendas, economic opportunities, and resource utilization.

Department of Human Services - The Center for Nonprofit Organization

Administration

HSP 3210 - Organizational Stability for Nonprofits

This course will examine the internal and external factors that affect short- and long-term function of the nonprofit organization. Special emphasis will be placed on organizational life cycles and use of strategic planning to ensure long-term sustainability.

Department of Industrial Design

IND 2690 - Alternate Energy and Transportation

This is a lecture course, designed to take a comprehensive look at the alternate energy sources and systems. It includes a study of modes of powering vehicles by other than fossil fuel and alternatives to private vehicle transportation.

IND 2810 - Technology, Society, and You

This course is designed to focus on the impacts and implications technology has or will have on society. The course presents students with the opportunity to study and develop an understanding of how technology affects people, families, education, economics, politics, and ethics. History and future implications will also be studied. Emphasis will be placed on people's understanding of industrial materials, processes, and control of technology.

IND 4860 - Research in Industrial Technology

This course provides in-depth research, laboratory experimentation, and/or development of a student-selected and faculty-approved topic in one technical system. The areas of research are: communications, manufacturing, and transportation/power. The course allows the student the opportunity to further develop problem-solving abilities. At the same time, the process enhances the student's knowledge and skills in a technical concentration.

Department of Physics

PHY 3082 - Energy and Environment

This course presents the supply and usage of energy resources and the environmental problems associated with our energy usage.

Department of Political Science**PSC 3230 - Environmental Politics**

The class will explore the political and administrative issues politics. Environmental areas to be reviewed will include environmental political behavior, assessment, law, and decision-making.

Technical Communication and Media Production Department**COM 3670 - Writing for the Environmental Industry**

This course presents communication models and techniques for reporting industrial and governmental information related to the environment for specialized and general audiences.

Centers and Programs:*Center for Math, Science & Environmental Education (CMSEE)*

Phone: (303) 556-4519

The Center for Math, Science, and Environmental Education (CMSEE) was established by Dr. Larry S. Johnson and Dr. Joseph Raab in 1993 to serve Colorado schools by offering programs and services in math, science, and environmental studies. One of the goals of CMSEE is to have math and science taught in a more activity-oriented way. Dr. Johnson, Director of CMSEE, believes that students have a better chance of retaining information if they participate in an activity, rather than have a teacher just tell them the facts. CMSEE is part of the Metropolitan State College of Denver's School of Letters, Arts and Sciences.

*Part 3: University of Colorado Denver***College of Architecture and Planning****Master's in Urban and Regional Planning, Concentration: Land Use and Environmental Planning**

This MURP concentration prepares students for making and administering plans and policies at all levels including neighborhood, city, watershed and region. Land use and environmental planning emphasizes regulation of land uses and development processes, organization of transportation infrastructure and other major public investments, and management of urban ecology, environmental quality and natural resources

Colorado Center for Sustainable Urbanism

The center examines one of Colorado's most urgent challenges—creating livable communities in the context of a booming population. This center studies growth-oriented

issues, disseminates information, tests growth scenarios and provides expertise to cities and organizations involved in growth-related issues.

Colorado Center for Community Development

The Colorado Center for Community Development assists organizations, communities, and neighborhoods which cannot afford or do not have access to such technical or educational assistance. The efforts of the Center are focused primarily on rural towns, low-income communities, and development organizations.

Children, Youth, and Environments Center for Research and Design

The Children, Youth and Environments Center for Research and Design works with the design professions and allied disciplines to contribute to the health, safety and welfare of children and youth. The Center undertakes and supports interdisciplinary activities in research, policy and practice, while recognizing young people's capacity for meaningful participation in the processes that shape their lives. It focuses in particular on children and youth in environments of disadvantage and those with special needs.

Business School

MBA, Managing for Sustainability Specialization

Provides business students with an understanding of the business issues associated with managing for sustainable growth including issues facing businesses in a world where resources are scarce, social safety nets are declining, and customers and commentators are concerned about companies behaving in an ethical and responsible manner. Approaches alternative ways to reduce the negative impact of economic activities through environmental finance and accounting, corporate social responsibility, social entrepreneurship, and social marketing. Examines the role business has in fostering the long-term health and viability of communities, the environment and the company.

MS in Global Energy Management (GEM)

Students gain a leadership and business education focused solely on the energy industry. Developed in partnership with leading energy companies, the curriculum addresses the practical, real world considerations and challenges energy companies face on a daily basis. GEM is designed to equip future leaders with the tools needed to find solutions to the issues and opportunities found in conventional (oil, gas, coal), nonconventional (oil sands, shale), alternative (nuclear, coal gasification) and renewable (solar, wind, bio-fuels, etc.) energy businesses. This real-world curriculum is taught by faculty members from around the world who have extensive experience in the energy industry.

Bard Center for Entrepreneurship/ Certificate in Entrepreneurial Studies

Established in 1996 as part of the Business School, the Bard Center offers graduate level entrepreneurship courses that can be applied toward a graduate business degree or a Certificate in Entrepreneurship. The Bard Center also hosts an annual business plan competition, manages a venture capital fund to help launch student-initiated ventures and offers incubator space to emerging businesses.

College of Engineering and Applied Science

Department of Civil Engineering

Program: MS, Environmental and Sustainability Engineering and MEng, Sustainable Infrastructure

The Center for Geotechnical Engineering Science

Advances the understanding of the safety, reliability, performance, and environmental impact of engineered geotechnical structures. The Center also examines geotechnical stability, rock engineering, geoenvironmental engineering, and expansive soils.

The Transportation Research Center

Seeks to address local, state, national, and international concerns in all areas of 21st century transportation. The Center works in collaboration with other colleges and businesses, and has established several partnerships with Colorado's high-tech industry.

The IGERT Center for Sustainable Urban Infrastructure

UC Denver received a prestigious \$3.2M Integrative Graduate Education and Research Traineeship (IGERT) grant from the National Science Foundation to develop an innovative inter-disciplinary graduate program on sustainable urban infrastructure. The award supports 26 doctoral students during the five-year grant period from 2007-2012. The graduate program, the first of its kind in the country for its breadth across disciplines, spans the Colleges of Engineering, Architecture and Planning, Public Affairs, and Liberal Arts and Sciences.

College of Liberal Arts and Sciences

Sustainability Undergraduate Minor

Sustainability as one of the CLAS approved Signature Areas has participation from most of the departments in the College contributing expertise of faculty to the interdisciplinary integration of scientific principles, historic trends, philosophic theories and cultural forces that frame the socio-economic and ecological issues in the study of sustainability.

Social Justice, Civic Engagement and Critical Consumption signature area

Social Justice's interdisciplinary theme empowers students to acquire the intellectual tools and moral commitment to participate effectively and responsibly in the world. Engaging topics such as democracy, education, consumerism, media, race, class, and gender, students acquire the intellectual tools to investigate, and the practical knowledge to affect, how these systems, practices, and identities actually interact in our dynamic world. In the classroom and in service to the community, students thereby gain the ability to face 21st century challenges with intelligence and moral courage.

MS Social Sciences Degree: Society & the Environment Option

Society and the Environment is an interdisciplinary option for completing the Master of Social Science that emphasizes the human side of environmental issues, while also emphasizing that human issues are never separate from issues of ecology. It challenges students to apply knowledge from the social and biological sciences to environmental problems across a broad spectrum of institutional sectors and geographic locations. Applications include environmental hazards and disasters, environmental impact assessment, protected area management and interpretation, collaborative conservation, ecoregion conservation, conservation policy, and international development.

International Studies BA, Concentration in Economics, Development and Environment

Students taking this concentration will develop an understanding of economic processes in an international context. The courses offer comparative approaches and cultural perspectives on development and environment. Students will gain an understanding of economic principles and the social science skills needed to understand the multiple policy choices facing world leaders and local actors.

Department of Anthropology

Sustainable Development and Political Ecology Concentration

This concentration provides a critical perspective to issues of development and resource conservation, multi-cultural and multi-disciplinary perspectives. A particular strength of this program is the integration of theoretical knowledge with field-based training opportunities. Three major themes are addressed within this concentration: the types of resource management systems that exist around the world and their relationship to particular ecosystems; the types of knowledge systems and ideas that are associated with this diverse array of resource management systems ; and the culture of the global and local institutions – from small-scale NGOs to the World Bank – that design and implement conservation and development. A central goal of this emphasis is to help students imagine careers in conservation and/or development, and to provide them with information, opportunities, and resources to pursue a wide variety of career options.

Department of Integrative Biology**Graduate studies in Ecology**

The Department of Integrative Biology master's in science program offers two tracks: the coursework (non-research) M.S. track or the thesis (research) M.S. Track. Either track is available to students in nine specialty areas, including ecology.

CROP (Campus Raised Organic Produce) Research and Outreach:
Aquaponics and Community Gardens.

Department of Chemistry

Coursework: Environmental Chemistry

Department of Communication

Coursework: Environmental Communication

Department of Economics

Coursework: Economics of Natural Resources, Environmental Economics, Economic Development: Theory and Problem

Department of Geography and Environmental Sciences**B.A. in Geography**

Five options: General Geography; Environmental Science; Environmental Studies; Urban Studies; or Earth Science.

Undergraduate minors: Environmental Sciences, Geography, Geology, and Urban and Regional Planning.

Certificates: GISci and Environmental Sciences

Center for Environmental Sciences

The Center for Environmental Sciences was founded to promote disciplinary and interdisciplinary research in a wide array of areas within the environmental sciences. Services provided by the Center are available to all members of the University community, as well as to members of the public and private sectors through joint partnerships.

Faculty: Larry Anderson

M.S. Environmental Sciences

The M.S. in Environmental Science is an interdisciplinary science degree that prepares students for a job in the environmental field and has six options: Air Quality; Water Quality; Environmental Health; Hazardous Waste; Geospatial Analysis; and Ecosystems.

Faculty: Jon Barbour, Associate Director; John Wyckoff, Director

Department of History

Coursework: Environmental history, commodities and globalization

Department of Philosophy

Coursework: Environmental Ethics

Center for Ethics and Community

The Center for Ethics and Community seeks to strengthen ethics in schools, the community, universities, and all professions. Certificate programs are available to members of the UC Denver community, as well as individuals outside the University.

Department of Political Science

Coursework: Political Science: Global Ecological Crises, Environmental Politics and Policy

Fourth World Center for the Study of Indigenous Law and Politics

This Center provides resources and services that focus on the legal and political issues faced by indigenous populations. The Center features a library, periodicals, audio and visual equipment, and newsfile archives on current development issues surrounding "the Fourth World," and will soon offer a certificate program in this area.

The Center for New Directions In Politics and Public Policy

Offers a Master's Degree, undergraduate courses, and a Leadership Certificate focused in the areas of politics and public policy development. All of the programs and the courses help students develop the political acumen necessary for being effective leaders and agents of change in neighborhoods, communities, governmental jurisdictions, and nonprofit entities.

Department of Physics

Coursework: Energy and the Environment

Department of Ethnic Studies

Program: Ethnic Studies Minor/Certificate in Cultural Diversity Studies

Helps students develop a breadth and depth of understanding of ethnicity and its significance in contemporary American society. Presents the ethnic experience from an interdisciplinary perspective, providing a background in the theories and concepts required to understand and interpret inter- and intra-group relations in the United States. The Ethnic Studies minor focuses on the history, culture, and contemporary situation of Asian Americans, African Americans, Latinos, and American Indians.

School of Public Affairs

MPA Concentration/Graduate Certificate: Environmental Policy, Management and Law

The Environmental Policy, Management, and Law (EPML) program provides qualified applicants with an understanding of how the environment is affected by relationships between various entities, including legislatures; administrative agencies; courts; federal, state, and local governments; government and the nonprofit and private sectors; and government and the public it has been established to serve. Offered by the School of Public Affairs, University of Colorado Denver, the EPML program can be taken as either a stand-alone graduate certification program or as an emphasis area within the school's Master of Public Administration curriculum.

Wirth Chair in Environmental and Community Development Policy

The Wirth Chair in Environmental and Community Development Policy honors the environmental and sustainable development achievements of former Senator and Undersecretary of State Timothy E. Wirth. The Wirth Chair is committed to helping governments, businesses, non-profit groups and community organizations form sustainable development partnerships that carefully balance economic, environmental and expanded social welfare objectives and strategies. The mission of the Wirth Chair is to foster effective sustainable development strategies that will strive to meet the needs of the present without compromising the ability of future generations to meet their own needs. The Wirth Chair works to develop: meaningful environmental protection policies and programs; cost-effective energy management and energy efficiency programs; sound greenhouse gas emission reduction strategies; and fair and effective growth management strategies.

Colorado School of Public Health

Department of Community & Behavioral Health

Community & behavioral health merges the fields of sociology, psychology, anthropology and epidemiology to assess community needs and develop programs and policies that promote health, prevent disease and enhance quality of life. Research and degree programs emphasize community involvement and collaboration along with scientific evidence to understand and influence health and well-being as well as tools to educate for healthy living. Programs: MPH Community and Behavioral Health, MPH Community Health Education, DrPH Community and Behavioral Health

Department of Environmental & Occupational Health

Environmental & occupational health ensures our residential, professional and industrial environments are safe and sustainable. Researchers work closely with industry and policy makers to address issues of clean air and water, environmental health hazards, community and urban development, laws and regulations and sustainability.

High Plains Intermountain Center for Agricultural Health and Safety

The mission of the High Plains Intermountain Center for Agricultural Health and Safety (HICAHS) organization is to reduce and ideally eliminate accidents, injuries, diseases and deaths resulting from agricultural operations through education, intervention and research. Located on the Colorado State University campus in Fort Collins, Colorado, HICAHS is a multi-disciplinary organization with input from a variety of areas including engineering, industrial hygiene, education, toxicology, social work, epidemiology, environmental health, and agricultural sciences. The HICAHS center is one of ten national centers dedicated to agricultural health and safety.

Latino/a Research & Policy Center

The Latino Research and Policy Center (LRPC) 's mission is "to improve the quality of life for Latinos/as in Colorado and beyond through research, policy analysis, forums and publications." The LRPC hosts policy forums to address topics of concern in the Latino and Latina community, including educational equality, regulations for health maintenance organizations in Colorado, and a National Association of Latino Elected and Appointed Officials (NALEO) training session for Latinos and Latinas seeking election to public office.

Mountain & Plains Education & Research Center

The Mountain and Plains Education and Research Center (MAP ERC) is one of 17 Education and Research Centers funded by the Centers for Disease Control/National Institute for Occupational Safety & Health (CDC/NIOSH). Provides graduate training, continuing education and outreach in the seven-state region in the area of occupational and environmental health and safety.

Center for Global Health

This center serves to improve health and healthcare in communities around the world, through interdisciplinary collaboration within the University and with partners in research, education and health services. The CGH serves as a focal point for global health activities within the University and broader community. The CGH also brings together faculty from various disciplines at the University of Colorado and other Colorado universities to develop and participate in interdisciplinary research on significant global health issues.

International education

Study abroad programs in conservation

Examples: Grenada: Sustainability in the Caribbean: a 2010 Maymester geography/environmental science study tour to explore sustainability in Granada in the context of a developing country including hands-on experience with devising and implementing possible solutions to locally-needed research questions and agendas