A Greenhouse Gas Inventory for the Auraria Campus

FY2012

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AURARIA HIGHER EDUCATION CENTER

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Significant Changes from Final 2010 GHG Inventory

- Metropolitan State University of Denver (MSU Denver - formerly Metropolitan State College of Denver) has constructed and opened two new buildings on the Auraria Campus – the Student Success Building (SSB) and the Hotel Learning Center (HLC). The latter includes a public/private partnership with Springhill Suites as well as Red Robin's Burger Works. MSU Denver's new buildings have set the "neighborhood" precedent outlined in the 2012 Auraria Master Plan. New buildings are being owned, occupied, and in some cases, operated by the institutions directly. These buildings relative greenhouse gas inventory will be credited to the respective institution accordingly.
- The St. Francis Center was acquired by the Community College of Denver (CCD) from the Auraria Foundation, and the land was donated to AHEC. Therefore consumption data for this facility will be accounted to by CCD for FY2012.
- Gas usage by the Mercantile Building (906 Curtis Street) had not previously been reported due to the direct billing of tenant. Data has since been acquired from the tenant, Sodexo (Einstein's), for this report.
- It has been determined that minor discrepancies in previous inventories will no longer be formally changed due to the inevitability of minor inaccuracies inherent in the data collection process. Once a report is considered "finalized," revisions shall no longer be made to that inventory. Rather, omissions and edits will be referenced in subsequent reports.
- Alpine Waste, the campus recycling and waste hauler, installed scales on their trucks during FY2012. Previous diversion estimates provided by the company were inaccurate and overestimated recycling tonnages.

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Executive Summary

The Auraria Campus, in downtown Denver, is home to the Community College of Denver (CCD), Metropolitan State University of Denver (MSU Denver) and the University of Colorado Denver (CU Denver). Auraria Higher Education Center (AHEC), an agency of the State of Colorado, operates and maintains the campus on behalf of the three institutions. The AHEC Sustainability Officer has conducted this Greenhouse Gas Inventory 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 agreement requires that each signatory complete a Greenhouse Gas Inventory in even-numbered years and a Climate Action Plan (CAP) in odd-numbered years. Due to staffing changes in FY2012, AHEC received an extension from the ACUPCC for the required progress report due on 1/15/12. Therefore during 2012, both the progress report and greenhouse gas data was reported for FY2011. This FY2012 report should be considered as an update to the *previous* reporting requirement.

Methodology

This inventory covers fiscal year 2012 (July 2011 – June 2012) and uses the World Resources Institute (WRI) protocol to describe greenhouse gas emissions represented as metric tons of carbon dioxide-equivalents (MTCO2e). This methodology includes three "Scopes" of greenhouse gas (GHG) emissions.

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 primary 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 emissions from those that commute to the Auraria Campus, waste disposal, water transportation, etc. These emissions are not required by the ACUPCC to be included in the campus Climate Action Plan, and vary widely in terms of what is being counted from institution to institution within the ACUPCC program.

Results

Scopes 1 & 2 GHG Emissions

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 FY2008 totaled 40,430 metric MTCO2e (metric tons of carbon dioxide equivalents). Scopes 1 & 2 GHG emissions for FY2012 totaled 41,621 metric MTCO2e, up 2.9% from the baseline year.

Total Campus Scope 1 & 2 Emissions	MTCO2e
FY2008	40,430
FY2009	37,773
FY2010	40,411
FY2011	42,920
FY2012	41,891

Figure 1: Total Campus Scope 1 & 2 Emissions (MTCO2e)

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

- By 2020 - 20% decrease from baseline
- By 2030 - 50% decrease from baseline
- By 2050 - 80% decrease from baseline
- By2099 – 100% decrease from baseline (aka "climate neutrality" date) [1]

In order to meet the Scope 1 & 2 emission reduction goals of the 2010 Auraria CAP a focus should be kept on reducing building energy use including electricity, steam, and natural gas usage. This is supported by the chart below, which displays the various sources of Scope 1 & 2 emissions on campus.

[1] The establishment of a "climate neutrality" date was new to ACUPCC for the FY2011 Progress Report. The CFO's decided to extend this date as far out as possible within the reporting system – the year 2099.

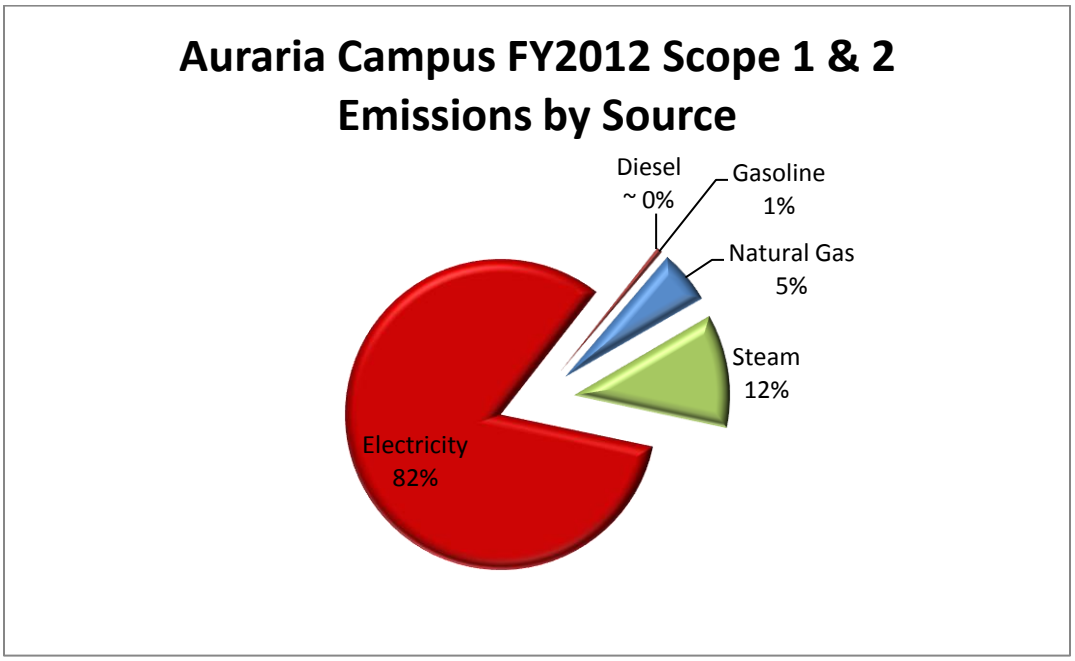

Figure 2: Auraria Campus FY2012 Scopes 1 & 2 Emissions by Source

Compared to FY2010, electricity consumption is up 4% as a percent of total Scope 1 & 2 emissions. This trend will need to be reversed if the ACUPCC GHG reduction targets are to be achieved.

Materials Sector: Additional Sustainability Metrics

Waste Management

Historically, diversion data provided by Alpine Waste had been *estimated* and not necessarily *weighed*. In early 2012, Alpine began to retrofit their hauling vehicles with scales to provide their customers with better data. This led to greater deviation in our monthly waste management data.

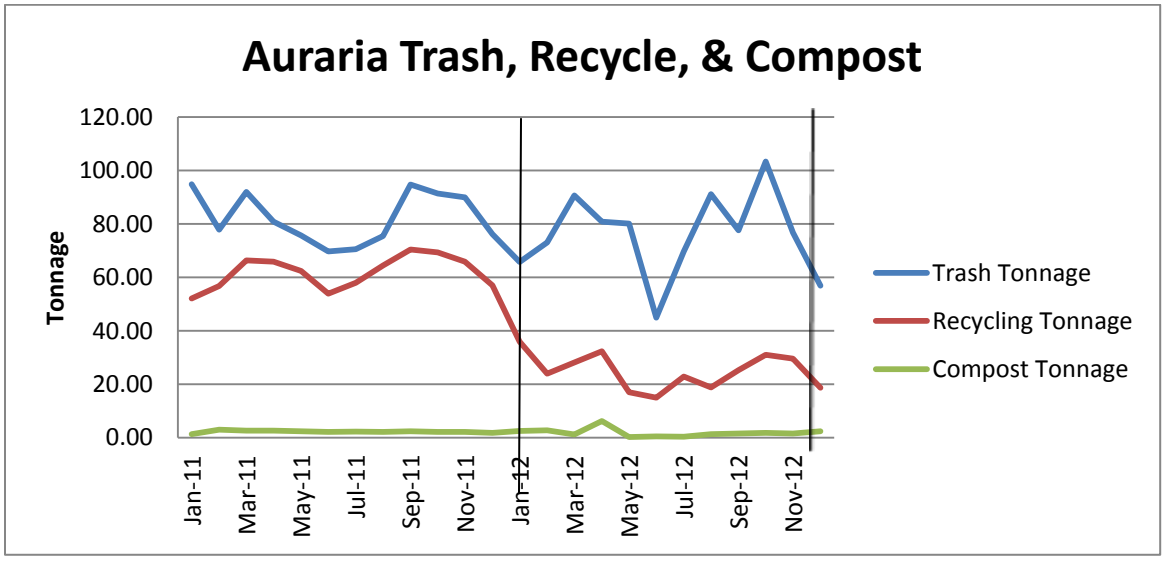

Figure 3.1: Auraria Campus Waste Management 1/2011-11/2012

The new data suggests that the campus diversion rate is much lower than previously thought. Therefore in partnership with AHEC Faculties Services, the AHEC Sustainability Officer has begun to take steps towards changing the recycling program logistics for the custodial crew.

Problem	Solution
Only one single-stream recycling compactor on campus	Convert two trash compactors to recycling
Time-consuming separation of cardboard from recycling	Convert "cardboard only" to single-stream recycling
Unrecognizable recycling drop-off locations for custodians (undifferentiated from trash)	Painted all recycling dumpsters/compactors blue and added signage/maps at each location
Trash and recycling locations mostly unpaired	Moved King Center trash compactor to Plaza dock, converted Tech cardboard recycling to single-stream
Unrecognizable trash vs. recycling bags	Recycling bins now use clear bags, black only for trash
Unpaired interior/exterior receptacles	All recycling bins must be paired with trash cans
Lack of education on program	In person trainings and handouts; ongoing education

Figure 3.2: Auraria Campus 2012 Waste Management Changes

Moreover, the composting program received funding in FY2012 to overhaul signage and bins within the Tivoli Student Union food court. This "phase 2" of the composting program also sparked a partnership with the US EPA in the form of AHEC formally partnering as a WasteWise member – committing to increase diversion rates by 5%. This includes participation in the EPA's *Food Recovery Challenge* that aims to keep food waste out of the landfill – further decreasing Auraria's Scope 3 emissions.

Commuter Fuel Use: Scope 3 Emissions

A commuter survey was performed during FY2012 prior to the submission of the Campus's 2011 ACUPCC Progress Report. The findings were reported in the FY2011 greenhouse gas inventory as no survey was completed during FY2011. However, this data shall be used for the FY2012 report as it is the most relevant data available. The aggregation of all commuting results in Auraria's total Scope 3 Emissions is 20,690 MTCO2e.

Total Scope 3 Emissions (Commuting)	Emissions (MTCO2e)
FY2008	22,428
FY2009	-
FY2010	19,723
FY2011	-
FY2012	20,690

Figure 4: Total Campus Scope 3 Emissions from commuting (MTCO2e)

As with the previous GHG inventory, only one half of the Scope 3 emissions resulting from campus commuting will be attributed to Auraria in order to avoid double-counting emissions claimed by the community in which each trip originates (Ramaswami, et al. 2007). No commuter survey was performed for FY2009 or FY2011.

Total Emissions (Scopes 1, 2 & 3)

The total GHG emissions for the Auraria Campus for FY2012 were 62,581 MTCO2e.

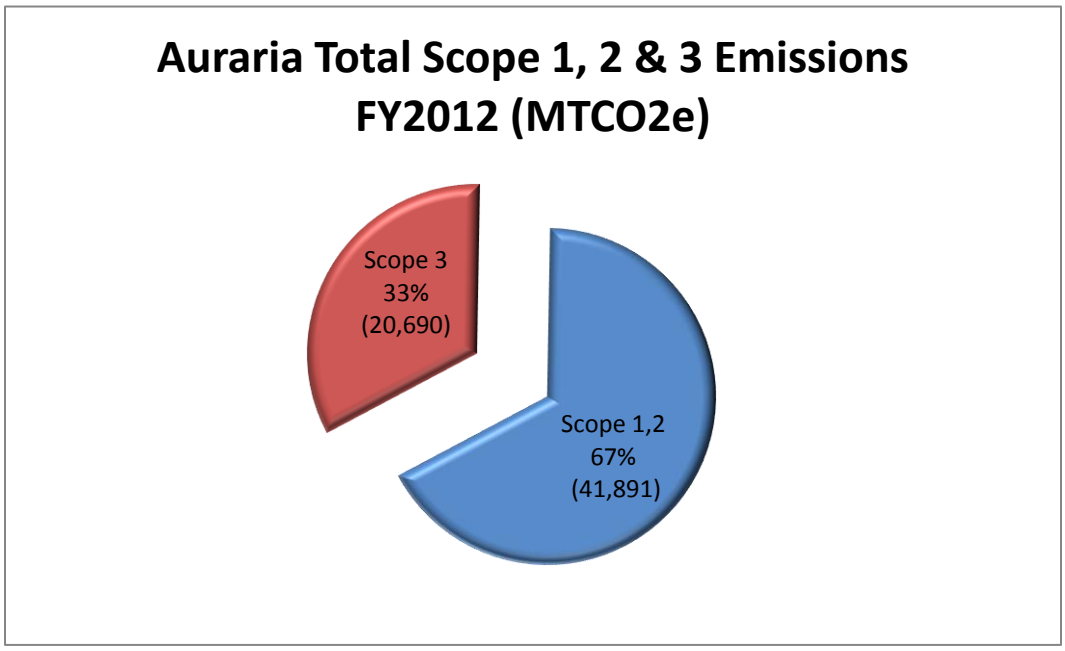

Figure 5: the total GHG emissions for the Auraria Campus for FY2012

Emissions by Intuitions

Shared

In a February 2010 meeting between AHEC staff and the Chief Financial Officers (CFOs) of the three institutions, for the purposes of the ACUPCC, it was decided to divide the total Scope 1 and 2 emissions amongst the three schools based on the amount of space the schools occupy on campus. This applies to facilities that remain shared between the three institutions and not newly constructed buildings owned by the respective institutions. The total amount of *shared* campus Scope 1 & 2 GHG emissions for FY2012 was 41,891 metric tons of CO2 equivalents (MTCO2e from buildings and vehicle fleet). Based on the methodology above the Scopes 1 and 2 emissions by institution are as follows:

1. CCD – 13.79% or 276,019 sq ft = 5,608 MTCO2e
2. MSU Denver – 56.81% or 1,137,408 sq ft = 23,101 MTCO2e
3. CU Denver – 29.40% or 588,537 = 11,955 MTCO2e

Institution Specific Buildings

1. CCD – Confluence Building (under construction) / St. Francis Center = 372 MTCO2e
2. MSU Denver – Student Success Building (opened March 2012) and Hospitality Learning Center (under construction) = 856 MTCO2e
3. CU Denver – Academic building coming in 2013 = 0 MTCO2e

Total Scope 1 & 2 Emissions by Institution

1. CCD = 5,980 MTCO2e
2. MSU Denver = 23,957 MTCO2e
3. CU Denver = 11,955 MTCO2e

Next Steps

- In order to meet the Scope 1 & 2 emission reduction goals of the 2010 Auraria CAP a focus should be kept on reducing building energy use, especially electricity.
- A more comprehensive, accurate, and reliable building energy use tracking system should be developed. *Update: in early 2013 an Energy Monitoring System was installed to collect utility use from existing meters in a more reliable, consistent, and timely manner. Therefore the "next step" should be purchasing EnergyCap analysis software that would be a valuable complement to the system. AHEC has decided to purchase this software as of April 2013.*
- AHEC could work with the campus institutions to develop more "Additional Sustainability Metrics," such as those related to campus procurement.

Section 1: Community of Auraria

The Auraria Campus, in downtown Denver, is home to the Community College of Denver, (CCD) Metropolitan State University of Denver (MSU Denver) and the University of Colorado Denver (CU Denver). Auraria Higher Education Center (AHEC), an agency of the State of Colorado, operates and maintains the campus on behalf of the three institutions. With nearly 50,000 students attending all three schools, and over 3,000 faculty and staff, the Auraria Campus is one of the largest urban campuses in the nation. The campus comprises 151.5 acres and nearly 40 buildings (not including trailers used as classrooms), a majority of which were 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.

Figure 6: Auraria Campus Map

Section 2: Background and Context

American College and University President's Climate Commitment

The American College and University President's Climate Commitment (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 Greenhouse Gas (GHG) Inventory in even-numbered years and a Climate Action Plan (CAP) Progress Report in odd-numbered years. The goal of a GHG Inventory is to describe "where an organization is" in terms of GHG emissions and is thus a detailed list.

The campus' first GHG Inventory accounted for FY0708 and was completed in January 2008. It was coordinated by an undergraduate student in the CU Denver Center for Sustainable Urban Infrastructure and revised in February 2010 by the AHEC Sustainability Officer, also a PhD student in the same program. The first Auraria Campus Climate Action Plan (CAP) was completed in August 2010, as AHEC was granted an extension from the original December 2009 deadline. The last and most recent submission was for the CAP Progress Report that was due in January 2012, but AHEC was granted an extension and reported mid-2012.

Consistent with other state colleges and universities and with the State of Colorado's Climate Action Plan, the 2010 Auraria Campus Climate Action Plan calls for the following goals for campus Scope 1 & 2 GHG emissions reductions:

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

Additionally, the ACPUCC calls upon signatories to create institutional structures to drive the development of GHG Inventories and CAPs and the requisite planning. In January 2010, AHEC hired a part-time Sustainability Officer to work on behalf of CCD and MSU Denver, 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[2]. A full-time professional Sustainability Officer was hired in January 2012 who now oversees reporting requirements and sustainability for the campus. This position chairs the Auraria Campus Sustainability Council (ACSC) which meets monthly to work together to inform this document as well as other sustainability and climate-related projects and policies on campus. In 2012, neighboring ACUPCC signatories within the state were surveyed and were found to approach their respective committee's membership appointments with direct support from the Administration. Campus leadership should consider formally institutionalizing this committee and developing requisite documents such as bylaws.

In addition to the ACSC, an advisory-based group, there is a Sustainable Campus Program (SCP) on the Auraria Campus. The SCP is a project-based group funded by a student fee that has existed since January 2008 and was extended from 2012 through Spring of 2016. The SCP fee was overwhelmingly approved by the student body in April 2007 and 2011. The SCP 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 on their website www.sustainableauraria.org.

In addition to the ACUPCC and SCP, another institutional context to consider is that campus climate action planning fits within the development principles of the Auraria Campus Master Plan of 2007 which was updated in 2012. 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. The 2012 Master Plan continues these principles. It is highly recommended that the next iteration in 2017 more thoroughly examines sustainability as a critical element of the planning process.

Section 3: GHG Inventory Goals and Methodology

Goals and Objectives

The primary goal of most GHG inventories in the U.S. today is the same as Auraria's goal: to facilitate

[2] CU Denver hired its own Sustainability Officer in November 2007 who submits documents to the ACUPCC for CU Denver

public reporting and participation in voluntary GHG programs, which in this case is the ACUPCC.

As climate-related legislation and policy is promulgated at the state and federal level there are additional goals and objectives to GHG reporting that will become increasingly important. GHG inventories facilitate participation in GHG markets such as the Chicago Climate Exchange or the Colorado Carbon Fund. On related points, these inventories can be used to manage GHG risks and identify reduction opportunities to allow recognition for early voluntary action.

Methodology

The World Resources Institute's (WRI) GHG Accounting Protocol is rapidly becoming the standard methodology used by companies, governments, and organizations around the world for greenhouse gas accounting. To determine what is included organizational activities are broken into two categories and emissions are broken into three categories, these are all described below. Also described below are explanations for the GHG units and calculations, discussion on the WRI accounting and reporting principles, and limitations of this GHG inventory.

In-Boundary Activities

Direct emissions, designated by the WRI as Scope 1 & 2, are required in all inventories and are those covered by the ACUPCC. In-Boundary activities include:

1) Energy use in buildings and facilities, including electricity, natural gas, and steam.
2) Tailpipe emissions from university-owned vehicles.

Out-of-Boundary Activities

Indirect emissions, designated by the WRI as Scope 3, are optional in terms of their inclusion in an inventory, but "provide an opportunity to be innovative in GHG management" (World Resources Institute 2004). A limited number of relevant Scope 3 emissions are highly recommended by the EPA. These emissions should be chosen to reflect critical functions of the organization. The only Scope 3 item included in this GHG Inventory is commuter travel: tailpipe emissions of non-university-owned vehicles (students, faculty and staff) used for commuting to Auraria's facilities.

In the pre-FY2010 GHG Inventories, the embodied energy of some "key materials" purchased for the Auraria community were also included in Scope 3 emissions. Some examples of these materials included: water, electronics recycling, and solid waste/recycling. The Scope 3 emissions resulting from the use of

these materials were NOT included in this report and the reasoning for this change is explained below.

First, these materials collectively make up less than 1% of Scope 3 emissions, with 99% resulting from commuting. Given this, and the fact that Scope 3 emissions are not required by the ACUPCC, it seemed less important and perhaps even distracting to drill down on these emissions. In other words, if Scope 3 emissions are to be reduced, a focus should be on reducing the GHG intensity of commuting. Also, the reduction of water use on campus as well as campus generated municipal solid waste, and a corresponding increase of recycling, have sustainability-related benefits beyond their respective GHG impacts.

Therefore, campus water use as well as waste management data will be reported as separate sustainability metrics in this document and their GHG impacts will not be examined. Data for other relevant Scope 3 inclusions was unavailable for metrics such as: institutional-sponsored air travel, campus purchases of office paper, and food.

GHG Units and Calculations

In an effort for consistency, all of these gases are measured in carbon dioxide-equivalents (CO_2e). CO_2e calculates the impact of the other GHGs by their Global Warming Potential (GWP) compared to that of CO_2. The Global Warming Potential is the "ratio of the time-integrated radiative forcing from the instantaneous release of 1 kg of a trace substance relative to that of 1 kg of a reference gas" (*EPA GHG Inventory 2007*). For example, one metric ton (1000 kilograms) of CO_2 equals one metric ton of CO_2e; however, one metric ton of methane (CH_4) is equal to 21 metric tons of CO_2e.

Total CO_2e emissions are calculated by multiplying the Energy/Material Flow Analysis (E/MFA) by that energy/material's Emission Factor (EF) from its Life Cycle Assessment (LCA): $Total\ CO_2e\ emissions = E/MFA * EF_{LCA}$. In this equation E/MFA represents the number of units of a material or energy (i.e. total kilowatt hours used, for example) and EF_{LCA} represents the amount of CO_2e attributable to each (kilograms of CO_2e per kilowatt hour, for example).

As mentioned, emissions are separated into two categories: *In-boundary* (direct) emissions, such as those as a result of heating, cooling and providing electricity to the buildings on campus, tailpipe emissions of AHEC-owned vehicles, and on-site leakage of refrigerant; and *Out-of-boundary* (indirect) emissions, such

as tail-pipe emissions of commuter traffic.

Accounting and Reporting Principles

Below is a summary of World Resources Institute's GHG Accounting Protocol, which served as the framework for this approach, and WRI's five accounting and reporting principles:

1) *Relevance* – This ensures that the data collected and the information harvested is of use to decisions makers, as opposed to just abstract measurements. This data must be collected according to clearly defined boundaries based on financial and managerial influences that allow the company procedural control. The boundaries can be based on organizational structures, operational boundaries and/or the business context of the entities involved.
2) *Completeness* – The data collected can only be useful if it is done in a consistent, comprehensive manner.
3) *Consistency* – For the data to be useful, it needs to be consistent enough to be compared over time between and among similar companies. Consistency overtime is crucial. Unnecessary changes that would deem past measurements as unreliable should be avoided.
4) *Transparency* – For that data to be tracked and compared over time and across sectors, the methodologies, procedures and limitations must be highly visible. These processes must be clear and understandable to allow internal review and external verification.
5) *Accuracy* – Decision-makers need to be assured of the precision of the data in order to minimize uncertainty and to maximize benchmarking. This will lend greatly to the credibility of the information and the transparency of the methods used to get it.

Limitations and Considerations

1) As previously mentioned, a commuter survey was performed in FY2012. However given the timing of the results, emissions associated with Scope 3 commuting were reported for FY2011 to ACUPCC. Since these numbers likely reflect emission during FY2012, the same survey (and results) has been used for this report.
2) Some materials essential to operations on campus were not reported, such as food, air travel, and office paper, so their impact is not taken into account. These could be considered "key materials" and are all very relevant considerations for educational institutions. Potential inclusion in future reports should be considered.
3) Auraria's energy intensity is seemingly much higher than the average identified by the 2003

Commercial Building Energy Consumption Survey (CBECS) for higher education. However, it's important to consider the reliability of such averages.

"Making fair comparisons between higher education institutions is always challenging due to the rich diversity of higher education. The unverified nature of the information in this database and unavailability of unbiased normalization metrics means such comparisons are even more difficult. Users should therefore approach direct institution to institution comparisons with caution and recognize that all comparisons between institutions are inherently biased" (ACUPCC 2008).

Nonetheless, Auraira needs to improve building efficiency regardless of comparison to other institutions of higher education (see section 4.1.3 Normalizing for Growth and Energy Use Index).

Section 4: Inventory Results by Sector

Section 4.1: Buildings Sector

The emissions resulting from Auraria's buildings and facilities sector in FY2012 totals 41,621 MTCO2e. This is up from the baseline year of FY2008 by about 3.6%. The building energy use and GHG emissions for the past three years are presented below.

Natural Gas	**Usage (therms)**	**kBtu**	**Emissions factor (source)**	**Emissions (MTCO2e)**
FY2008	583,030	58,303,000	0.056 kg CO2e /kBtu (ICLEI)	3,265
FY2009	514,965	51,496,500	0.053 kg CO2e / kBtu (USEIA)	2,729
FY2010	573,746	57,374,600	0.053 kg CO2e / kBtu (USEIA)	3,041
FY2011	459,838	45,983,800	0.053 kg CO2e / kBtu (USEIA)	2,437
FY2012	434,019	43,401,900	0.053 kg CO2e / kBtu (USEIA)	2,300
Electricity	**Usage (kWh)**	**kBtu**	**Emissions factor (source)**	**Emissions (MTCO2e)**
FY2008	40,433,156	137,958,000	0.800 kg CO2e / kWh (Xcel)	32,347
FY2009	40,531,754	138,294,000	0.743 kg CO2e / kWh (Xcel)	30,115
FY2010	43,955,138	149,974,931	0.717 kg CO2e / kWh (Xcel)	31,516
FY2011	45,834,869	156,388,572	0.763 kg CO2e / kWh (Xcel)	34,972
FY2012	46,942,925	160,169,260	0.734 kg Co2e / kWh (Xcel)	34,456
Steam	**Usage (lbs)**	**kBtu**	**Emissions factor (source)**	**Emissions (MTCO2e)**
FY2008	54,218,000	54,218,000	84 kg Co2e / 1000 lbs (Xcel)	4,554
FY2009	55,607,000	55,607,000	84 kg Co2e / 1000 lbs (Xcel)	4,671
FY2010	66,934,000	66,934,000	84 kg Co2e / 1000 lbs (Xcel)	5,577
FY2011	62,383,770	62,383,770	84 kg Co2e / 1000 lbs (Xcel)	5,240
FY2012	57,917,675	57,917,675	84 kg Co2e / 1000 lbs (Xcel)	4,865
FY2008				**40,166**
FY2009				**37,515**
FY2010				**40,134**
FY2011				**42,649**
FY2012				**41,621**
Scope 1	Scope 2	Total Scopes 1 & 2		

Figure 7: Total Emissions from Auraria Campus Building Energy Use FY2008 – FY2012

These emissions represent the vast majority of all Scopes 1 & 2 emissions but a small amount of Scope 1 emissions results from the tailpipe emissions AHEC fleet, which will be discussed later.

Section 4.1.1: Campus-wide Energy Use: Scopes 1 & 2 Emissions

Campus energy use data used to calculate GHG emissions was provided by Karline Balmforth in AHEC Facilities Management in the form of energy bills from Xcel Energy (a private third-party provider of electricity, steam, and natural gas) as well as Tiger Gas (a private third-party provider of natural gas) entered into an AHEC spreadsheet. This data includes electricity, steam, water, and natural gas use throughout the entire campus for FY2011-FY2012.

The campus building energy use by source for the last five fiscal years is listed below in both table and graph form. The units of therms (natural gas), kilowatt-hours (electricity), and pounds (steam) have all been converted to British Thermal Units (Btu) to facilitate comparisons (1 kBtu = 1,000 Btu).

Auraria Campus Building Energy Use (kBtu)					
Energy	FY2008	FY2009	FY2010	FY2011	FY2012
Natural Gas	58,303,000	51,496,500	57,374,600	45,983,800	43,401,866
Electricity	137,958,000	138,294,000	149,974,931	156,388,572	160,169,260
Steam	54,218,000	55,607,000	66,394,000	62,383,770	57,917,675
Total	250,479,000	245,397,500	273,743,531	264,756,142	261,488,801

Figure 8: Auraria Campus Building Energy Use by source FY2008 – FY2012

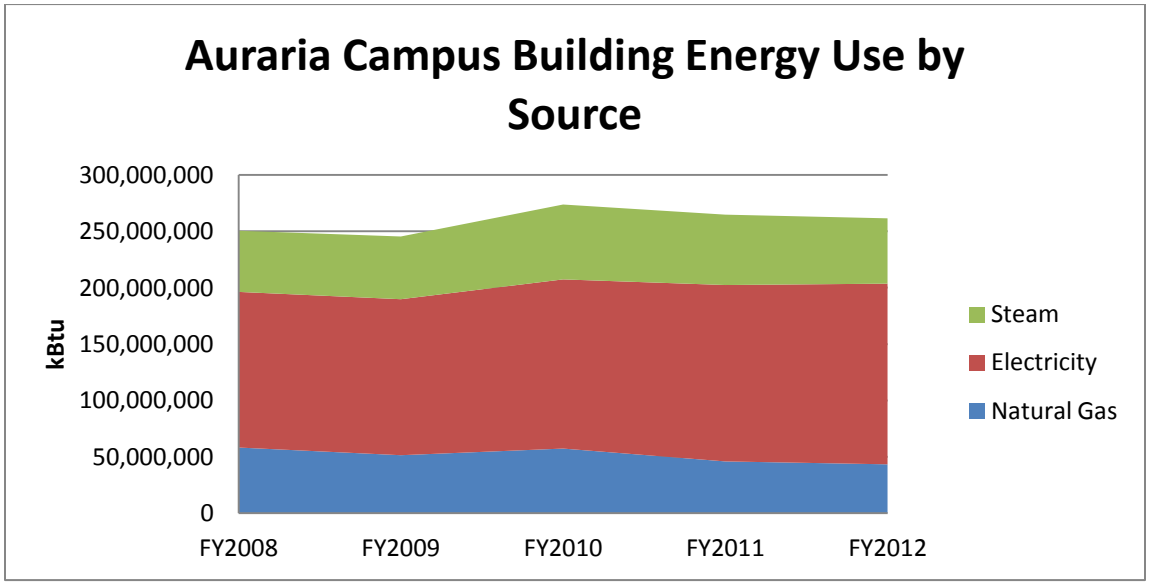

Figure 9: Auraria Campus Building Energy Use by source FY0708 – FY0910

Of the three energy sources that are used to power Auraria Buildings, electricity is the largest both in terms of consumption and in terms of responsibility for Scopes 1 & 2 Emissions, as can be seen below.

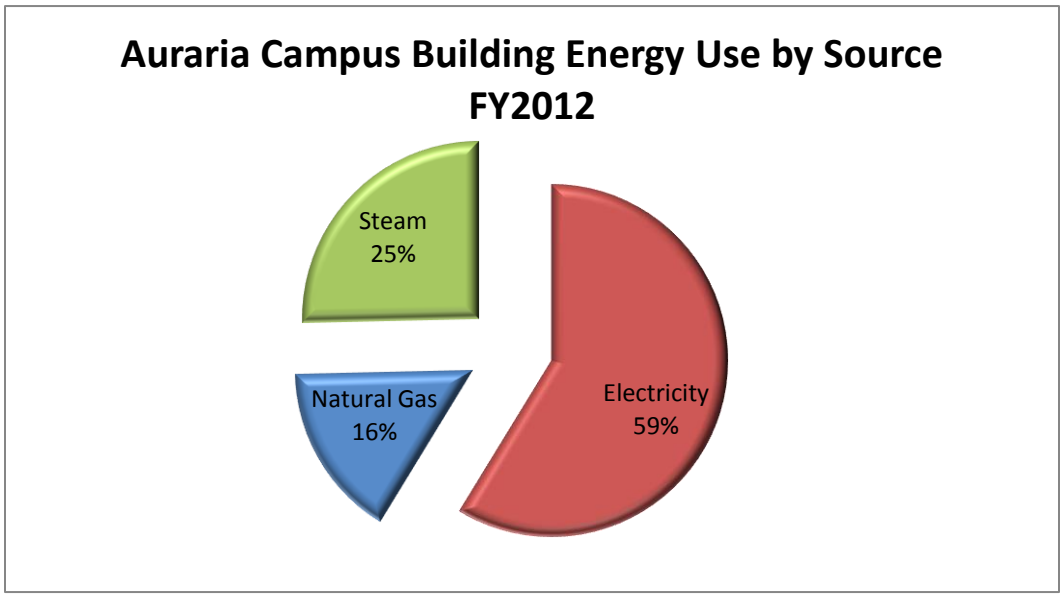

Figure 10.1: Auraria Campus Building Energy Use by relative source FY2012

Natural Gas Use

Natural gas use for the campus totaled 434,019 therms (or 43,401,866 kBtu) for FY2012, which is down significantly from the baseline year of FY2008. This can be explained by mild winters and improvements in the efficiency of on-campus boilers.

Natural gas is used to heat many campus buildings and represents 16% of the energy used in campus buildings. The greatest consumers of natural gas on campus are the King Center and the St. Francis Center. The latter is now controlled by the Community College of Denver as part of their new campus "neighborhood." The King Center however is still owned and operated by AHEC, and will be receiving a technical-grade retro-commissioning study in FY2013 thanks to funding by the Sustainable Campus Program. This study should further decrease natural gas consumption on the Auraria Campus. It is worth noting, however, that since this building is supplied by "transport" gas, it is *not* eligible for gas saving rebates from Xcel Energy.

Steam Use

Steam use for the campus totaled 57,917,675 pounds (or roughly 57,917,675 kBtu) for FY2012. This amount is down compared to FY2010 and FY2011, but similar to FY2008 and FY2009. AHEC Facilities Management has undertaken many projects over the years to improve the steam system by repairing or replacing steam traps when feasible. Better sub-metering infrastructure is being installed during FY2013 to better track, trend, and manage steam use on campus for the future.

Steam is used to heat many of the campus buildings, and represents 25% of the energy used in campus buildings. The most effective way to reduce the consumption of steam and the resulting emissions from its use is to upgrade any additional steam traps not repaired or replaced and to fix any additional sources of significant leaks. It's worth noting that the long-term utility infrastructure master plan for campus calls for a shift away from steam use on campus. Rather, on-site natural gas boilers have been specified for most new applications (with the exception of the Science Building).

Electricity Use

Electricity use for the campus totaled 46,942,925 kilowatt-hours (or 160,169,260 kBtus) for F2012, making up the majority of energy used to power campus buildings, such as lighting and HVAC systems. Electricity as a source is the vast majority of campus Scope 1 & 2 emissions. Therefore, reducing electricity consumption should continue to be a focus of efforts to reduce campus GHG emissions. The following depiction from FY2012 shows the disproportionate effect that electricity use has on our greenhouse gas inventory. This is in part due to the carbon intensity of the fuel (predominantly coal) as well as the high-levels of relative consumption.

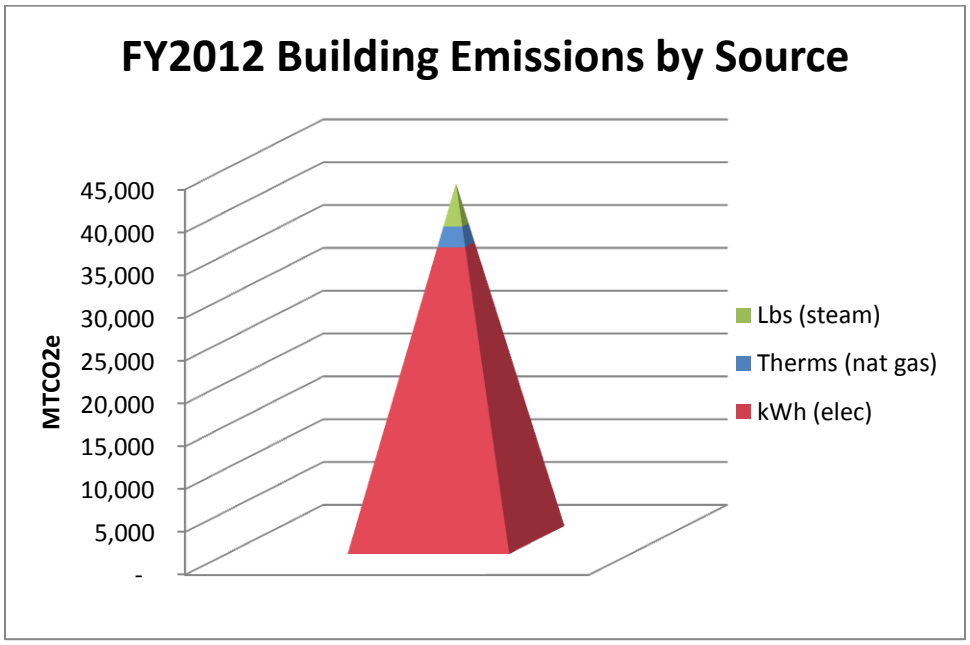

Figure 10.2: Auraria Campus Building Emissions by relative source FY2012

Section 4.1.2: GHG Emission Factors

Natural gas

Natural gas emission factors do not vary greatly from region to region and have been calculated as 53 kg of CO_2e/MMBTU (EIA, 2003).

Steam

Emissions from steam generation are dependent on the efficiency of boilers at the steam plant. Xcel's steam plant averages a CO_2e intensity of 185 pounds (83.91 kgs) per pound of steam (Kutska 2008). However, the Zuni Street steam plan is scheduled to be retired in the near future. New facilities may have a higher efficiency and therefore and lower emissions factor.

Electricity

The emission factor for electricity use is calculated for each region by the mix of energy sources used to generate electricity for the grid, including transmission and line losses. Due to numerous statewide public policies and industry advancements, the grid in Colorado has become less carbon-intensive. For instance, in 2011 (published in 2012) in Colorado coal made up 59.80% of the fuel mix, down from 61.31% in 2010. The level of reneable and non-fossl fuel energy on the grid increased from 11.81% to 16.09% during the same period (Xcel Energy 2012). This reduction in the emission factor positively effects the campus inventory despite an increase in electrical consumption of 2.42% from FY2011 to FY2012.

The emission factor for electricity in Colorado in FY2012 accounts for 0.734 kg of CO_2e/kWh (down from 0.763 CO_2e/kWh in FY2011). Colorado's emission factor is still higher than the national average of 0.6 kg of CO_2e/kWh because of the lack of nuclear and additional hydroelectric power sources.

Section 4.1.3: Normalizing for Growth and Energy Use Index

The Auraria Campus has, and will continue to, add a number of buildings to accommodate growth in academic and research programs. For this reason, reducing total aggregate energy use on campus will be much more difficult. However by examining the ratio of total campus building energy use in kilo British Thermal Units (kBtu), to total campus building GSF, we can make more meaningful comparisons. This ratio is called the Energy Use Index (EUI) and is the best indication of building efficiency.

Year	EUI (kBtu/SF)
FY2008	122
FY2009	119
FY2010	122
FY2011	124
FY2012	123
Auraria Average	**122**
National Median for College Campus Buildings (CBECS, 2003)	104

Figure 11: Campus Energy Use Index FY2008 – F2012 Compared to National Median

It is important to note the increase in EUI compared to what was published previous reports. This discrepancy is partially due to a conversion factor used to convert 1,000 lbs of steam to kBtu - this graph uses 1.194 (Energy Star) whereas previous reports used 1.0. It was also found that the national median was lower than initially reported (CBECS, 2003).

The aggregated campus EUI for the baseline year of FY2012 is 122 kBtu/gsf. This value is much higher than the 2003 national median of 104 EUI for a college/university campus[3]. This is not surprising as the vast majority of buildings operate with original 1970's mechanical systems. There is also a significant opportunity with lighting controls and automation that has yet to be utilized.

[3] Commercial Building Energy Consumption Survey (CBECS), 2003.

The Auraria Campus is currently unable to calculate accurate EUI for each building because not all buildings are individually sub-metered.

Section 4.1.4: Building Energy Use Considerations

Issues regarding FY2011 energy usage

On August 9,2010, the Central Classroom officially switched over to a new steam line from one that had previously been leaking. This may account for much of the decrease in steam usage for FY2011. Other leaks/issues were remedied in the Science Building and North Classroom. However, the new Science Building now uses steam for building heat and hot water purposes which most likely off-set much of these savings.

Moreover, the utility spreadsheet that was provided for the FY2011 report had inaccurate steam consumption figures. The amount initially reported in was 77,017,000 lbs of steam. However after getting consumption numbers from Xcel later in FY2012, actual billed usage was 62,383,770 for FY2011. It is important to note that this updated figure (and all reported figures to-date) includes a 19% trap loss allowance from Xcel. Since this is the figure that is on our bill each month, this number has been (and will be) used for reporting purposes.

Another discrepancy was found in the spreadsheet for Electrical consumption. It appears that only one of two King Center meters was being recorded. The combined consumption has been updated following the initial report to ACUPCC.

Issues regarding FY2012 energy usage

The biggest change in FY2012 was the start of the institution-owned buildings “neighborhood” concept. Not only does the new consumption add to our overall energy use, it also requires careful assignment of said greenhouse gas emissions specific to that institution. FY2013 will see more of an impact from these activities as FY2012 was primarily a construction year for said buildings.

The same King Center discrepancies identified for FY2011 were also identified for FY2012. The correct numbers are reflected in this report. In the future, data compiled by the Energy Monitoring System (ETA March 2013) will be used to cross check manually read or billed figures.

Section 4.2: Transportation Sector

The transportation-related Scope 1 emissions are tailpipe emissions from the AHEC vehicle fleet used in the operations and maintenance of the campus. As discussed earlier, these emissions are covered by the ACUPCC but it should be noted that these emissions represent approximately 1% of the total Scope 1 & 2 emissions for the campus, and are thus dwarfed by the emissions related to building energy use.

The Scope 3 transportation emissions come from the commuting habits of the Auraria community. Travel by automobile, light rail or bus also produces point-of-use emissions but these cannot be directly controlled by AHEC and thus are Scope 3, outside the purview of the ACUPCC.

Section 4.2.1: Campus-wide Fuel Use: Scope 1 Emissions

The scope 1 emissions resulting from tailpipe emissions of all AHEC vehicles equals 270 MTCO2e which is up approximately 2.3% for the baseline year FY0708.

As mentioned, these activities include the tail-pipe emissions of vehicles owned and operated by AHEC, which are fueled by an on-site station which buys its fuel in bulk. AHEC purchased a total of 27,610 gallons of gasoline and 1,349 gallons of diesel in order to fuel its fleet in FY2012. While a noble goal, reducing the gasoline and diesel consumption on campus would do very little to reduce the Scope 1 & 2 emissions of the Auraria Campus. Nonetheless it is worth noting that diesel use was down 41.48% in FY2012 compared to FY2011. The Grounds Department believes this was due to a mild snow season.

Gasoline	Usage (gallons)	Emission factor (source)	Emissions (MTCO2e)
FY2008	26,099	9.3 CO2e / gallon (GREET)	243
FY2009	25,920	9.3 CO2e / gallon (GREET)	241
FY2010	27,752	9.3 CO2e / gallon (GREET)	258
FY2011	26,827	9.3 CO2e / gallon (GREET)	249
FY2012	27,610	9.3 CO2e / gallon (GREET)	257
Diesel			**Emissions (MTCO2e)**
FY2008	2,196	9.5 kg CO2 / gallon (GREET)	21
FY2009	1,783	9.5 kg CO2 / gallon (GREET)	17
FY2010	2,027	9.5 kg CO2 / gallon (GREET)	19
FY2011	2,305	9.5 kg CO2 / gallon (GREET)	22
FY2012	1,349	9.5 kg CO2 / gallon (GREET)	13

Figure 12: Auraria Scope 1 Transportation Emissions

Section 4.2.2: Campus-wide Fuel Use: Scope 3 Emissions - Commuting

A commuter survey was administered by AHEC in March 2012 to determine parking and transportation behaviors of its own staff, and the students, faculty and staffs of each of the three campus institutions. There were 2,929 respondents representing approximately 6% of the campus population of 46,810 students, faculty and staff.

The campus population estimates are based on: 1) faculty and staff counts reported by the three institutions and AHEC from Human Resources departments (Total = 3,180), and 2) counts of fee paying students from the three institutions (Total = 43,630 as of Spring Semester). Approximately 80% of survey responders were students. UCD made up 73% of responders, Metro State 13%, CCD 10%, and AHEC 3%. Across all three institutions plus AHEC staff, on the average day:

- 44% of the respondents take the bus or light rail to campus
- 29% of respondents drive alone and park either on-campus or off-campus
- 5% carpool to campus or are dropped off
- 5% bike to campus
- 6% walk to campus
- 10% work from home
- The average commuting distance for the respondents was 13.7 miles one-way

Using this survey data, a composite per-capita transportation model was created for the campus community using the behavior estimates below.

- The average commute of 13.7 miles one-way was halved (6.85 miles) for the percentage of the community that carpool to campus or are dropped off
- The estimated weighted average miles-per-gallon for gasoline in Colorado of 16.8 mpg, (ICLEI)
- A reasonable number of days on campus each week (assuming students = 3, faculty and staff = 5 days per week)
- A reasonable number of weeks on campus per year (assuming students = 32, and both faculty and staff = 48 weeks per year)

Based on the survey data 59,697,000 person-miles were travelled via bus or light rail by students, faculty and staff in 2012 to get to and from campus. The associated emissions with this mode of transport equates to 8,955 MTCO2e.

Excluding public transportation, the campus community burned 2,524,000 gallons of gasoline commuting to and from campus, creating 11,735 MTCO2e in greenhouse gases.

Commuting (auto)*	**(gallons)**		**Emissions (MTCO2e)**
FY2008	2,812,843	9.3 kg CO2e / gallon (GREET)	13,080
FY2009	-		-
FY2010	2,822,704	9.3 kg CO2e / gallon (GREET)	13,126
FY2011	-		-
FY2012	2,524,000	9.3 kg CO2e / gallon (GREET)	11,735
Commuting (public)*	**(Peron-Miles-Traveled)**		**-**
FY2008	62,321,196	0.3 kg CO2e / PMT (WRI)	9,348
FY2009	-		-
FY2010	43,978,982	0.3 kg CO2e / PMT (WRI)	6,597
FY2011	-		-
FY2012	59,697,000	0.3 kg CO2e / PMT (WRI)	8,955
Total Commuting			**Emissions (MTCO2e)**
FY2008			22,428
FY2009			-
FY2010			19,723
FY2011			-
FY2012			20,690

*Only 1/2 of these emissions are attributed here, to avoid double-counting (Ramaswami, et al. 2007).
No commuter survey performed for FY2009 or FY2011 (though FY2012 data originally reported in FY2011 to ACUPCC)

Figure 13: Auraria Scope 3 Commuting Emissions

Emissions of commuter traffic are particularly important for the Auraria Campus as it is primarily a commuter campus with students, faculty and staff having to drive or take transit to reach the campus.

Section 4.2.3: Emission Factors

According to GREET (a transportation-related GHG emissions model developed by the US Department of Energy), the tailpipe emissions for gasoline and diesel amount to 9.3 and 9.5 kg-CO2e /gallon, respectively (GREET 2010.). According to the World Resources Institute, the emissions from mass transit (bus and lightrail) are averaged to be 0.3 kg CO2e / Person-miles-traveled (WRI 2009).

Section 4.3 Material Sector: Additional Sustainability Metrics

In pre-FY2010 Campus GHG Inventories, the Scope 3 emissions resulting from the campus waste and recycling as well as water use were calculated. The contribution to the total campus emissions from these sources was negligible and considered "de minimis" for reporting purposes. Given this, and the fact that Scope 3 emissions are not required by ACUPCC, the decision was made to not calculate the GHG contribution from these activities and instead track them as additional sustainability metrics.

Section 4.3.1: Water

The Auraria Campus used 74,027,117 gallons of water in FY2012. This includes 27,047,117 gallons of non-potable water from the campus well. It's important to note that FY2010 water consumption figures included inaccurate well water consumption data. New totals have been established to reflect both Denver Water (potable) and well (non potable) consumption.

Year	Potable (gal)	Well (gal)	Total (gal)
FY2012	46,980,000	27,047,117	74,027,117
FY2011	53,855,000	24,049,970	77,904,970
FY2010	60,708,000	23,883,382	84,591,382

Figure 14.1: Auraria Campus Water Use by Source FY2010 – FY2012

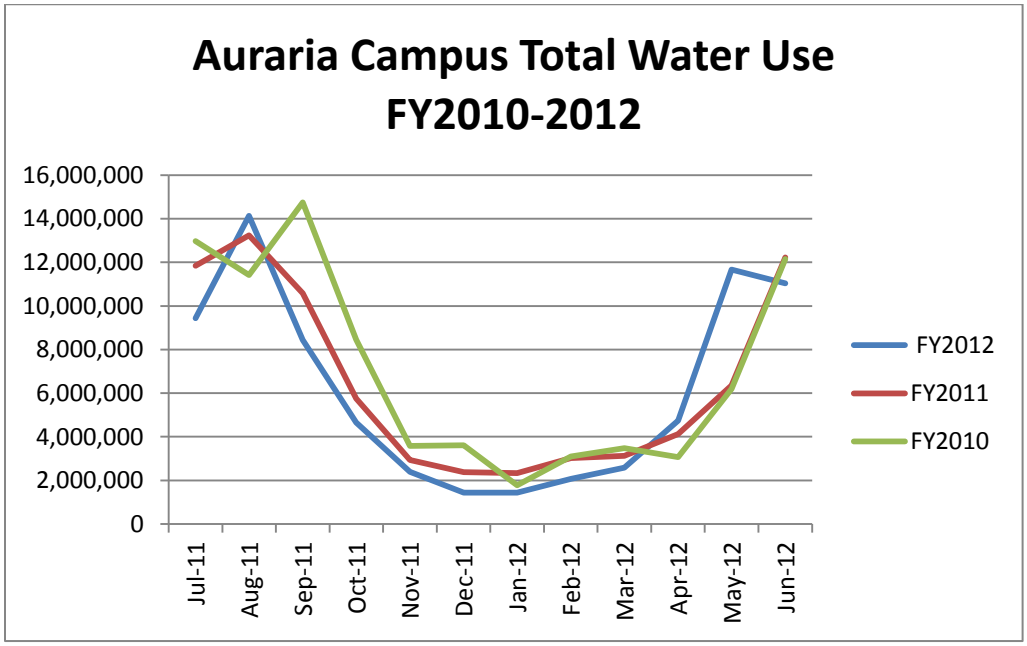

Figure 14.2: Auraria Campus Total Water Use FY2010 – FY2012

In the summer of 2012, Denver Water performed an "Irrigation Audit" of the Auraria Campus. The report found that the irrigation system was "severely inefficient" where irrigation water was supplied by potable water (32 gallons/sf/year) and moderately inefficient where supplied by the well (23 gallons/sf/year).

Efforts to address this issue are underway. For example, AHEC Sustainability Officer applied for and received a grant from the Colorado Department of Public Health and Environment (CDPHE) to purchase a "smart" irrigation controlled that uses evapo-transpiration data to conserve water at 9th Street Historic Park and across campus. However, a comprehensive re-design and/or retrofit of the campus irrigation system may be needed to adequately address inefficiencies.

Section 4.3.2: Waste & Recycling

The campus-wide single stream recycling program funded by the Sustainable Campus Program was launched in January 2008. Thanks to this initiative, thousands of pounds of recyclable materials have been kept out of the landfills.

However in early 2012, Alpine Waste and Recycling began to retrofit their hauling vehicles with scales. This changed reported data considerably; recycling hauls had been estimated at 100% full regardless of actual use during slower seasons such as summer and winter break. This dramatically lowered the campus' diversion rate. What was originally thought to be a nearly 40% landfill diversion rate turned out to be about closer to a 25% rate.

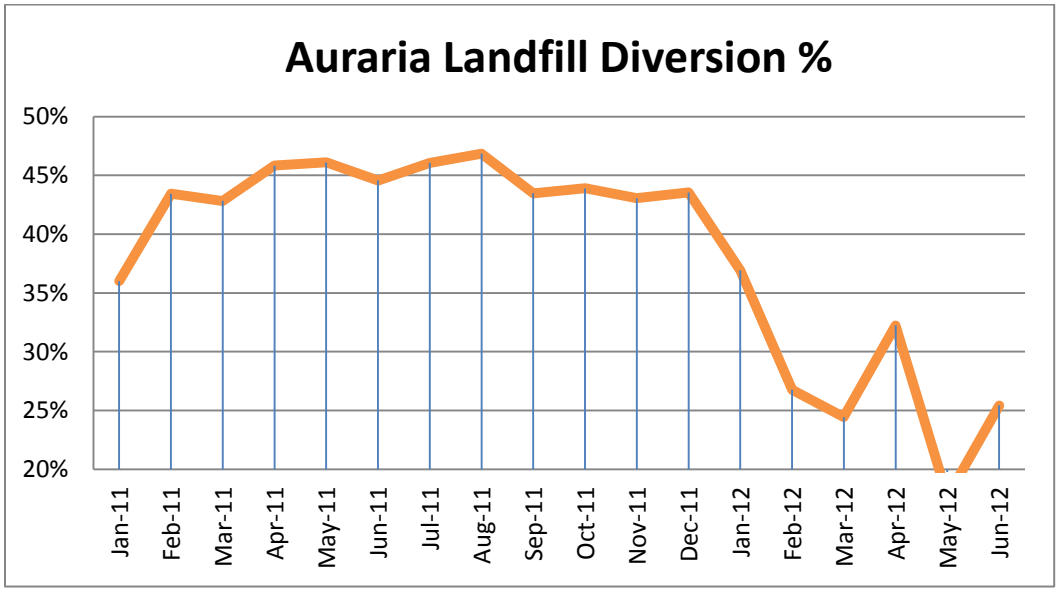

Figure 15.1: Auraria Campus Landfill Diversion 1/2011 – 06/2012

It is difficult to compare diversion rates with other institutions since Alpine Waste "is the only company in the industry" (according to Alpine) who has made the investment to install accurate scales on all of their vehicles. Nonetheless, many strategies were identified to improve the recycling program on campus and regain 40% diversion rates (see figure 3.2 for additional details).

	Landfill (tons)	Recycling/Composting
FY2008	1,291	166
FY2009	1,143	407
FY2010	1,025	508
FY2011	1,007	689
FY2012	933	537
Estimated. FY2012 was first year actual weights (some) were being reported. A full year of actual weights will be available for reporting year FY2013.		

Figure 15.2: Auraria Campus Waste & Recycling Weights FY2008 – FY2012

In addition to this campus-wide single stream recycling program, AHEC's Department of Environmental Health and Safety runs an e-waste program. This program collects used CPUs, monitors, printers, televisions, and other miscellaneous items and recycles them. Not only does this reduce the waste sent to the landfill, it should be noted that this particular program is important as these electronic devices are incredibly toxic to the environment and human health.

Section 5: Overall Results

The overall results of the FY2012 Auraria Campus GHG Emissions Inventory will be detailed below in a number of tables and graphs, but first we will examine the GHG emission most relevant to the ACUPCC – the major impetus for the creation of this document.

Scopes 1 & 2 Emissions

Scopes 1 & 2 GHG emissions are those which are required by the ACUPCC, and given the three institutions' participation in this program, require tracking and reduction plans. These emissions (caused by 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 FY2008 totaled 40,430 metric MTCO2e (metric tons of carbon dioxide equivalents). Scopes 1 & 2 GHG emissions for FY2012 totaled 41,891 metric MTCO2e, up 3.6% from the baseline year.

Total Campus Scope 1 & 2 Emissions	MTCO2e
FY2008	40,430
FY2009	37,773
FY2010	40,411
FY2011	42,920
FY2012	41,891

Figure 16: Total Campus Scope 1 & 2 Emissions (MTCO2e)

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

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

In order to meet the Scope 1 & 2 emission reduction goals of the 2010 Auraria CAP, a focus should be kept on reducing building energy use, especially that of electricity. This is supported by the chart below, which displays the various sources of Scope 1 & 2 emissions on campus.

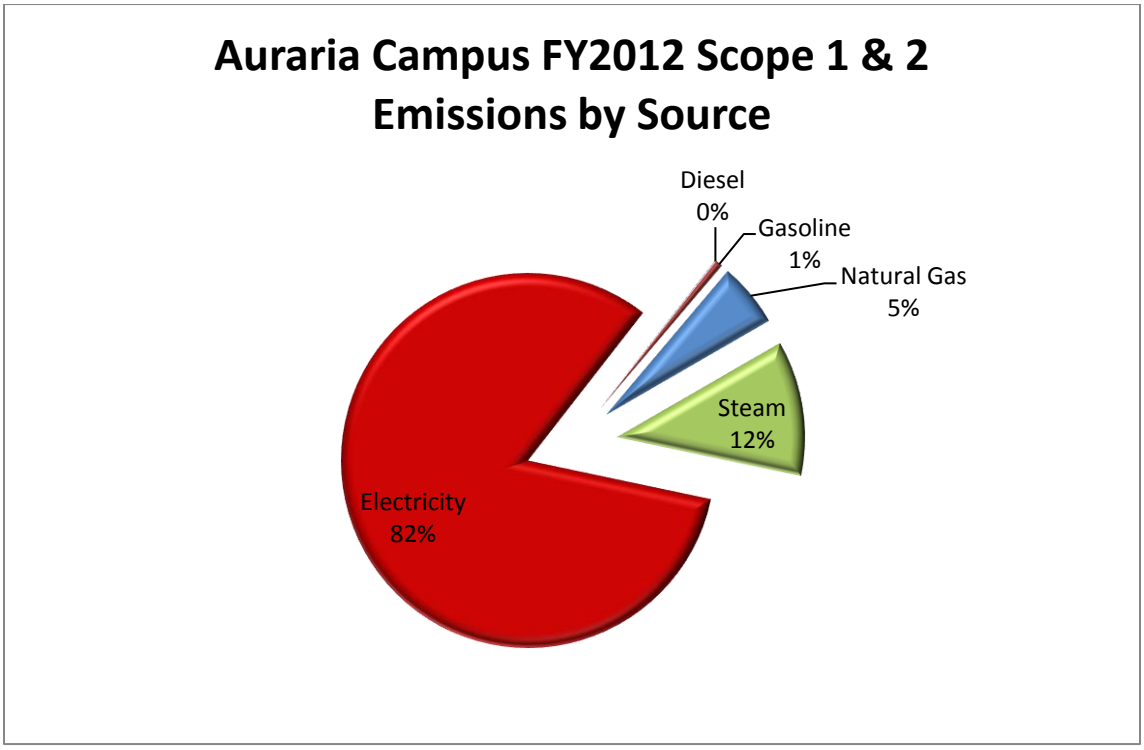

Figure 17: Auraria Campus FY2012 Scopes 1 & 2 Emissions by Source

Total Emissions

Total Emissions (Scopes 1, 2 & 3)

The total GHG emissions for the Auraria Campus for FY2012 were 62,581 MTCO2e. This includes emissions from the commuting behavior of students, faculty and staff which accounts for all of the Scope 3 emissions and one third of the campus total emissions.

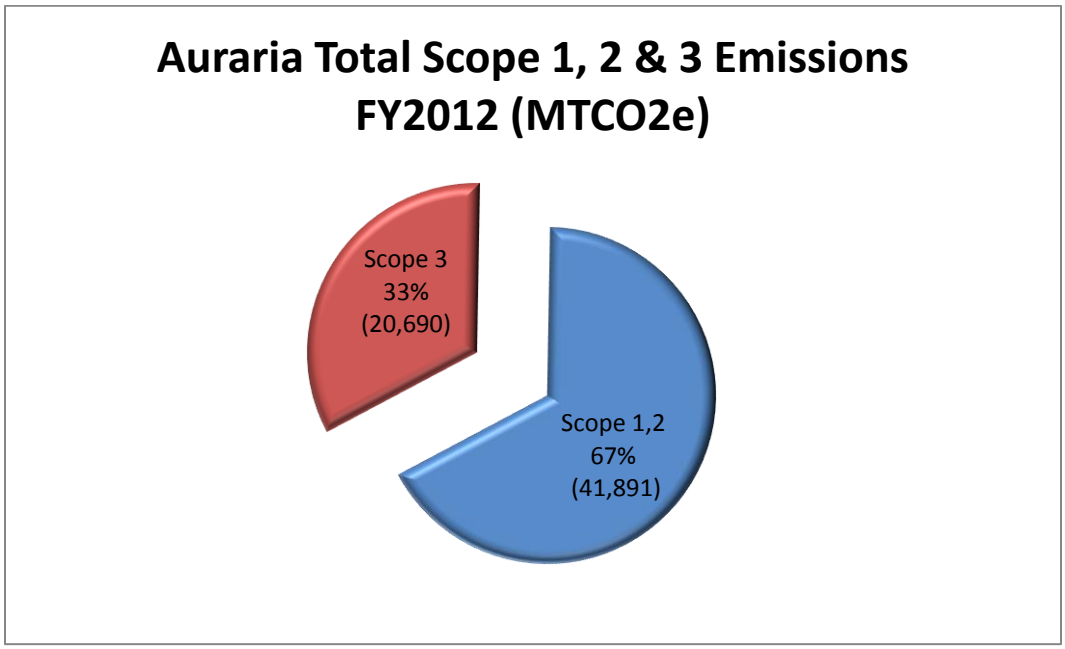

Figure 18: the total GHG emissions for the Auraria Campus for FY2012

GHG Emissions Summary Table

The figure below details the energy flows, emission factors, and GHG emissions for the campus in FY2008– FY2012. This was included to facilitate comparisons across the previous five years, especially for the Scope 1 & 2 emissions.

Energy	Usage	Emission Factor (Source)	Emissions (MTCO2e)
Campus Buildings			
Natural Gas	**Therms**		
FY2008	583,030	0.056 kg CO2e / kBtu (ICLEI)	3,265
FY2009	514,965	0.053 kg CO2e / kBtu (USEIA)	2,729
FY2010	573,746	0.053 kg CO2e / kBtu (USEIA)	3,041
FY2011	459,838	0.053 kg CO2e / kBtu (USEIA)	2,437
FY2012	434,019	0.053 kg CO2e / kBtu (USEIA)	2,300
Electricity	**kWh**		

FY2008	40,433,156	0.800 kg CO2e / kWh (Xcel)	32,347
FY2009	40,531,754	0.743 kg CO2e / kWh (Xcel)	30,115
FY2010	43,955,138	0.717 kg CO2e / kWh (Xcel)	31,516
FY2011	45,834,869	0.763 kg CO2e / kWh (Xcel)	34,972
FY2012	46,942,925	0.734 kg Co2e / kWh (Xcel)	34,456
Steam	**lbs**		
FY2008	54,218,000	84 kg CO2e / 1000 lbs (Xcel)	4,554
FY2009	55,607,000	84 kg CO2e / 1000 lbs (Xcel)	4,671
FY2010	66,394,000	84 kg CO2e / 1000 lbs (Xcel)	5,577
FY2011	62,383,770	84 kg CO2e / 1000 lbs (Xcel)	5,240
FY2012	57,917,675	84 kg CO2e / 1000 lbs (Xcel)	4,865
Transportation			
Gasoline (AHEC)	**gallons**		
FY2008	26,099	9.3 kg CO2e / gallon (GREET)	243
FY2009	25,920	9.3 kg CO2e / gallon (GREET)	241
FY2010	27,752	9.3 kg CO2e / gallon (GREET)	258
FY2011	26,827	9.3 kg CO2e / gallon (GREET)	249
FY2012	27,610	9.3 kg CO2e / gallon (GREET)	257
Diesel (AHEC)	**gallons**		
FY2008	2,196	9.5 kg CO2e / gallon (GREET)	21
FY2009	1,783	9.5 kg CO2e / gallon (GREET)	17
FY2010	2,027	9.5 kg CO2e / gallon (GREET)	19
FY2011	2,305	9.5 kg CO2 / gallon (GREET)	22
FY2012	1,349	9.5 kg CO2 / gallon (GREET)	13
Personal Commuting*	**gallons**		
FY2008	2,812,843	9.3 kg CO2e / gallon (GREET)	13,080
FY2009	-		
FY2010	2,822,704	9.3 kg CO2e / gallon (GREET)	13,126
FY2011	-		
FY2012	2,524,000	9.3 kg CO2e / gallon (GREET)	11,735
Public Commuting*	**Person Miles Traveled**		
FY2008	62,321,196	0.3 kg CO2e / PMT (WRI)	9,348
FY2009	-		
FY2010	43,978,982	0.3 kg CO2e / PMT (WRI)	6,597
FY2011	-		
FY2012	59,697,000	0.3 kg CO2e / PMT (WRI)	8,955
Total Campus Scope 1 & 2 Emissions			
FY2008			**40,430**
FY2009			**37,773**
FY2010			**40,411**
FY2011			**42,920**

FY2012			**41,891**
Total Campus Scope 1, 2 & 3 Emissions			
FY2012			**62,581**
Scope 1	Scope 2	Scope 3	
Total Scopes 1 & 2	Total Scopes 1, 2 & 3		
*Only 1/2 of these emissions are attributed here, to avoid double-counting (Ramaswami, et al. 2007)			

Figure 19: Annual community-wide material and energy flows with associated benchmarks and GHG emission factors (EF) for various sectors of the Auraria Campus. GHG emissions are reported in metric tons CO_2 equivalents MTCO2e.

Renewable Energy Credits (REC's)

The Fiscal Year of 2012 was the last of three previously purchased allotments of Renewable Energy Credits (REC's). The decision to not pursue additional REC's was made by the Sustainable Campus Program in 2012 due to the external nature of such an investment. It was determined that the student's "green fee" would be best invested on-site for lasting projects that reduced the Campus's collective dependence on fossil fuel.

The FY09-FY12 REC purchase included the following:

YEAR 1 (July 2009-June 2010) 40,367,932 kWh

YEAR 2 (July 2010-June 2011) 40,795,863 kWh

YEAR 3 (July 2011-June 2012) 40,795,863 kWh

However, the net benefit to the climate of REC purchases is not included in the greenhouse gas calculations due to preference to report accurate performance data. For example, it would be misleading to report gains in electric efficiency due to a purchase of REC's. Regardless, it is worth noting that based on the emission coefficient calculated for FY12, 29,944 MTCO2e were "offset" with REC's.

Section 6: Emissions by Institution

In a February 2010 meeting between AHEC staff and the Chief Financial Officers (CFOs) of the three institutions, for the purposes of the ACUPCC, the CFOs decide to divide to the total Scope 1 and 2 emissions 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 MSU Denver would not be included in the 2010 greenhouse gas (GHG) inventory, the 2009 climate action plan (CAP), or this report due to complications arising from the control of energy use and payments on those facilities.

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 MSU Denver, and 48.5% to CU Denver.

Update: With the new "neighborhood" concept being implemented, institutions have begun to own (and in some cases, operate) their own buildings. Therefore this respective consumption data will be added to the institutions respective inventory.

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 campus Scope 1 & 2 GHG emissions for FY2012 was 41,891 metric tons of CO2 equivalents (MTCO2e). Based on the methodology above the Scopes 1 and 2 emissions by institution are as follows:

Shared

1. CCD – 13.79% or 276,019 sq ft = 5,608 MTCO2e
2. MSU Denver – 56.81% or 1,137,408 sq ft = 23,101 MTCO2e
3. CU Denver – 29.40% or 588,537 = 11,955 MTCO2e

Institution Specific

1. CCD – Confluence Building (under construction) / St. Francis Center = 372 MTCO2e
2. MSU Denver – Student Success Building (opened March 2012) and Hospitality Learning Center (under construction) = 856 MTCO2e
3. CU Denver – Academic 1 building coming in 2013 = 0 MTCO2e

Total Scope 1 & 2 Emissions by Institution (includes shared and institution specific)

1. CCD = 5,980 MTCO2e
2. MSU Denver = 23,957 MTCO2e
3. CU Denver = 11,955 MTCO2e

Section 7: Recommendations and Next Steps

Pursuing Emission Reductions

In order to meet the Scope 1 & 2 emission reduction goals of the 2010 Auraria CAP, a focus must be kept on reducing building energy use which is responsible for virtually all of these emissions. This is especially true of building electricity, which is alone responsible for a staggering 82% of Auraria's Scope 1 & 2 emissions. That is not to say that improvements should not be made to capital equipment such as natural gas fired boilers or steam traps – rather, a prioritized list must be established based on the most "bang for the buck." In 2012, energy audits were performed across ten campus buildings and a more in-depth study of the energy-intense King Center is underway. These reports will identify which projects can be accomplished in the short-term.

In the long-term, however, sweeping overhauls of campus mechanical and electrical systems is imminent. Without additional state funding, the most feasible option would be to engage an Energy Services Company (ESCo) and seriously consider a performance contract. Auraria could use this financing mechanism to fund major projects with no up-front capital or bond rating impact; improvements are directly funded by the utility savings. To-date this option has been considered to be "off the table," but is highly recommended if the ACUPCC goals are ever to be achieved.

Building Energy Data Collection

The collection and consolidation of utility data has been an issue while compiling these reports. Specifically, meters are still manually read and handwritten monthly. This process is inherently slow and unreliable. Efforts to automate meter readings are underway thanks to the Sustainable Campus Programs $160,000 commitment to wireless communication hardware that will integrate campus sub-meters with an energy dashboard. This should be considered as the "first step" toward utility data management.

As complementary "next step," a more comprehensive solution is still needed to comprehensively manage the hundreds of utility readings and paper bills that are processed by AHEC. EnergyCap, a utility tracking software, is highly recommended to facilitate this process. This software has been utilized by many State agencies and institutions of higher education in order to streamline the collection process and enhance their analytic capacity.

In terms of energy intensity, there is plenty of room for improvement. Though the construction of efficient new LEED certified buildings may improve this per-square-foot figure, the overall footprint of the campus continues to balloon and attention must be given to the 2+ million square feet of space that was predominantly built in the 1970's.

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