COLORADO COLLEGE

CARBON ACTION REPORT

ACHIEVING CARBON NEUTRALITY BY 2020 AND BEYOND

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Acknowledgments

This document was created by the Colorado College Office of Sustainability in response to a request by the president for an updated report including individual options and costs for achieving carbon neutrality. The primary authors of this document are Ian Johnson and Katy Dupree from the Office of Sustainability. Data provided in this document was provided by George Eckhardt, Michael Brubaker, and Mark Ferguson. This document is supported by the Campus Sustainability Council Steering Committee and Campus Sustainability Council members to present to the president.

Executive Summary

The Climate Action Report at Colorado College is a dynamic document designed to move Colorado College towards achieving carbon neutrality while allowing for the inclusion of developing market opportunities along the way. The data and information within this document is intended to provide a record of our past efforts and options for future projects and investments to achieve carbon neutrality. All data was collected from and calculated using official Colorado College facilities documents, available upon request.

The original commitment of the college approved by the Board of Trustees and President Celeste was through the American College and University President's Climate Commitment, pledging to become carbon neutral by the year 2020. In 2008, the Brendle Report was compiled to investigate what it would take for Colorado College to become carbon neutral. This document included several action recommendations in order to become carbon neutral, including the purchase of Renewable Energy Credits (RECs) and carbon offsets. Since 2008, progress has been made in reducing the college's carbon footprint by nearly 30%. Though this reduction is an amazing step forward, there is still much work to be done in order to become carbon neutral. By analyzing the reductions of past, current, and future projects as well as the local options for RECs and carbon offsets, the Office of Sustainability has produced this report towards becoming a carbon neutral campus.

In order to become carbon neutral, Colorado College must tackle carbon emissions that are directly and indirectly produced by the presence of our campus. This includes on-site emissions, purchased electricity, and indirect emissions from commuting, waste generation, and air travel, to name a few. On-site emissions and indirect emissions can be mitigated by reducing usage via efficiency and conservation projects as well as investing in local carbon offsets. Emissions from purchased electricity can be reduced by generating or purchasing renewable energy and/or RECs which provide a secure and stable source of clean energy.

The Carbon Action Plan looks at past, current, and planned projects and their corresponding costs and emissions reductions and compares these to RECs and offset costs and emissions reductions. The results of the emissions and financial analysis shows that RECs and offset options are the least initial cost for emissions reductions at a maximum of $2.87 and $6.56 per metric ton, respectively. Following these in increasing cost per metric ton are sustainability initiatives, energy projects, central plant upgrades, and fleet conversion.

Cost savings of these investments were also calculated. Currently, the college has saved over $4 million in reduced utility expenditures as a result of conservation and efficiency projects since 2008. Due to utility cost escalations, the college could potentially save up to $60 million or more in energy purchases by investing in long-term power purchase agreements to 2050, provided such contract options are commercially available. These savings increase as our energy usage is reduced through ongoing efficiency projects. Using the recommendations provided in this document, a combination of REC and offset investments and total emissions reductions is a financially feasible and timely approach to becoming a carbon neutral campus.

Greenhouse Gas Emissions

Greenhouse gas emissions, although regularly discussed today, are still difficult for most people to understand. Greenhouse gas emissions come from multiple sources, including the combustion of fossil fuels, microbial processes, manufacturing processes, geological processes, and refrigerant chemicals. Major greenhouse gases include carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and multiple refrigerant chemicals. Each of these gases traps heat in our atmosphere in differing amounts and each gas persists within the atmosphere for different periods of time before being absorbed or converted through chemical, physical, geologic, or other processes. The global warming potential, or GWP, is a number assigned to the warming potential each gas has based on how it traps heat and how long it persists in the atmosphere. These are compared to carbon dioxide, which, as the reference, has been given a GWP of 1. All GWPs then, are compared to the GWP of carbon dioxide. To give all emissions a common unit of measurement, they are reported as carbon dioxide equivalencies, or CO_2e. Thus the greenhouse gas inventory that Colorado College and all entities report, are in metric tons (mT) of CO_2e, which includes multiple gases.

Carbon dioxide equivalencies are based on the latest Intergovernmental Panel on Climate Change (IPCC) reports that rely on the best available science to determine GWPs for each greenhouse gas, and levels of emissions from various processes. Colorado College currently uses the IPCC fifth assessment report, which is the most recent report, released in 2013.

Emissions are divided into three scopes for reporting purposes:

Scope 1 emissions include all emissions that the college (or any reporting entity) owns and produces on our campus as part of our business. For example, the college owns and maintains a central heating plant that primarily burns natural gas to heat our buildings. The emissions from that combustion are from fuel that the college has purchased and then burned to create a product (heat) on our campus. Similarly, the college owns a vehicle fleet, which we power with gasoline and diesel that we purchase and burn in those vehicles.

Scope 2 emissions, for our purposes at Colorado College, consists entirely of emissions resulting from the generation of electricity that the college purchases. As most electrical generation comes from fossil fuel combustion, the college's electrical use directly results in emissions to generate that power.

Scope 3 emissions consist of indirect emissions that result from processes that are not owned or controlled by Colorado College, but are a direct result of the college's business. For example, the college doesn't own or operate any airplanes for business travel, but we frequently use commercial airlines for business travel. Similarly, once we send our waste to the landfill, its fate is out of our hands. But the waste we generate through our normal course of business creates methane in the landfill, which is vented into the atmosphere. At a minimum, the college must account for and report all Scope 3 emissions related to business travel, employee and student commuting, and solid waste disposal.

Colorado College uses an operational control approach to conduct its greenhouse gas inventory, meaning all facilities and business activities that the college controls the operation of are included in the annual greenhouse gas inventory. In general, this currently includes the main campus and its operations, the Stabler-Gilmore Cabin, and the Baca campus.

Achieving Carbon Neutrality

Colorado College's commitment to become carbon neutral stems from the college's signing of the Presidents' Climate Commitment in 2009. In 2008, in response to student requests to commit to carbon neutrality, then President Celeste requested more information on costs, impacts, and methods related to the commitment before signing. The Campus Sustainability Council worked with the college's Sustainability Coordinator and the Brendle Group to author the Brendle Report, which was presented to the Board of Trustees in September of 2008. In 2011, the plan developed involved a 20 percent reduction via conservation efforts and a further 30 percent reduction via efficiency projects. The last 50 percent of our carbon footprint would be mitigated through renewable energy investments. In 2013, the plan became more prescriptive with the following four steps: 1) improve conservation and efficiency, 2) install a 2 MW solar array, 3) implement a campus—wide combined heat and power system, and 4) invest in carbon offsets (Appendix A). At the time, the estimated cost to achieve carbon neutrality by 2020 was $30M (Appendix B).

The college's carbon footprint baseline was set in 2008 and is calculated at 35,019 metric tons of CO_2 ($MTCO_2$) (This is an updated baseline from the initial inventory as methodologies and source data have become more reliable. The college's Sustainability Director is a certified greenhouse gas inventory quantifier and has updated some methodologies from the original inventory.). Since 2008, Colorado College has been progressing towards its carbon neutrality goal. As of 2015, the college's carbon emissions are estimated at 24,711 $MTCO_2$ for a reduction of 29 percent from the baseline year (See fig. 1)

Colorado College's greenhouse gas emissions are down 29 percent since 2008.

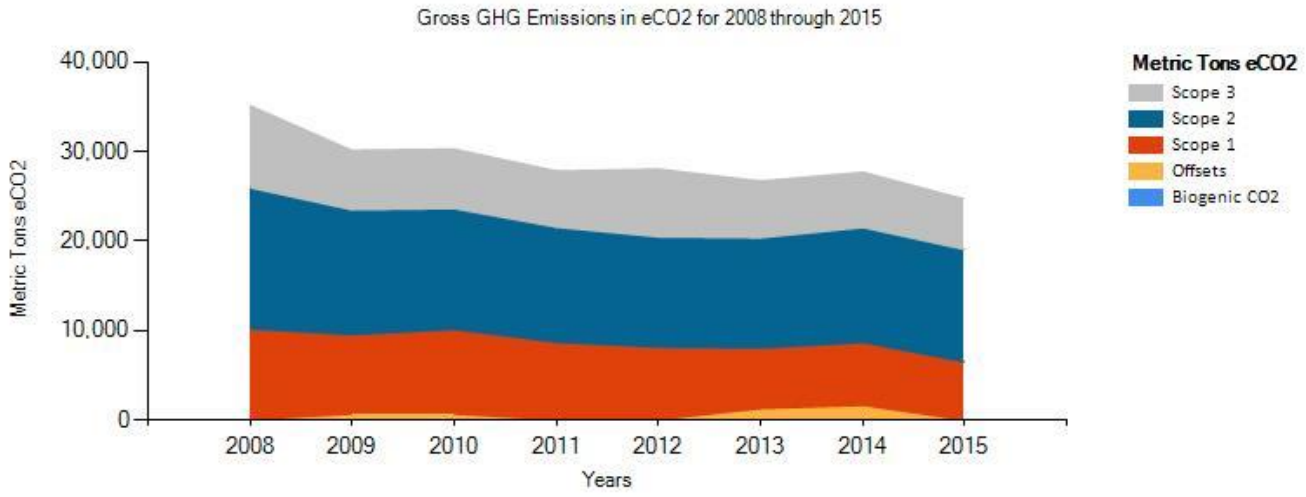

Fig. 1: Colorado College Greenhouse Gas Emissions 2008-2015

The majority of these reductions have come from ongoing conservation and efficiency projects across the campus that reduce our overall energy usage. Since FY13 Colorado College has had an annual $250,000 sustainability project budget to fund these projects. Not all efficiency upgrade projects are funded through this budget, but many of the additional, sustainability-related costs of existing projects are. Thus, it is difficult to track and capture the full expenditure on efficiency and greenhouse gas reduction projects. However, when this fund is combined with major efficiency and reduction projects between 2008 and 2013, we arrive at a reasonable approximation of expenditures and progress towards the college's carbon neutrality goal. See Table 1 for a list of the projects funded through this budget and other major projects that impact carbon emissions.

It is estimated that since 2013, Colorado College has spent nearly $1.1M on projects that have reduced our greenhouse gas emissions.

Fund Name	Expenses to date
Tutt Library Occupancy Sensors	39,533.61
3D Arts T-5/T-8 Lighting Upgrade	8,328.10
Cossitt Classics N Side Replace Windows	8,730.75
Van Briggle Exterior Repairs(Phase 2)	60,378.55
Packard 2nd & 3rd Floor Studio Window Treatments	1,106.40
Campus Annual Sustainability Projects Program	15,184.12
Synergy Passive Solar Greenhouse	79,878.24
Campus Bldgs Annual Controls Upgrades	44,462.00
Olin Hall Power Factor Corrections	22,390.40
Synergy House(1006) Install Net-Zero Energy System	29,291.06
Worner Install Solar Thermal	47,440.18
Armstrong Auditorium Install CO2 Sensor Controls	3,699.50
Campus Housing Install Wireless Thermostats	2,477.28
Campus Occupancy and Lighting Level Audits (Phase 1)	818.73
Barnes Modify Heating Sys Piping & Install Isolation Valves	64,108.61
Palmer Windows Rehabilitation	283,204.83
CSC-Recycle Cooking Oil For Biodiesel Fuel	8,788.08
CSC-Campus Install Xeriscape Landscape Gardens(CSC & Gift)	24,197.87
CSC-Recycling Process Improvements & Education	50,799.12
CSC-Science Labs Energy Conservation Assessments	932.59
CSC-Shove Chapel Install PV Solar System	1,673.42
CSC-Sustainability Signage	4,535.78
El Pomar Energy Efficiency Upgrades	16,009.16
CPS HVAC Controls Data Storage	36,359.76
CPS HVAC Controls Monitoring	7,949.40
Baca CPS Install PV Solar System	123,258.04
El Pomar Install Occupancy Sensors	0.00
CSC-CPS Renewable Energy Projects Education	0.00
Central Plant Replace CW Pump & Controls Upgrade	27,859.00
CPS Additional Recycle Containers	20,563.66
El Pomar Electrical Service Upgrade	61,760.00
CPS Recycling Process Improvements & Education	0.00
	1,095,718.24

Table 1: Sustainability Projects Funded Through the Annual Sustainability Budget and R & R Budget Since FY13

Colorado College's 2015 greenhouse gas emissions sources are as shown in Figure 2:

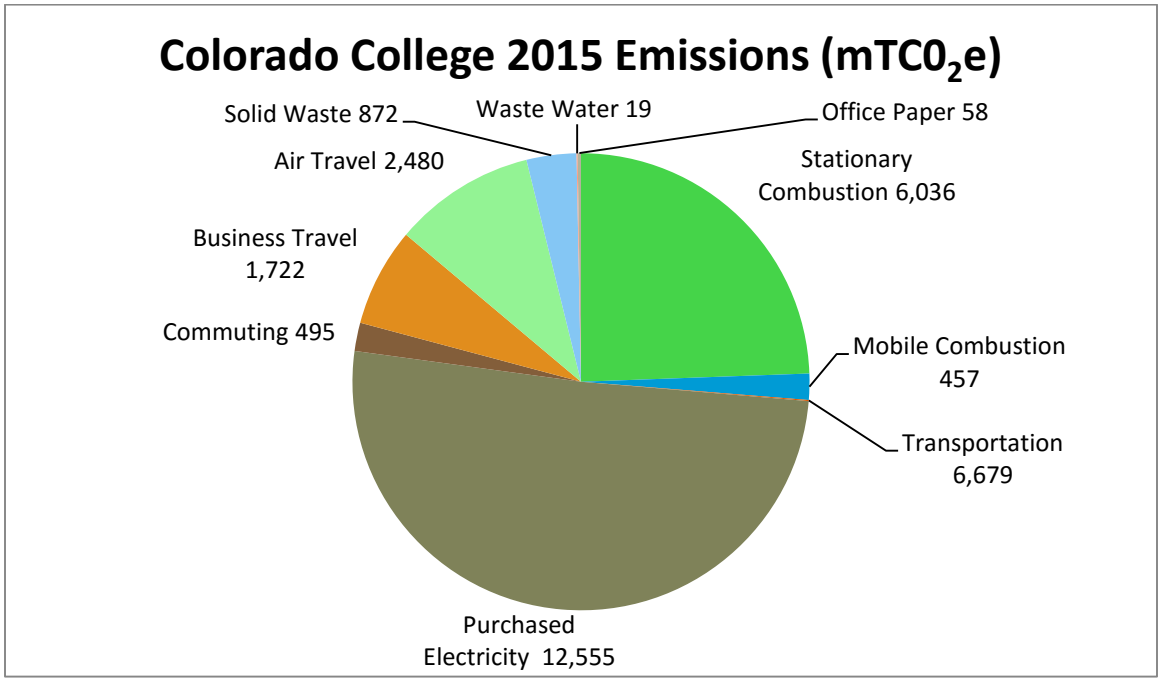

Figure 2: Colorado College's 2015 Greenhouse Gas Emissions Sources

If these expenditures are used as an approximation for total expenditures towards carbon neutrality, then the current reduction in emissions can be assumed to have cost $106.30 per mTCO2e. However, this is a poor approximation for a number of reasons. First, many projects that improve energy efficiency and reduce utility expenditures are part of routine maintenance. As buildings age, windows, heating and cooling systems, and insulation are updated in the course of regular business. The Spencer Center, for example, was scheduled for a major retrofit regardless of the college's sustainability goals. The major improvements that led the building to become the most efficient on campus did not add more to the cost of the project – it was overdue for a major upgrade and had constraints that mandated the use of the systems installed regardless of their efficiency. Thus, scheduled projects are often lumped into sustainability expenditures and reductions in utility expenditures are often attributed strictly to sustainability efforts. The reality is a blend somewhere between the two. Second, this analysis overlooks the impacts on the core mission of the college. Many of the projects have an impact on our students' ability to understand and navigate sustainability issues here and beyond. Student research, individual engagement with the projects and metrics, and networking through involved contractors, engineers, architects, and other professionals build our students' competency. These intangibles cannot be quantified monetarily, but they provide concrete examples of ways our students are becoming more sustainability-literate as a result of their time at Colorado College. Finally, this approximation leaves out any monetary savings attributed to the efficiency upgrades over time. Since 2008, avoided utility costs have saved the college over $4M due almost exclusively to these conservation and efficiency projects. If those avoided costs are considered in the cost per mTCO2e equation, a very different picture begins to form – one where the savings more than justify the expenses and emissions reductions become a sound financial decision with bonafide short-term paybacks (Fig. 3,4).

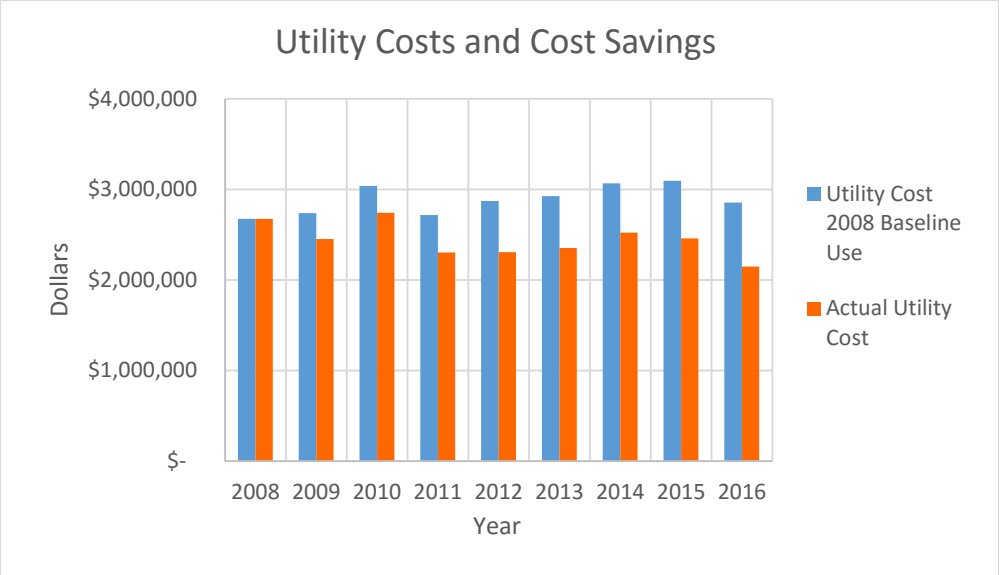

Figure 3: Utility Costs and Cost Savings

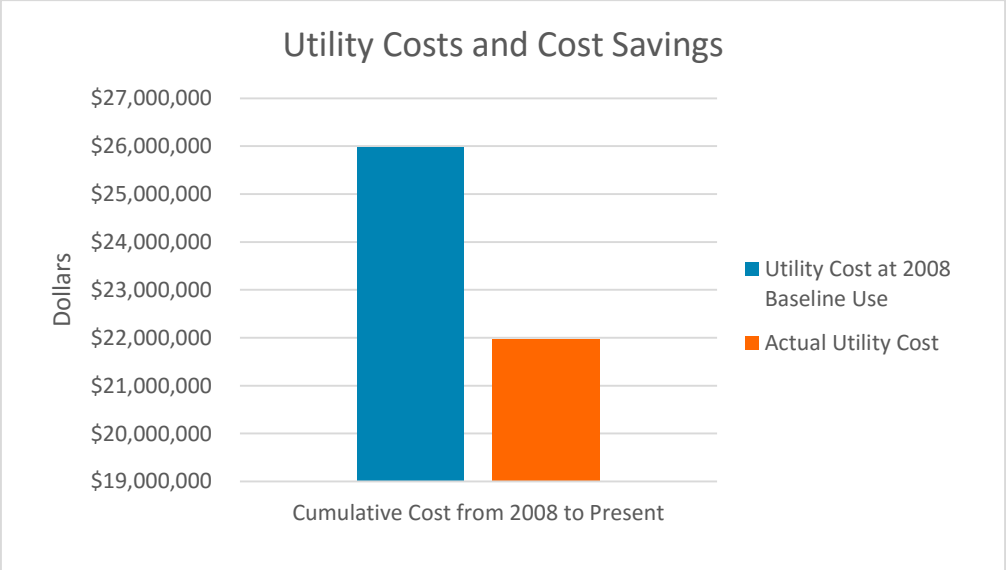

Figure 4: Cumulative Utility Costs and Cost Savings

While there is still more 'low hanging fruit' for Colorado College to benefit from through conservation and efficiency reductions, eventually we reach diminishing returns. Retro-commissioning – the process of verifying building and system performance and ensuring that they continue to operate at the highest efficiency – is of primary importance to both occupant comfort and energy efficiency, especially as the college has seen double digit increases in utility rates annually. It is recommended that an ongoing retro-commissioning program be established to ensure the highest performance from our capital assets and avoid developing 'low-hanging fruit' over time. See Table 2 for this and other recommendations.

Since 2008, Colorado College has saved over $4M in reduced utility expenditures as a result of conservation and efficiency projects.

Achieving carbon neutrality will require multiple strategies, including continued efforts towards conservation and efficiency as noted above. While those efforts reduce emissions, they will not eliminate them. The fastest and perhaps easiest way to eliminate emissions on a net annual basis is to purchase renewable energy credits (RECs) for Scope 2 emissions and carbon offsets for Scopes 1 & 3 emissions.

An investment in offsets represents the legal transfer of environmental attributes of a project, the associated greenhouse gas emissions reduction, and all associated claims to the college. Similarly, RECs represent the same transfers for a project that produces energy. A REC can be sold separately from the power it originates from or may be coupled with a power purchase. Offsets and RECs encourage construction of new renewable energy and carbon reduction projects by helping to make them financially viable. The college can achieve carbon neutrality through the use of offsets and RECs from a variety of options (See Power Purchase Agreements, REC and Offset Options).

Purchasing offsets can be less than attractive to many people as it can be difficult to see a tangible outcome from their expenditures. Purchasing verified and certified products can help alleviate some of these concerns as the products are subject to rigorous conditions and tracking by a third party. However, purchasing offsets produced locally is perhaps the best way to see tangible outcomes from any offsets. While the global atmospheric outcomes remain the same from local or far-reaching offset projects, a local product impacts the local landscape, can create jobs and opportunities within the nearby community, and – perhaps most importantly – can impact the core mission of the college by creating educational and research opportunities. Often these offsets can be coupled with tangible products, such as wind-based power and the associated RECs. Depending on the purchase contract, this can often become financially attractive over the long-term, where power prices can be locked in and avoid the volatile swings associated with the fossil fuel market (Appendix A). Local offset and REC options are currently limited. The Colorado College Office of Sustainability is investigating options to develop or catalyze local projects in collaboration with student and faculty research.

To further add to the confusion, all RECs are not equal. Because the carbon intensity of grid-based power varies considerably across the country depending on the local fuel mixtures and generation facilities, a REC produced in one region may not avoid the same emissions as a REC produced in another region. Because of our heavy reliance on coal, Colorado and some surrounding regions have the highest carbon intensity in

the United States per kilowatt-hour generated (see Fig. 5). This provides yet another benefit in purchasing RECs from nearby sources where they directly offset or avoid the emissions that would otherwise result from power purchases.

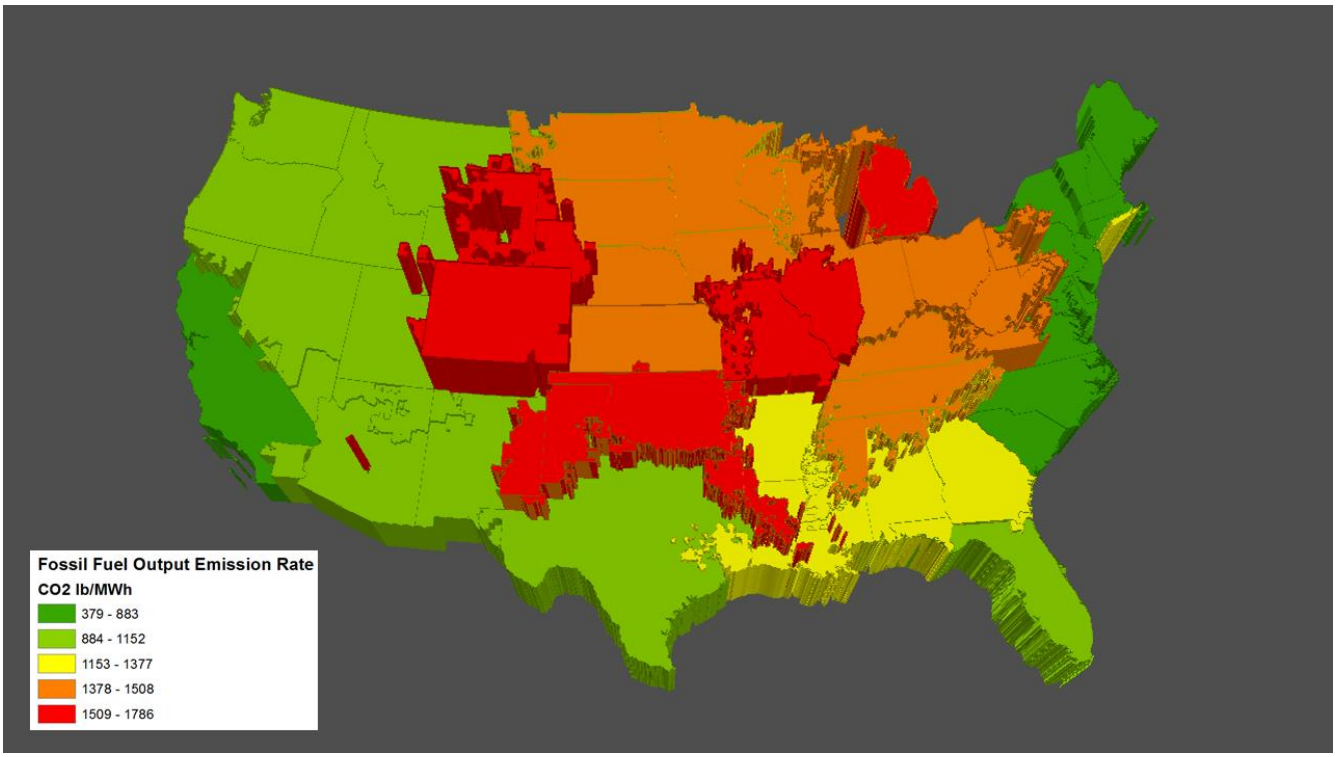

Figure 5: Carbon intensity per kilowatt hour generated for various sub-regions of the electrical grid. Map created from EPA eGRID SRL14 data by Colorado College GIS Lab.

Methodology: Past and Future

The college's original plan for achieving carbon neutrality was to consider the total carbon emissions and reduce as much as possible through efficiency, conservation, and renewable energy generation. At the time, the plan presented to the Board of Trustees was to reduce energy usage by 50 percent through conservation and efficiency (Appendix A). After further development, the plan changed to having conservation and efficiency account for only 25 percent of emissions reductions. A list of opportunities, associated costs and carbon reductions was developed and compared to the target to determine the most fiscally and socially responsible solutions. As previously mentioned, the reduction goal has already been achieved, with a nearly 30 percent reduction in emissions to date.

One of the major constraints the college faces in reaching carbon neutrality is its ability to substitute renewable energy – one of the most easily understood and obtained forms of offsets in the form of RECs – for campus emissions. RECs, whether purchased or generated through college-owned facilities, can only be applied to Scope 2 (purchased electricity) emissions. If offsets become the preferred or most feasible way to achieve carbon neutrality, Scopes 1 and 3 emissions must be offset through the use of carbon offsets derived from projects that avoid emissions or sequester carbon in other ways. Some examples are landfill gas destruction projects and forest carbon projects. New methods of developing local project-based offsets are also beginning to emerge, including through research at Colorado College. This document will be updated with new methods as they become available.

Using a combination of long-term REC contracts and verified carbon offsets, our campus can become carbon neutral by 2020. Once the expense of the RECs and offsets are recognized as part of the cost of doing business responsibly, we can begin to include the savings on RECs and offsets as part of the payback for any efficiency project. At that point, any reductions in emissions also save the expenditure on offsets for those emissions. A few institutions have begun considering this price in their payback schemes, although not all have not yet fully committed to purchasing offsets. This practice has been referred to as "shadow pricing".

Financial Considerations

The initial investment for this plan is substantial. The original Brendle Report estimated that updating all campus systems to achieve carbon neutrality would cost $30 million. With renewable energy and other efficiency options becoming mainstream and new options arising for local offset development, however, actual costs at this time are likely to be much lower. The reality is that the college will likely need to continue upgrading buildings as appropriate, building low- and no-impact (i.e. – net zero) buildings, investing in renewable energy, updating fleet, central plant and other systems, retro-commissioning buildings, and will need to purchase offsets and RECs in order to achieve our stated goals. There are many options for these types of projects and a nearly infinite combination thereof that can help us achieve those goals. The actual combination used will depend on other competing goals in interests, available finances, co-benefits of each project, and appetite for specific types of strategies. This document is intended to present those options for consideration, not to prescribe any one path towards neutrality. This is a living document and some options may become more or less feasible as we move forward, meaning this document will need continual updating to remain relevant.

Colorado College can purchase offsets and RECs to become carbon neutral for as little as $21,625 annually.

If RECs and Offsets are used to achieve carbon neutrality at Colorado College – either as a long-term strategy or as an interim strategy while other methods continue to be developed and achieved – the annual cost would be between $21,625 and $144,842, depending on the location and strategies chosen (Tables 2, 3, and 4). These prices are subject to change based on market conditions.

Project Options and Timelines

Project	Estimated Cost	Estimated Annual $MTCO_2e$ Reduction	Expected Lifespan (years)	Lifetime Emissions Reductions	Project Type
Energy Audits largest 15 Buildings Phase 1	$100,000	50	1	50	Demand-Efficiency
Campus Sustainability Initiatives, Communication, and Recycling	$200,000	250	1	250	Demand-Conservation
Energy Improvements Construction Phase 1	$2,000,000	1000	50	50,000	Demand-Efficiency
Energy Audits largest 15 Buildings Phase 2	$400,000	100	1	100	Demand-Efficiency
Energy Improvements Construction Phase 2	$6,000,000	2300	50	115,000	Demand-Efficiency
Design Central Plant Energy Upgrades	$200,000	0	1	0	Demand-Efficiency
Construction Central Plant Energy Upgrades	$2,500,000	1000	50	50,000	Demand-Efficiency
Energy Audits largest 15 Buildings Phase 3	$300,000	50	1	50	Demand-Efficiency
Energy Improvements Construction Phase 3	$10,000,000	3900	20	78,000	Demand-Efficiency
Begin Fleet Conversion to Higher Efficiency	$1,250,000	250	10	2,500	Demand-Efficiency
Complete Fleet Conversion to Higher Efficiency	$1,250,000	250	10	2,500	Demand-Efficiency
Long-Term Wind Contract	TBD	3,656 to 14,624	1	3,656 to 14,624	Supply-Renewable
Retro-Commissioning (Annual)	$100,000	TBD	10	TBD	Demand-Efficiency
Purchase Carbon Offset	$3,369 to $48,841	3,404 to 17,018	1	3,404 to 17,018	Supply-Renewable
REC Purchase	$2,200 to $96,000	3,656 to 14,624	1	3,656 to 14,624	Supply-Renewable
Campus Recycling Improvements & Education	$335,000	TBD	10	TBD	Demand-Conservation

Table 2: A list of current and future project options, costs, and relative $MTCO_2$ reductions.

Power Purchase Agreements

An alternative to purchasing fossil-fuel generated electricity from a utility is investing in long-term contracts, called power purchase agreements (PPA's), for renewable power. These contracts provide a secure and stable source of electricity at a locked-in rate for a pre-determined amount of time, with the option to couple the RECs from the power generated with the power purchased. With power at a locked in rate for a contracted period of time, the college will begin to see increasing cost savings on energy purchases due to annual escalation rates from utilities on fossil-based generation portfolios. Assuming a conservative 3 percent escalation rate annually, the college could potentially save $60 million or more in energy purchases by investing in long-term renewable energy PPA's to 2050. There have been recent discussions between Colorado College and Colorado Springs Utilities about a local wind power purchase in Limon, Colorado. Despite significant interest on the part of the college, Colorado Springs Utilities has decided not to pursue the project further. If renewable PPA's are to become commercially available in the Colorado Springs Utilities service area, the college must continue to actively advocate for and pursue options through the utility, through its utility board, and through our elected representatives. Involvement from our students is a necessary part of that advocacy. Until such power purchase agreements become commercially available in our area, we must invest in other options if we are to reduce our carbon footprint.

The college could potentially save $60 million or more in energy purchases by investing in long term renewable energy power purchase contracts to 2050, should they become commercially available in our area.

RECs and Offset Options

The rates available for RECs vary due to the location of production and the volume purchased, with the highest rates being in Colorado and adjacent states due to the limited availability. The different estimates for REC purchases to cover all purchased energy are outlined in Table 3 below.

REC Options				
Location	**Annual Cost***	**$MTCO_2$**	**Cost/$MTCO_2$**	**Cost/MWh**
National	$ 7,840.00	14,624	0.53610503	$ 0.49
West Based	$ 8,800.00	14,624	0.60175055	$ 0.55
Colorado Based	$ 96,000.00	14,624	6.56455142	$ 6.00
US Wind	$ 8,000.00	14,624	0.54704595	$ 0.50

*Table 3: A list of current REC options, costs, and relative $MTCO_2$ reductions. *Annual cost based on 2015 electrical purchase.*

It would be optimal to purchase RECs in Colorado, as these are the most tangible and are linked to the carbon intensity of our current energy production. If 100 percent of our purchased electricity is covered by our REC contract, our Scope 2 emissions will be 0 $MTCO_2$, offsetting nearly 50 percent of our current annual emissions.

In order to become completely carbon neutral by 2020, purchases of offsets are required to cover our Scope 1 and Scope 3 emissions. In order to cover both Scope 1 and 3, offsets equivalent to 17,018 $MTCO_2$ would currently need to be purchased. These offsets take the form of investment in landfill gas destruction and forestry projects. Some options and their estimated costs are represented in Tables 4 and 5 below.

Landfill Gas Destruction			
Location	**Volume ($MTCO_2$)**	**Per unit**	**Total Cost**
US	17,018	$ 0.81	$ 13,784.58
UT + OK	17,018	$ 0.99	$ 16,847.82
UT + OK	10,211	$ 0.99	$ 10,108.89
UT + OK	3,404	$ 0.99	$ 3,369.96

Table 4: A list of current landfill gas offset options, costs, and relative $MTCO_2$ reductions.

Landfill Gas Destruction + Forestry			
Location	**Volume**	**Per unit**	**Total Cost**
UT + CA	17,018	$ 2.87	$ 48,841.66
UT + CA	10,211	$ 2.87	$ 29,305.57
UT + CA	3,404	$ 3.00	$ 10,212.00

Table 5: A list of current landfill gas and forestry offset options, costs, and relative $MTCO_2$ reductions.

The relative cost per $MTCO_2$ for offsets and RECs as compared to other projects on campus is shown in the graph below.

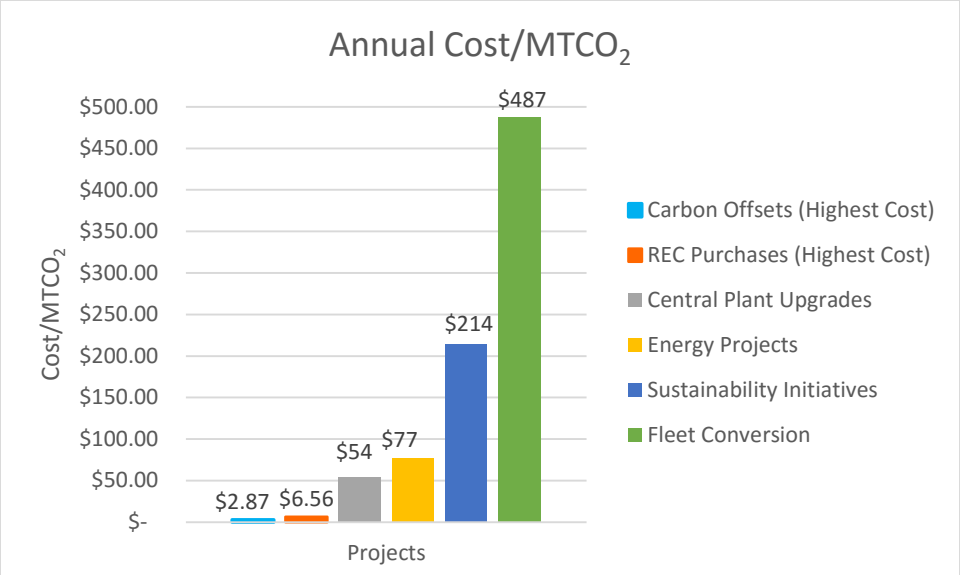

Figure 6: A comparison of annual project costs/$MTCO_2$ from Tables 2, 3,

Conclusion

Considering the fluctuations of the energy market, the prices for purchased electricity are difficult to predict. In the past few years, the cost escalation of purchased electricity rates has increased by double digits annually. As resources become more and more scarce and demand continues to increase, it is highly probable that purchased electricity rates will continue to escalate. Using a conservative 3 percent annual cost escalation model, the college's energy expenditure will rise to over $3 million annually by 2050 at the current level of usage. With a less conservative annual escalation rate of 7 percent, these expenditures reach over $11 million annually. The annual cost escalation models of 3 percent, 7 percent, and 12 are shown below.

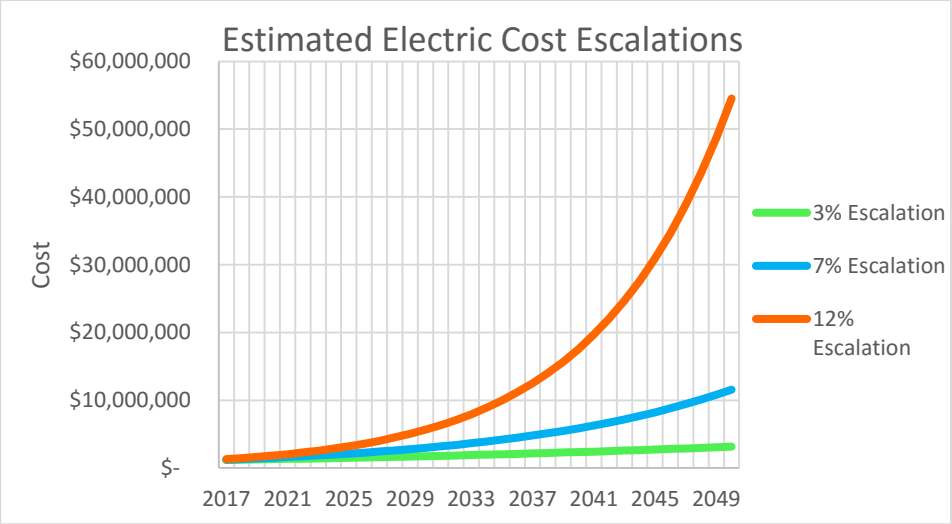

Figure 7: A graph showing the estimated electric cost through 2050 at escalation rates of 3 percent, 7 percent, and 12 percent.

Considering all available options, if Colorado College were to purchase the necessary RECs and offsets tomorrow to become "immediately" carbon neutral, the total expenditure annually could be as low as $21,625 and would not exceed $145,000 at current market rates. The more preferable options from a visibility and learning perspective are also the most expensive, due to a limited supply and limited diversity in options.

The results of the emissions and financial analysis shows that RECs and offset options are the least expensive initial cost for emissions reduction at $2.87 and $6.56 or less per metric ton, respectively. Following these in increasing cost per metric ton, sustainability initiatives, energy projects, central plant upgrades, and fleet conversion were also analyzed. The cost savings of these investments were also calculated. Currently, the college has saved over $4 million in reduced utility expenditures as a result of conservation and efficiency projects since 2008. Depending on utility cost escalations, the college could save over $60 million in energy purchases by investing in long term power purchase agreements to 2050. This savings increases as our energy usage is reduced through efficiency projects. If a long-term renewable PPA becomes available, a combination of the coupled RECs and purchased carbon offsets and total emissions reductions is a financially feasible and timely approach to becoming a carbon neutral campus.

Appendix A – Historical Plans

The initial plan presented to the Board of Trustees in 2011 was to reduce energy usage by 50 percent through conservation (20 percent) and efficiency projects (30 percent). The following is an excerpt from the 2011 strategy.

EFFICIENCY IN EXISTING BUILDINGS & CONSERVATION

Goals:

Colorado College will implement energy efficiency upgrades, energy management strategies and educational initiatives to achieve a 50% reduction in energy intensity per square foot by 2020. The target for energy efficiency is a 30% reduction in buildings campus-wide through technological upgrades. The target for conservation is a persistent 20% reduction in energy consumption through behavior change resulting from education.

RENEWABLE ENERGY

The purpose of this section is to provide assessment of the College's renewable energy options. Renewable energy is an important part of the carbon neutrality plan. According to this plan, renewable energy sources account for 50% of emission reductions. This goal requires the use of *X amount* of renewable energy sources. This *amount* can be produced on and off campus using solar energy, wind energy or some mix of both. What follows is an analysis of 4 different scenarios. Each includes a discussion of financing options, strategies, and the benefits/drawbacks of each scenario.

Figure 8: The college's original approach to becoming carbon-neutral

In 2013, the plan changed to using the four steps shown in the flowchart below. Conservation and efficiency accounts for only 25 percent of reductions in the updated plan. Colorado College has reduced emissions through conservation and efficiency nearly 30 percent since 2008, effectively achieving Phase 1 in the initial plan.

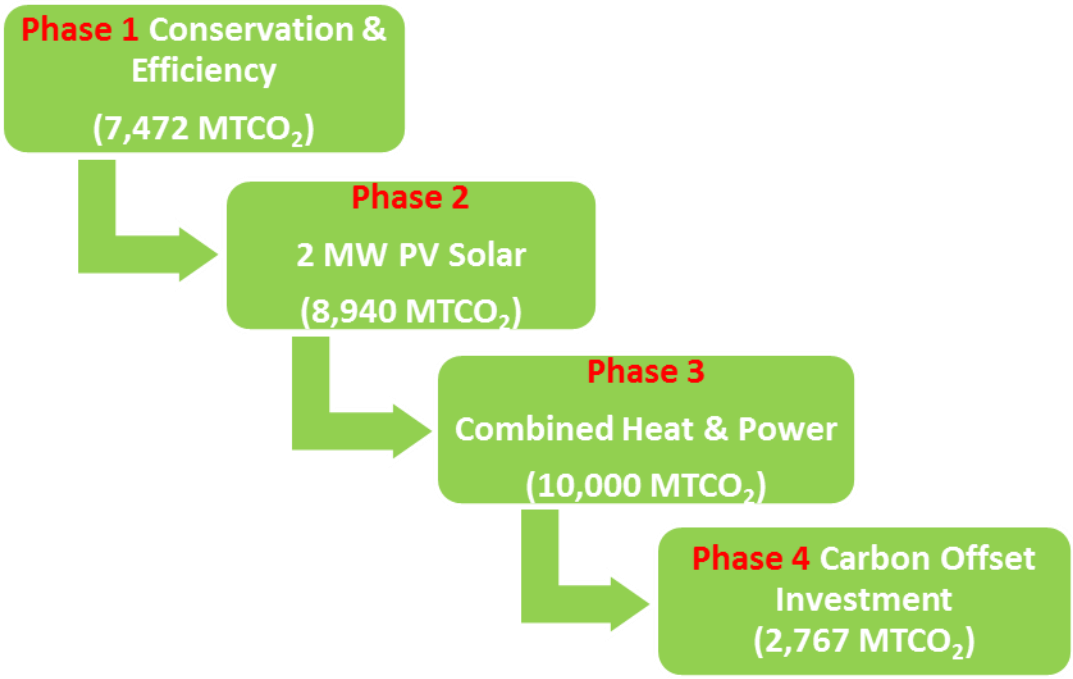

Figure 9: The college's 2013 four-step approach to becoming carbon-neutral

One of these steps, the 2MW solar array had an initial investment estimate of $6,500,000. This project has since been abandoned due to complications in land leasing with Colorado Springs Utilities. Large-scale combined heat and power has been determined to be too costly an undertaking. However, the college is currently installing a building-scale combined heat and power system on the Tutt Library as part of the net-zero energy/net-zero carbon design. Seeing as Phase 1 of the original plan has been achieved, the only relevant step left from the original plan is carbon offset investment.

Appendix B – Brendle Report

Excerpt from the Executive Summary of the 2008 Brendle Report:

Developed by The Brendle Group, the SMP includes both short-term and long-term goals to help bring Colorado College towards carbon neutrality and into greater alignment with sustainability on a wide range of issues. Central to this effort is the College's greenhouse gas inventory, assembled through the collection and analysis of annual utility data, discussions with facility staff, and a 2008 online campus survey. This information was compiled using Clean Air-Cool Planet, a software tool that is customized for colleges and universities to profile their greenhouse gas emissions.

The results show that in fiscal year 2006, Colorado College generated a gross of 32,208 metric tons (MT) of carbon dioxide and other greenhouse gases, with net emissions of 31,815 MT when accounting for the College's composting program and renewable energy purchases. Electricity and stationary fuels comprise the largest share of the College's emissions. Other contributing sources include airline travel, solid waste, fleet transportation, commuting, water use, and fertilizer.

This SMP also examines Colorado College's emissions compared to several of its peer liberal arts colleges, as well as other Colorado schools. As the following figures show, Colorado College was third highest among schools benchmarked in greenhouse gas emissions per student (with 13.16 MT per student) but fell in the middle for greenhouse gas emissions per square foot (.014 MT per square foot).

As part of the American College and University Presidents Climate Commitment (ACUPCC), The Brendle Group investigated what it would take for Colorado College to become carbon neutral. The resulting Carbon Neutral Plan, included in this SMP, identifies 9 strategies which, if collectively implemented, could help Colorado College reach this goal. At the direction of Colorado College, the Carbon Neutral Plan does not include the use of carbon offsets or renewable energy certificates (RECs).

While certain items in the Carbon Neutral Plan above have extended paybacks, the overall package represents a 15-year payback on a $30 million Plan. Both of the extended payback items – co-generation and solar photovoltaic – were evaluated at the direction of Colorado College. Of note, both may become financially more attainable as state and local policies are implemented to incentivize these technologies and as energy costs continue to rise. It is also important to note that this figure of $30 million only includes capital costs; additional funding would be needed for administration, staffing, and other management and operations to fully implement the Plan.

The line item in the Carbon Neutral Plan above that addresses energy efficiency is developed in more detail in the following table. These recommendations were developed by The Brendle Group through on-site energy assessments of a sampling of 15 individual buildings totaling over 1 million square feet, with savings extrapolated to buildings campus-wide, and investigation of additional energy efficiency strategies applicable campus-wide. As the findings show, Colorado College can achieve over 35 percent savings in its energy use with a combined payback on up-front costs in 18 years. Similar to the Carbon Neutral Plan, some of these recommendations have individual paybacks that extend beyond 25 years. However, these measures have other valuable benefits beyond payback and energy savings, such as in the case of replacing lab hoods – a measure that offers human health and safety benefits that should be taken

into consideration. Bundling higher payback items into a package allows for valuable building improvements where high-cost items can be offset by quick payback items.

In addition to Colorado College's greenhouse gas emissions, the SMP documents existing practices and outlines goals, metrics, and strategies for 15 qualitative topics relating to sustainability:

- LEED Certification
- Curriculum
- Solid Waste and Recycling
- Food
- Transportation
- Hazardous Waste
- Refrigerants
- Personnel Policies
- Campus Life
- Pest Control
- Construction Practices
- Procurement and Resource Use
- Grounds and Landscape Maintenance
- Workplace Environment
- Custodial Operations

Beyond successful implementation of the Carbon Neutral Plan and other strategies identified above, the success of the College's SMP depends on the ability to fund projects and initiatives, to collect and manage the large amounts of data needed to track progress towards carbon neutrality and sustainability, and to provide the staff resources needed to put the SMP into action.

Current investment levels in campus sustainability are substantial, but reaching carbon neutrality and implementing other sustainability measures will require additional sustained and committed financial resources. The consultant team identified several options for funding these efforts, including reducing operating costs and re-directing savings into sustainability, outside incentives such as rebates and grants, debt financing, capital campaigns, and a sustainability revolving fund.

Finally, to carry this all out Colorado College will require a commitment from the entire campus community. Additional capacity will be necessary among College staff to help manage energy efficiency programs and coordinate sustainability initiatives. Support will also be needed from the administration, the Campus Sustainability Council (CSC), faculty, and students alike.

The Brendle Group observed Colorado College's many cultural and institutional assets in the course of this project that should greatly increase its chances of success surrounding this SMP's implementation. Of note, The Brendle Group was selected to conduct this project not just for its traditional engineering experience, but for its proven approach to working with customers in a collaborative way. The Brendle Group's approach employs documented methods for leading organizational change toward sustainability aimed at increasing the ownership and success rate of its customers' sustainability plans long after the consulting work is done. As examples of this high touch approach for this project, The Brendle Group provided training and included students in conducting lighting and water conservation assessments; provided guest lectures in sustainable development classes; solicited ideas from students, faculty, and staff through a facilitated project kick-off event; conducted individual and small-team interviews to partner with staff in developing recommendations for the non-energy topics of this SMP; met with the President's Advisory Council on Sustainability to gain their feedback on the project approach and preliminary results;

conducted an electronic survey of faculty, students, and staff; and had several work sessions with the Campus Sustainability Council to engage the Council in reviewing and enhancing the goals and recommendations noted in this SMP.

As a result of this approach, this SMP represents not just a quantitative path towards carbon neutrality and 35 percent gain in energy efficiency, but also continued strides in 15 other areas of sustainability and recommendations addressing funding, staffing, managing, and monitoring needs in order to position Colorado College for enduring success in the area of sustainability.

From this collaborative approach, Colorado College is well suited to develop its own living SMP document as it validates and pursues The Brendle Group's recommendations.

Colorado College Carbon Action Report

Achieving Carbon Neutrality by 2020 and Beyond