



**COLORADO
COLLEGE**

2020 ENERGY REPORT



Mark J. Ferguson, P.E.
Campus Operations & Plant Manager

Table of Contents

Executive Summary.....	2
Utilities Overview.....	3
Avoided Cost.....	4
Carbon Footprint.....	5
Benchmarking Colorado College.....	6
Benchmarking Educational Facilities.....	9
Benchmarking Residential Facilities.....	10
Benchmarking Support Facilities.....	11
Utility Rates.....	12
2019 Energy & Sustainability Projects.....	13
2020 Energy & Sustainability Projects.....	16

Executive Summary

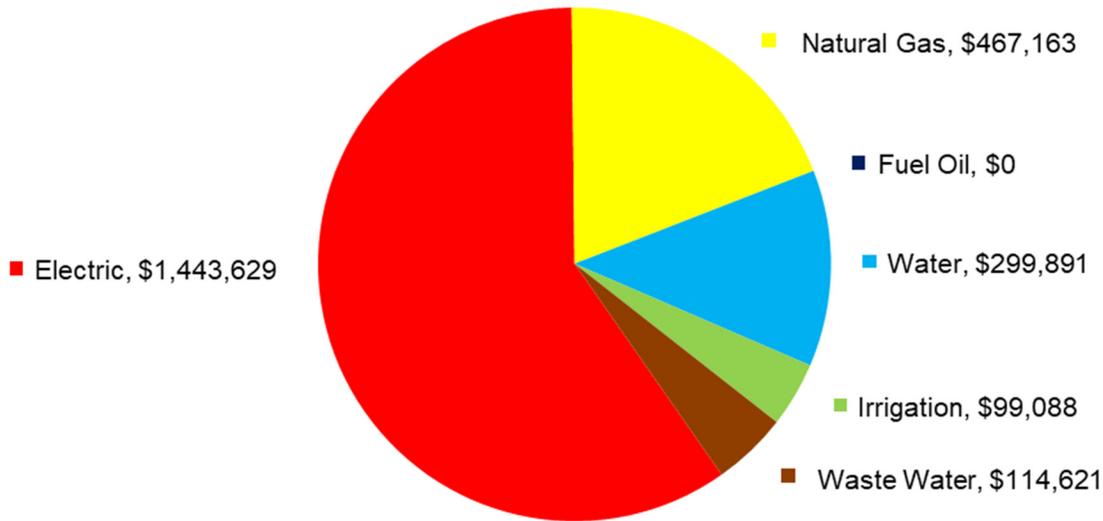
The Facilities Services Department at Colorado College (CC) is committed to taking action to meet the College's climate commitment. The stewardship of resources and utilities management is one of the primary strategic initiatives of the Technical Services Department. In FY 20, CC experienced a 7.4% decrease in energy consumption. Since 2008 campus energy intensity per square foot has decreased 27.9% even after the addition of the Fine Arts Center. Cumulative avoided costs for utilities are estimated to be nearly \$7.7M since the 2008 baseline year.

Notable events for 2020 are:

- Carbon Neutrality – The campus achieved carbon neutrality in January of 2020. CC began purchasing all electricity under Colorado Springs Utilities green power tariff January 1st, 2020. The tariff provides power from the Grazing Yak and Palmer Solar Arrays with renewable energy credits through contract with Colorado Springs Utilities. CC renegotiated its natural gas purchasing agreement to a lower delivery cost. This allowed carbon offsets to be purchased for natural gas emissions at the same delivered cost. CC purchased 6500 MTCO_{2e} of carbon offsets to offset natural gas emissions in 4 landfill gas capture projects.
- COVID-19 – In-person learning ended following spring break in response to COVID-19. Students completed courses through distanced learning and did not return to campus after spring break. Summer conferences and events were cancelled.
- Energy – Campus energy intensity per square foot decreased 5.3% compared to the 2019 academic year. Energy costs decreased 12.9% due to 31.1% lower commodity pricing for natural gas.
- Water – Campus potable water consumption decreased by 23.8% for the 2020 academic year. Rates increased by 9.2% for potable water compared to the 2019 academic year.
- Renewable Energy Production - This year 48.7% of the electricity used on campus was produced from onsite and offsite solar. 5.3% of the electricity consumed was produced from on-campus solar arrays.
- Utilities Infrastructure – This year CC installed new distribution piping HTHW and chilled water (CW) piping to Robson Arena across Cache La Poudre Street.

Utilities Overview

CC FY 2020 Utility Cost Summary Total Cost \$2,424,393



- **For the 2020 academic year, Colorado College’s main campus energy related characteristics were:**

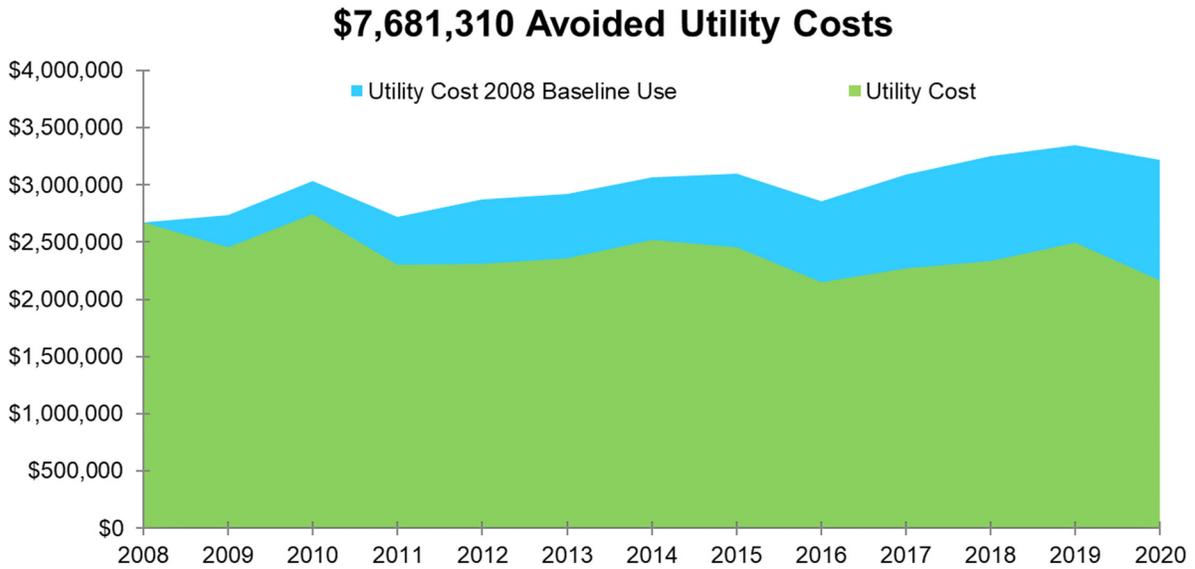
 - 2,212,765 square feet (SF) of space
 - Approximately 100 acres of land
 - 147 Buildings

- **For the 2020 academic year, Colorado College’s main campus energy performance statistics were:**

 - Energy use averaged **75.8 kBtu per square foot (SF)**
 - 5.3% decrease over previous year
 - 48.7% of electricity from renewable sources
 - Energy costs averaged **\$0.86 per SF**
 - 10.9% decrease over previous year
 - \$7.7M in avoided costs since 2008
 - MTCO₂ emissions from energy use averaged **0.0027 MTCO₂e per SF**
 - 61.5% decrease over previous year
 - 75.6% decrease since 2008

Avoided Cost

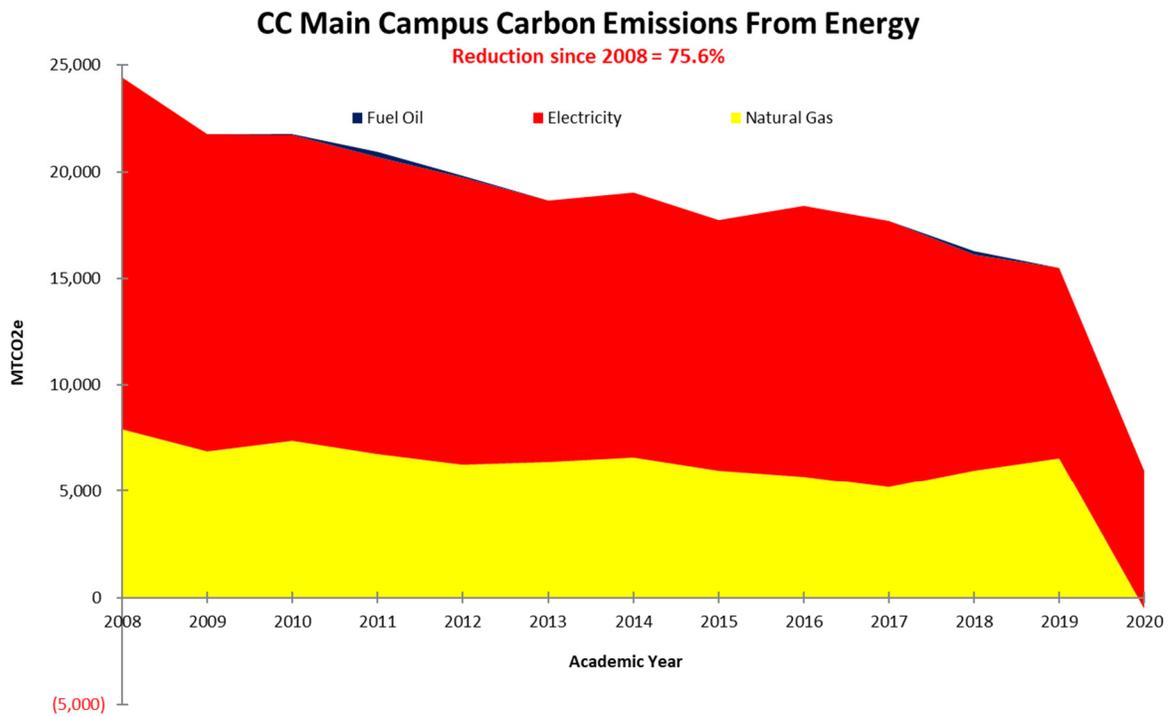
The cumulative campus utility cost avoidance compared to the campus baseline of 2008 is estimated at nearly \$7.7M. The avoided cost for the 2020 academic year is estimated at \$1.1M. These numbers reflect combined utility savings, which include avoided electricity, natural gas, water, and wastewater costs. Below is a graphical representation of overall avoided utility costs (area in blue).



Carbon Footprint

Colorado College’s commitment to become carbon neutral stems from the college’s signing of the Presidents’ Climate Commitment in early 2009. The college’s carbon footprint, in 2008, from energy use is estimated at 24,437 metric tons of CO₂ (MTCO₂). In January of 2020, Colorado College achieved carbon neutrality. For the 2020 academic year beginning July 1st, 2019 and extending through June 30th, 2020, the College’s carbon emissions from energy use are estimated at 5,968 MTCO₂ for a reduction of 75.6% compared to the 2008 baseline.

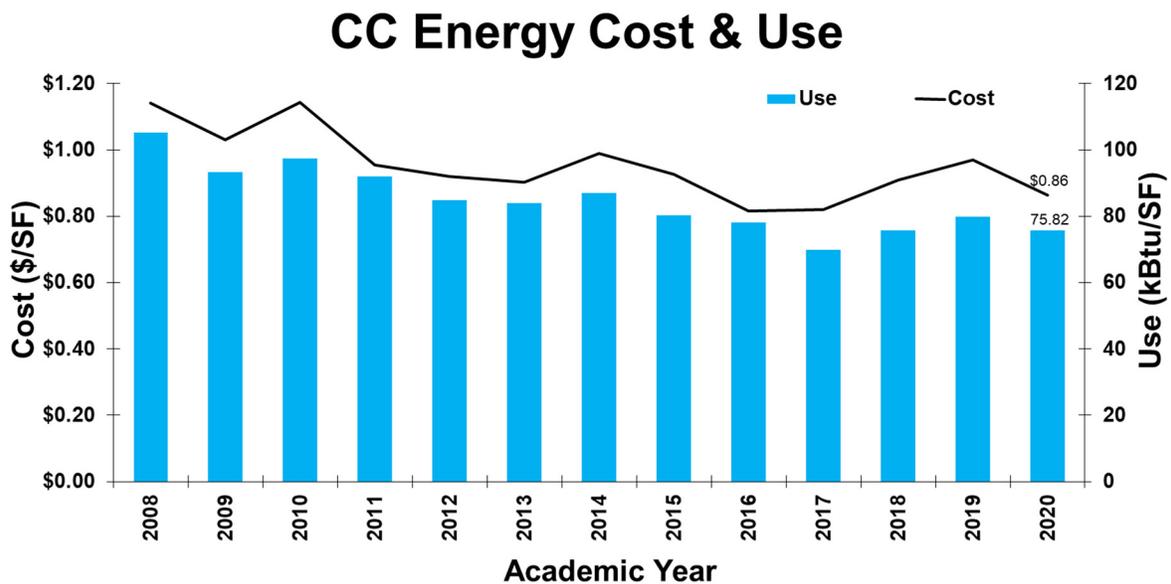
These measurements assume a consistent Colorado Springs Utilities (CSU) fuel mix. Colorado Springs Utilities fuel mix has improved over the duration of the college’s carbon reduction efforts. CSU fuel mix has increased renewable energy sources and reduced coal consumption. The result is actual combined carbon reductions are more than stated in this report. The chart below includes emissions reductions from CC’s efforts:



The largest carbon emissions decreases are due to green energy purchases in local solar gardens and carbon offsets acquired to compensate for emissions from natural gas consumption on campus. Green energy purchases began January 1st, 2020 and are contracted with automatic renewal annually.

Benchmarking Colorado College

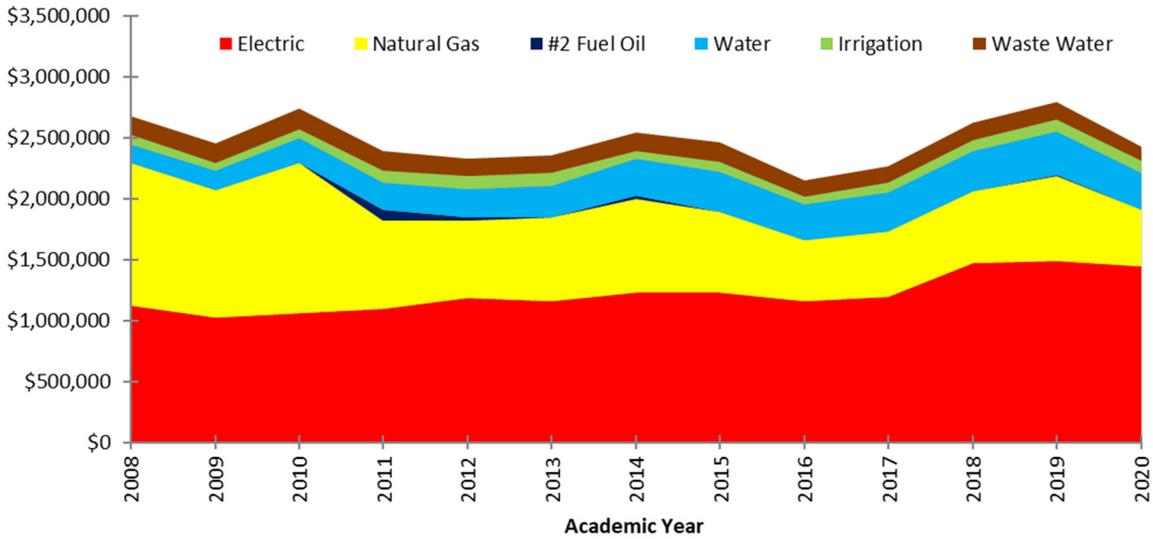
Colorado College has closely monitored and documented overall campus energy and cost intensity since 2008. For reference, the Association of Physical Plant Administrators (APPA), who represents the largest international association of educational institutions and their facilities departments, list the 2019 average energy intensity for higher education facilities at 122.5 kBtu/SF/Yr. APPA lists the average utilities cost per square foot at \$2.16 / SF. The chart below illustrates that CC’s performance exceeds both figures with an average energy intensity of 75.8 kBtu/SF/Yr and energy cost of \$0.86/SF.



One factor that is unclear is what effect CC’s block plan has on our overall energy use intensity. The block plan is thought to require more educational space because all classroom spaces are used simultaneously. For comparison to the CC average 75.8 kBtu/SF/Yr, the following annual kBtu/SF/Yr numbers were calculated using the most recent Association for the Advancement of Sustainability in Higher Education (AASHE) Sustainability Tracking, Assessment and Rating System (STARS) data at comparable institutions:

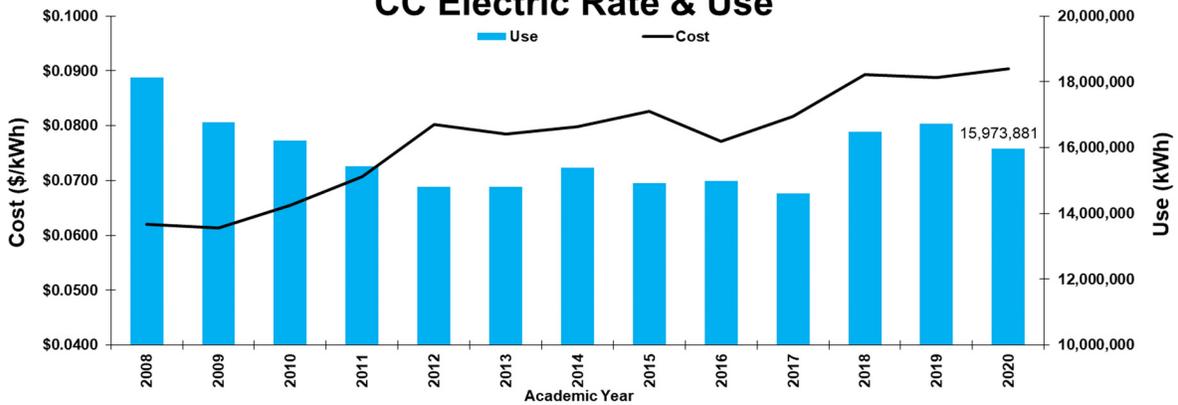
- | | | |
|----------------------------------|---------------|--------------|
| • Colby College | 135 kBtu / SF | 11/2018 data |
| • Colgate University | 129 kBtu / SF | 08/2017 data |
| • Middlebury College | 177 kBtu / SF | 06/2017 data |
| • Pomona College | 114 kBtu / SF | 10/2015 data |
| • University of Denver | 104 kBtu / SF | 02/2016 data |
| • University of Colorado Boulder | 90 kBtu / SF | 03/2018 data |
| • Williams College | 122 kBtu / SF | 05/2019 data |

CC Annual Utility Costs by Service

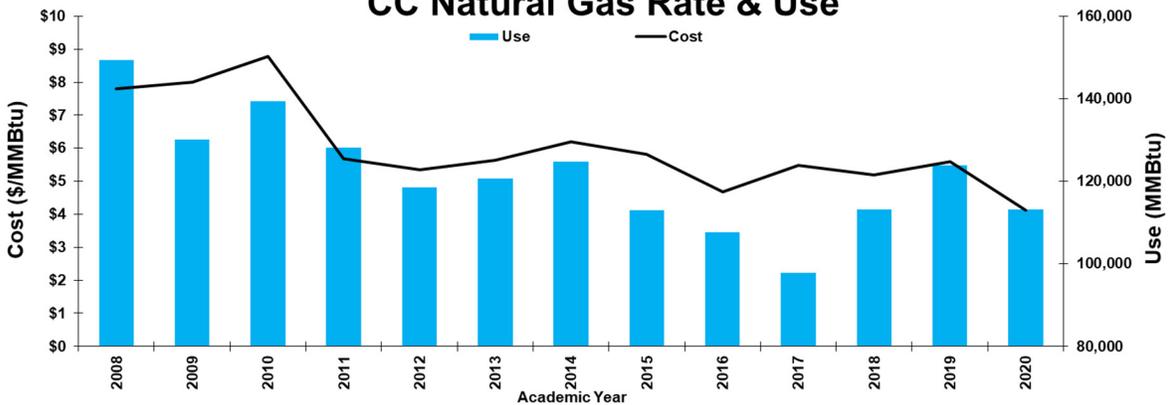


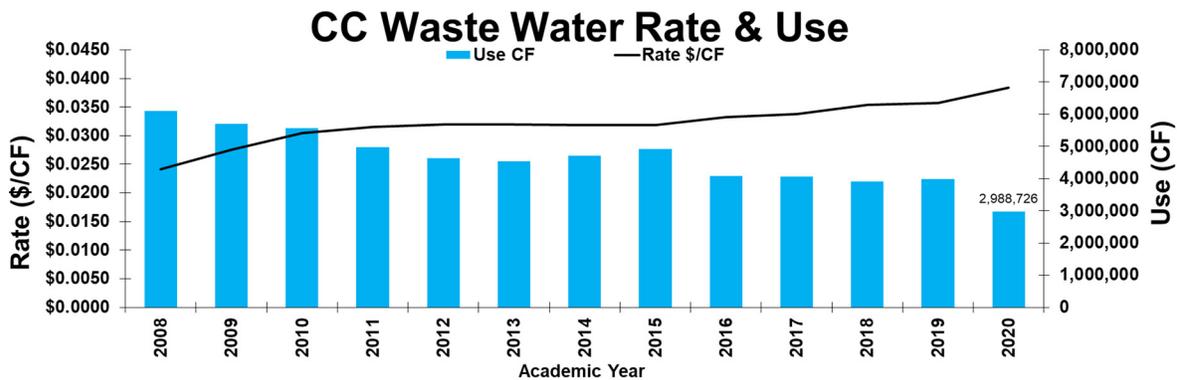
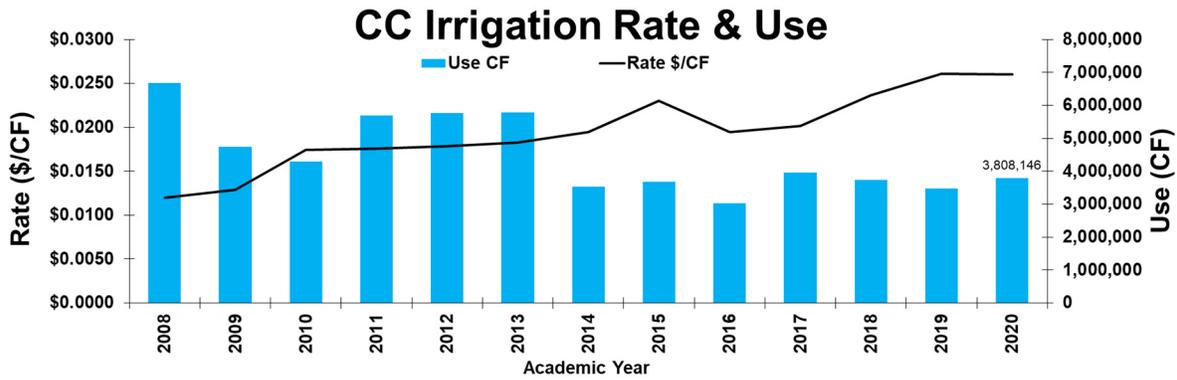
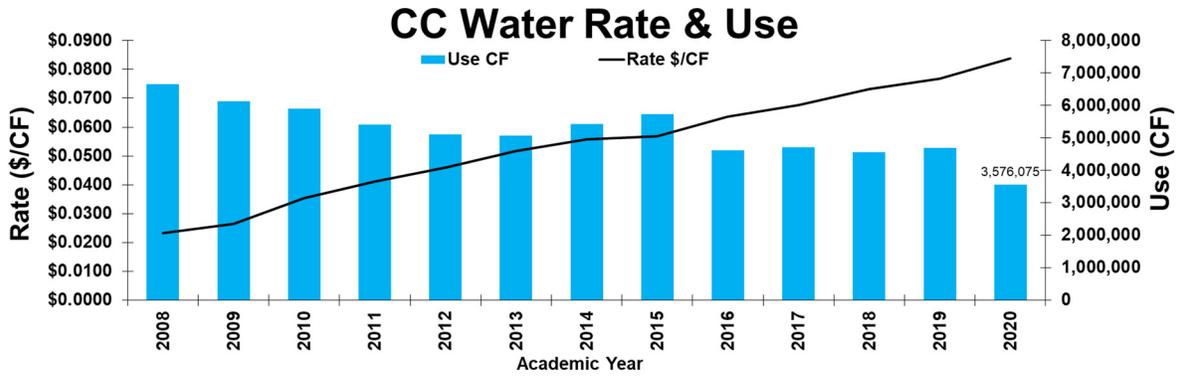
The chart above breaks down expenses by utility commodity. The most notable information is the decrease in natural gas commodity costs. The decrease in water costs is due to a large decrease in use (consumption). The charts below give more detail on rate and use relationships.

CC Electric Rate & Use



CC Natural Gas Rate & Use

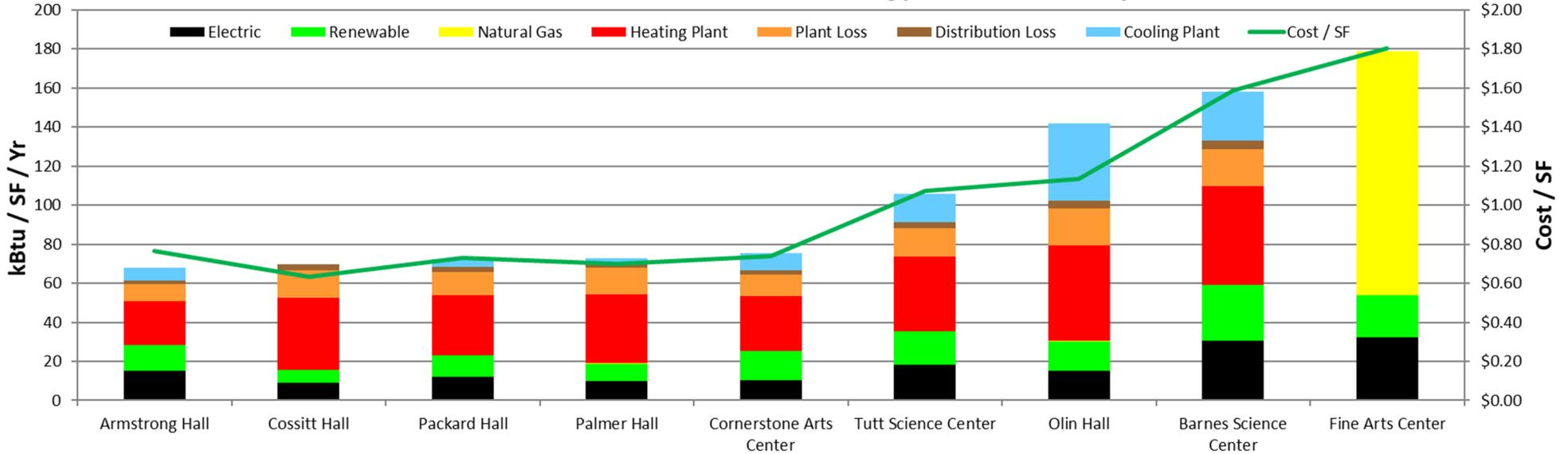




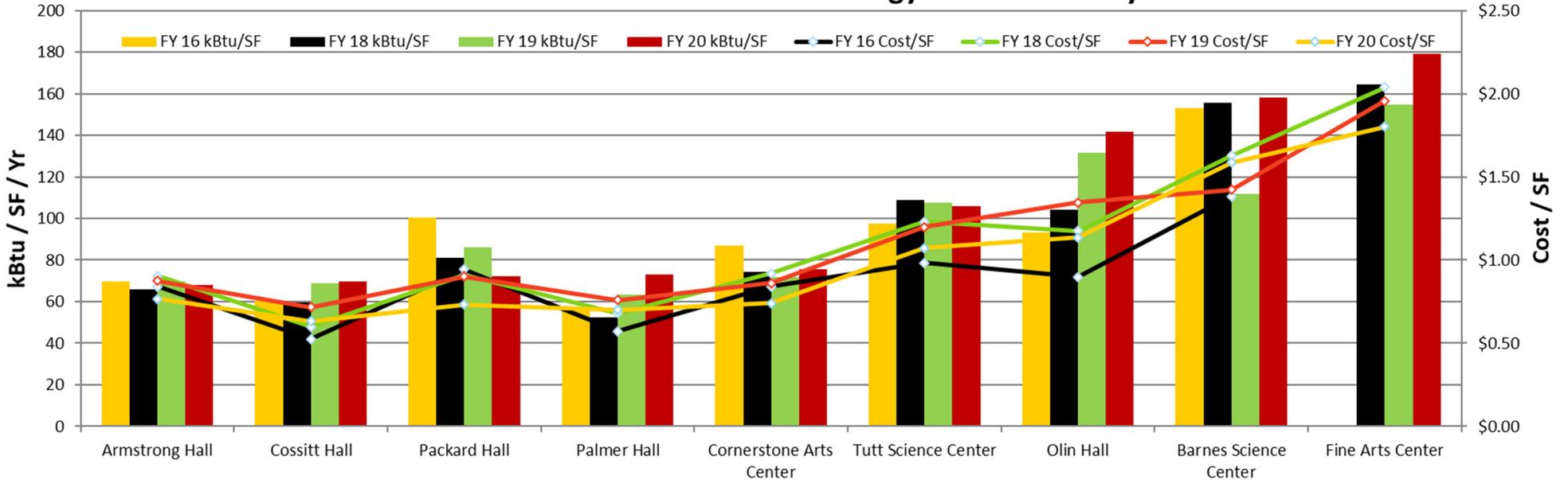
This is the eighth year for energy benchmarking at the building level. In 2011, thermal metering was installed. Thermal metering has enabled CC to measure the amount of heating and cooling energy flowing from the central plant to respective buildings. The following charts are the result of building level thermal and electrical metering.

Benchmarking Educational Facilities

CC 2020 Educational Facilities Energy & Cost Intensity

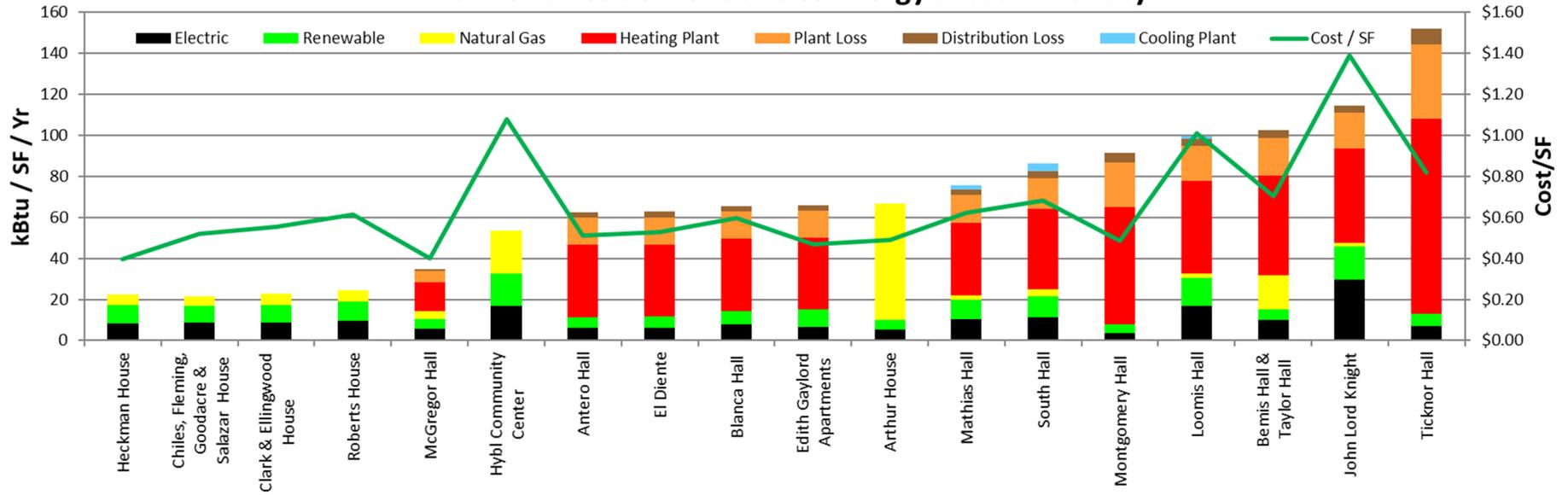


CC 2020 Educational Facilities Energy & Cost Intensity

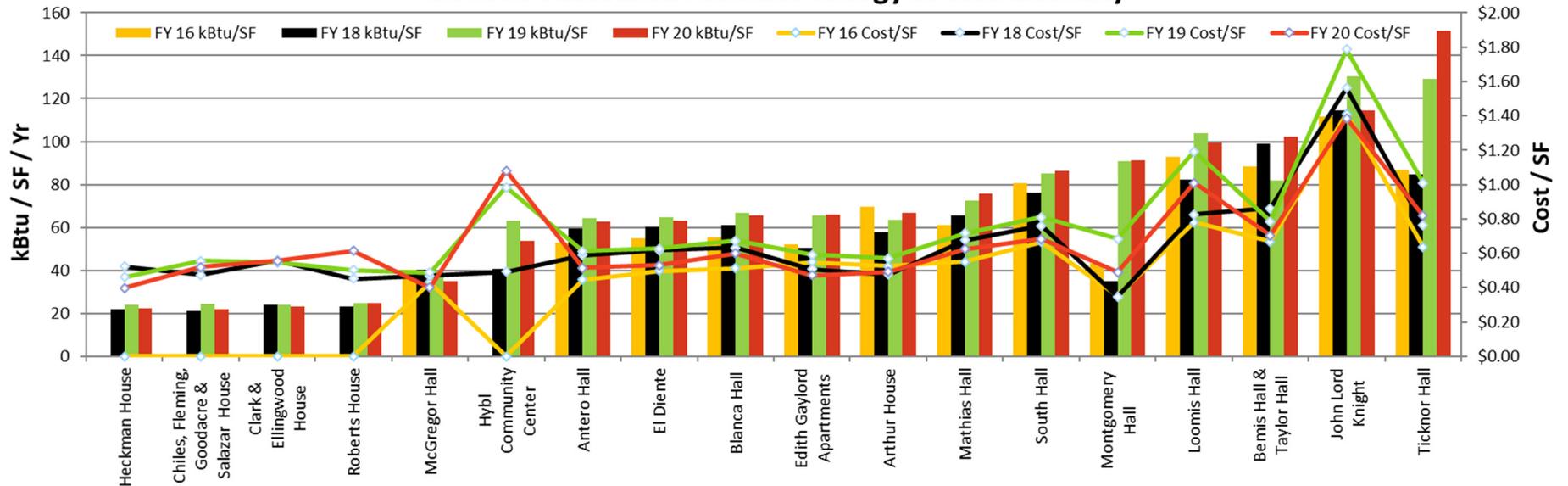


Benchmarking Residential Facilities

CC 2020 Residence Facilities Energy & Cost Intensity

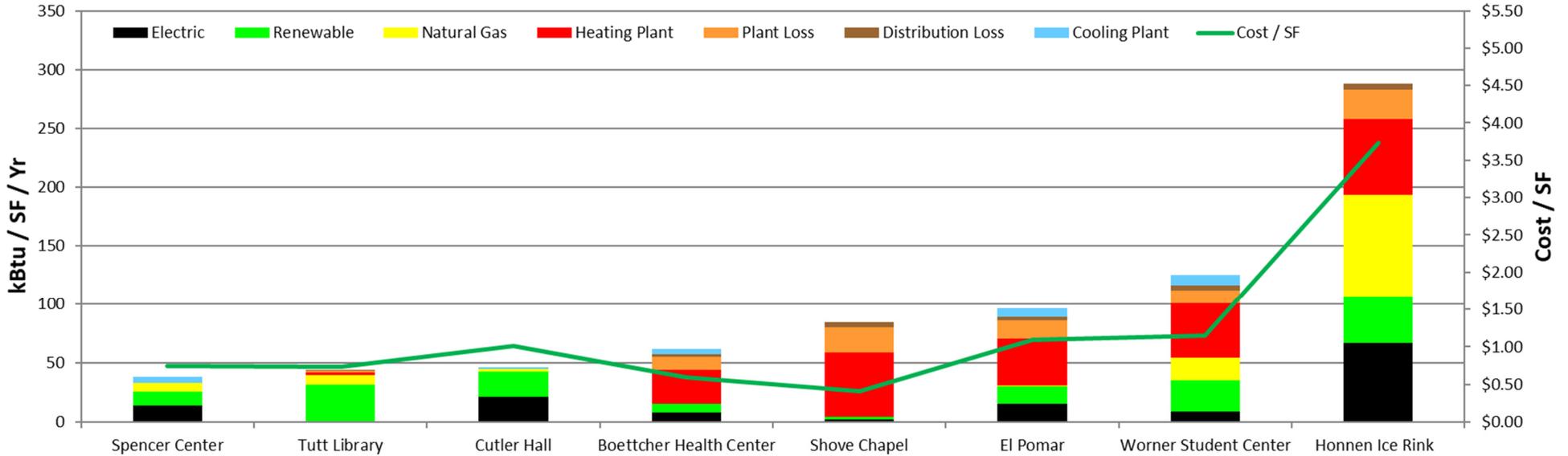


CC 2020 Residence Facilities Energy & Cost Intensity

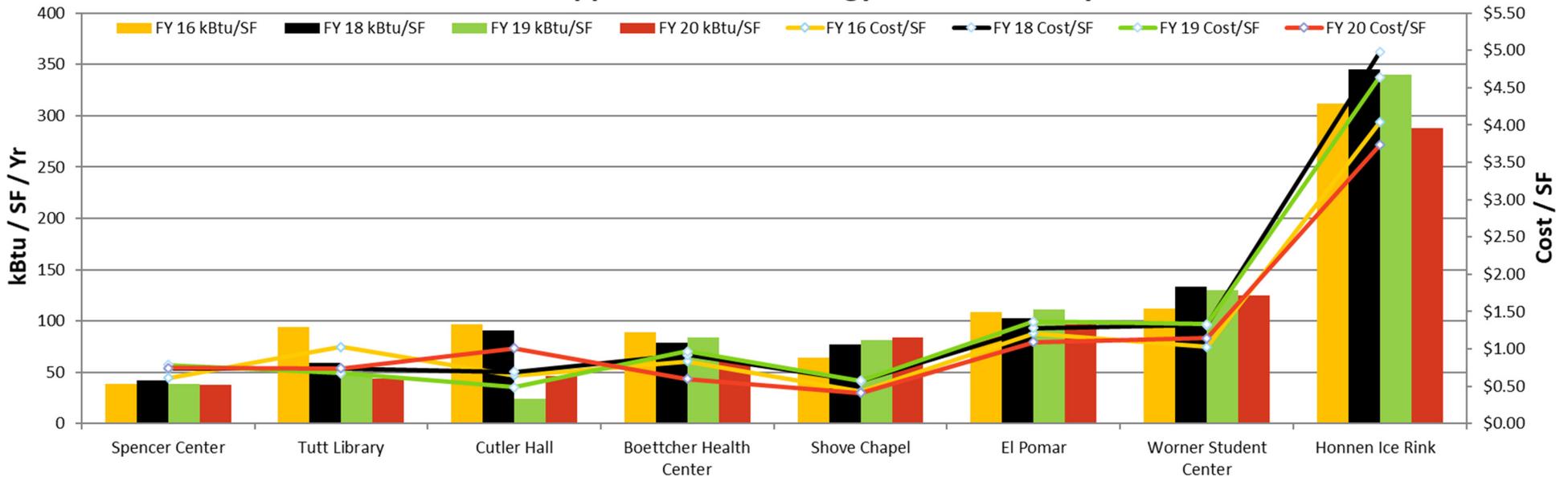


Benchmarking Support Facilities

CC 2020 Support Facilities Energy & Cost Intensity



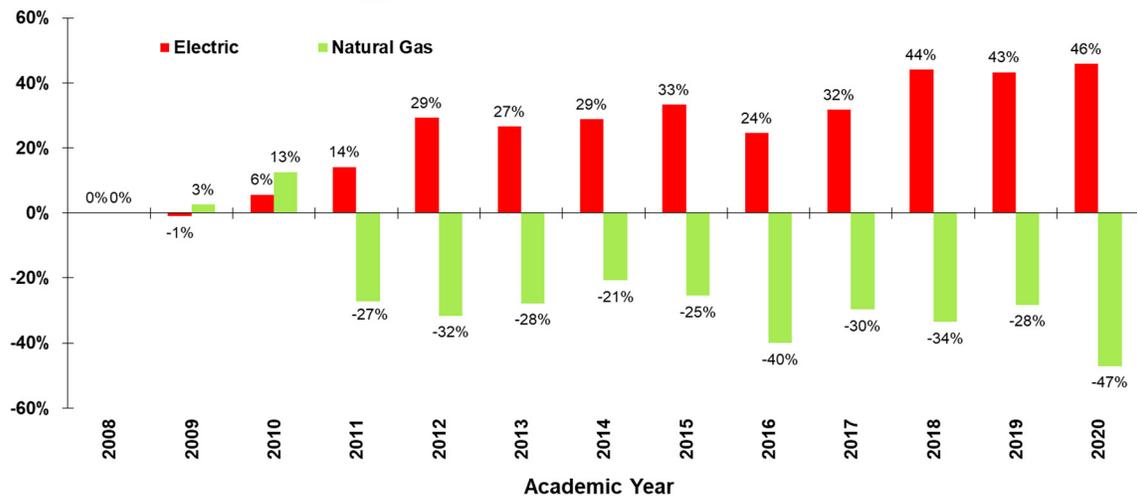
CC 2020 Support Facilities Energy & Cost Intensity



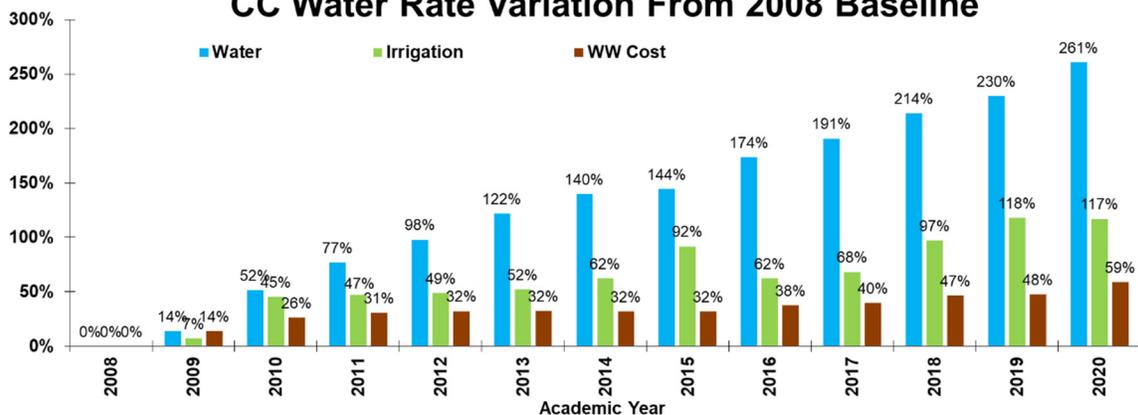
Utility Rates

CC has made significant improvements in reducing utility consumption since 2008. Because of these improvements, total costs are relatively unchanged even with increases in most utility rates. Commodity rates can found on the charts in the Benchmarking Colorado College section of this report. The charts below show the variation in commodity rates per unit experienced by CC since 2008. Electricity and water rate increases have seen larger than expected upward pressure. Natural gas costs have declined due to market conditions.

CC Energy Rate Variation From 2008 Baseline



CC Water Rate Variation From 2008 Baseline



For the 2020 academic year, the campus experienced a 31.1% decrease in natural gas commodity cost delivered over the previous year. Rates increased by 9.2% for potable water and 7.4% for wastewater compared to the 2020 academic year. On January 1, 2021, we are expecting Colorado Springs Utilities to change rates as follows:

- Natural gas 4.0% base rate increase

2020 Energy & Sustainability Projects

Monthly Building Automation Review

Project Status: **Ongoing**

Project Description: The monthly building automation review project is a periodic review with stakeholders to review building performance through the building automation system and make adjustments as needed. This periodic review is used to commission new projects, troubleshoot controls issues, and retro-commission buildings that are not operating at their peak efficiency. In response to COVID-19 this process served to minimize operating schedules and equipment runtimes to conserve energy while buildings were unoccupied.

Fine Arts Center Chiller Replacement

Project Status: **Complete**

Project Description: The Fine Arts Center chiller replacement project replaced the facility's main chiller improving the buildings reliability and efficiency. Due to the need for cooling and dehumidification to maintain special collections, the chiller is required to run year round and during low ambient temperature conditions. This has caused the existing chiller to fail prematurely due to short cycling. The new chiller incorporates free cooling to provide cooling during low ambient temperature conditions without a compressor improving efficiency.

Project Highlights:

- Improves reliability
- Improves efficiency



Robson Arena Utilities

Project Status: **Complete**

Project Description: The Robson Arena utilities project is a project to extend campus utilities to the site for the new Robson Arena. It includes:

- Adding campus HTHW and chilled water (CW) lines from Tava Quad to the project site across Cache La Poudre St.
- Vacating the alley between Nevada Ave. and Tejon Ave. running from Cache La Poudre St. to Dale St.
- Removing overhead power lines and poles and rerouting them underground around the site.
- Filling existing sanitary sewer lines in the alley and rerouting them around the site in Cache La Poudre St., Tejon Ave., and Dale St.

Project Highlights: We have been working to model future utilities consumption and minimize its impact on future operating budgets. We have split the facility into multiple electrical services to manage demand rates associated with the facility's varying demand events. Left unmanaged the facility's demand has the ability to increase electrical cost for the facility to 300% of the campus average electrical rate. In addition, there is a cost premium of approximately 10% for green power to provide 100% emissions free solar.

Currently Honnen Arena is 32,584 square feet (SF) of space with a utilities expense of \$170,000 for FY 19. This equals \$5.22/SF/YR for all utilities. Robson Arena and Campus Support Building will add 149,925 SF of conditioned square footage. The entire buildout of the arena, garage, and campus support structure is 262,675 SF.

The cost of utilities at Robson Arena will largely depend on utilization. Because the space is planned to be a multi-use facility we are anticipating a substantial increase in utilities costs. Our best estimate on the increase is moving from \$170,000 at Honnen to ~\$500,000 at the Robson facility buildout.



Worner Center Kitchen Repairs

Project Status: **Complete**

Project Description: The Worner Center kitchen improvements project repaired energy issues at Worner Center. The project scope included replacing HTHW valves serving the kitchen, replacing the dishwasher, insulating refrigerant piping, and adding the freezer to the emergency generator. All scope items are complete with the exception of replacement of the dishwasher. The dishwasher is scheduled for replacement in the winter of 2020.

2021 Energy & Sustainability Projects

Campus Building Ventilation Assessment & Upgrades

Project Status: **In-progress**

Project Description: The campus building ventilation assessment & upgrades project is an initiative to reduce the spread of COVID 19 by increasing ventilation in major buildings. The goal of the project is to improve filtration and increase ventilation to three air changes per hour for two hours prior to occupancy and continuing through two hours after occupancy to meet American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) recommendations. By increasing air changes to three air changes per hour ASHRAE, calculations show that 95% of airborne contaminants will be removed. This project is anticipated to increase energy consumption by as much as 25%.

Robson Arena Commissioning

Project Status: **In-progress**

Project Description: The Robson Arena commissioning project will work to ensure that construction matches the design intent, improving quality and reducing operational issues of the delivered facility. The number one performance goal at Robson Arena is to provide the best sheet of ice in North America. We are currently in the approval and observation stages of commissioning. Our activities are focused on reviewing submittals, inspecting fabrications and field installations to include mockups to reduce issues during functional testing and ensure that all systems perform as designed.

Clarke House and Ellingwood House Photovoltaic Solar

Project Status: **Planning**

Project Description: The Clarke House and Ellingwood House photovoltaic solar project is scheduled to begin construction in October of 2020. This project will add rooftop solar reducing carbon emissions and annual operating costs. This project was made possible through a generous donation.

Project Highlights:

- 1 – 8.7 kW PV array

Monthly Building Automation Review

Project Status: **Ongoing**

Project Description: The monthly building automation review project is a periodic review with stakeholders to review building performance through the building automation system and make adjustments as needed. This periodic review is used to commission new projects, troubleshoot controls issues, and retro-commission buildings that are not operating at their peak efficiency.

Utilities Master Plan Update

Project Status: **On-hold pending funding**

Project Description: The Utility Master Plan Project will update our 1998 utilities master and align it with our 2015 Campus Master Plan and 2017 Campus Master Plan Update . The plan will be completed in phases to complete condition assessments, identify future projects, and locate utilities in geographical information system format.

Worner Kitchen Dishwasher Replacement

Project Status: **Planning**

Project Description: The Worner dishwasher replacement project will replace the dishwasher in Worner center. The major energy component of this project is fuel switching the dishwasher from steam to electric for sterilization. The Worner Center steam requirements are a major constraint for higher central plant temperatures through the summer. Removing the Worner Center steam requirement will allow for lower HTHW temperatures to campus during the summer saving energy.