COLORADO COLLEGE

2019 ENERGY REPORT

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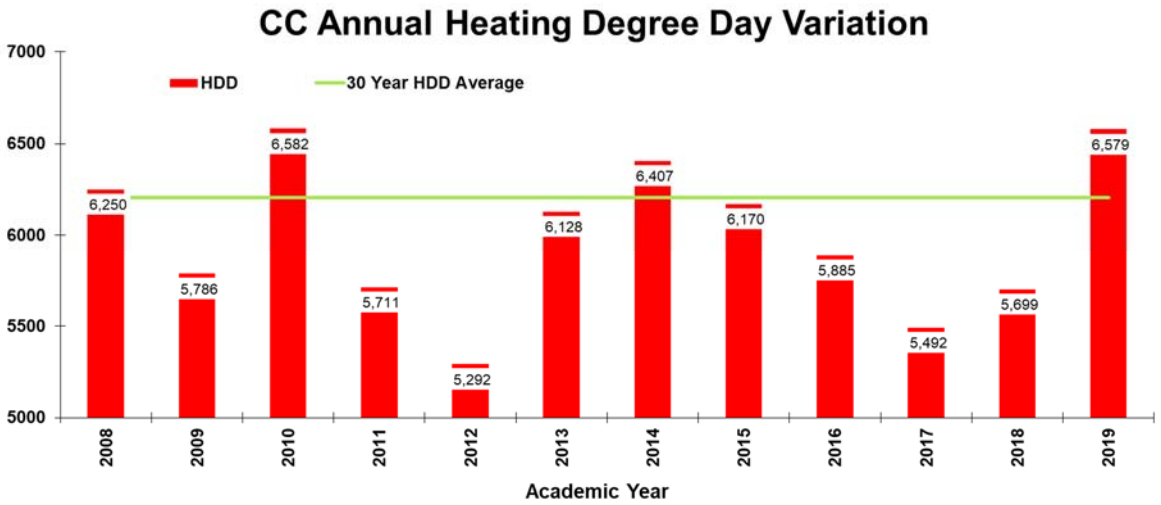
Table of Contents

Executive Summary

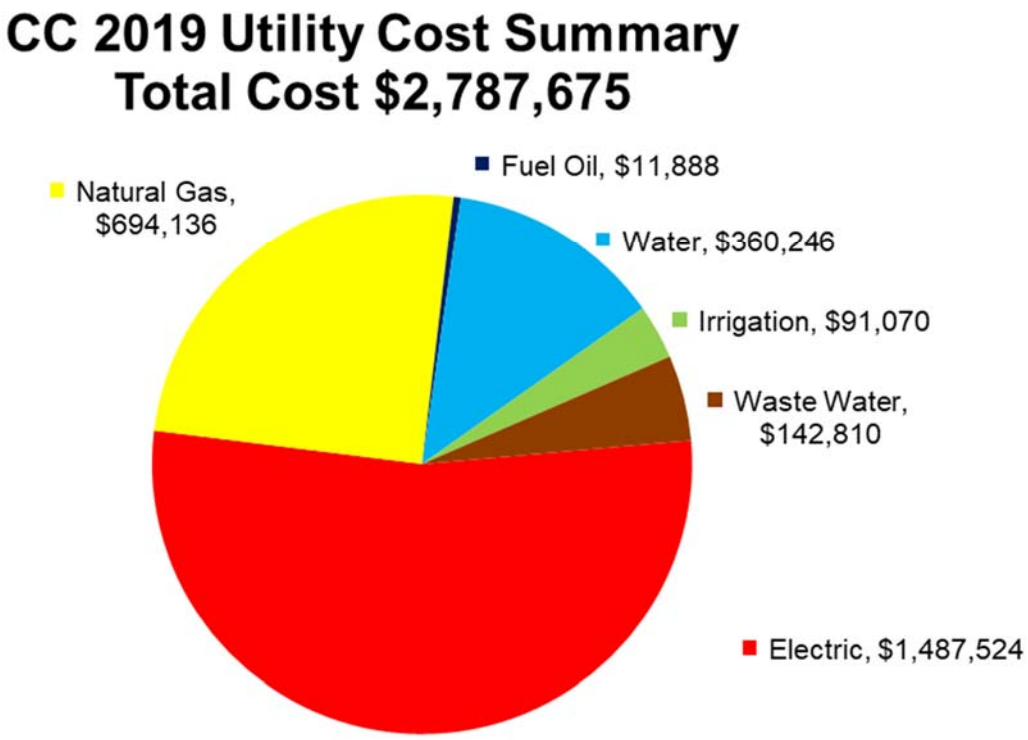
The Facilities Services Department at Colorado College (CC) is committed to taking action to meet the College's climate commitment. The stewardship of resources and utilities management is one of the primary strategic initiatives of the Technical Services Department. In FY 19, CC experienced a 5.3% increase in energy consumption due to a colder than average winter. Since 2008 campus energy intensity per square foot has decreased 24.0% even after the addition of the Fine Arts Center. Cumulative avoided costs for utilities are estimated to be over $6.6M since the 2008 baseline year.

Notable events for 2019 are:

- Energy – Campus energy intensity per square foot increased 5.6% over the 2018 academic year with the addition of the Fine Arts Center. Energy costs increased 6.6% due to increased natural gas consumption.
- Water – Campus non-potable water consumption decreased by 6.8% for the 2019 academic year. Rates increased by 4.8% for potable water and 9.4% for non-potable water over the 2018 academic year.
- Renewable Energy Production - This year 6.6% of the electricity used on campus was produced from on & offsite solar. 4.0% of the electricity consumed was produced from on-campus solar arrays.
- Carbon – The campus has reduced annual carbon emissions from energy consumption by 36.6% over the 2008 baseline.
- Utilities Infrastructure – This year we made progress on improving the reliability and resiliency of our aging high temperature hot water (HTHW) distribution system infrastructure. We replaced HTHW phase 2 of HTHW piping to Packard Hall across Cache La Poudre Street.
- Colder than average winter conditions depicted in the chart below:



Utilities Overview

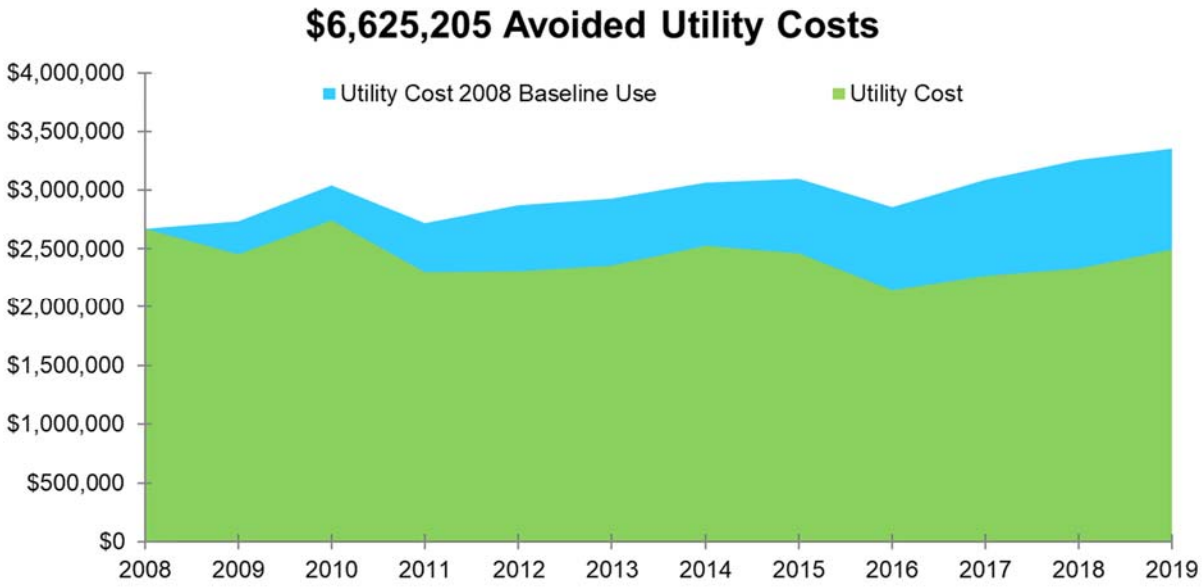


- **For the 2019 academic year, Colorado College's main campus energy related characteristics were:**
  - Approximately 2,264,533 square feet (SF) of space
  - Approximately 100 acres of land
  - 155 Buildings

- **For the 2019 academic year, Colorado College's main campus energy performance statistics were:**
  - Energy use averaged **80.0 kBtu per square foot** (SF)
    - 5.3% increase over previous year
    - 6.6% of electricity from renewable sources
  - Energy costs averaged **$0.97 per SF**
    - 6.6% increase over previous year
    - $6.6M in avoided costs since 2008
  - $MTCO_2$ emissions from energy use averaged **0.0072 $MTCO_2e$ per SF**
    - 14.3% decrease over previous year
    - 36.6% decrease since 2008

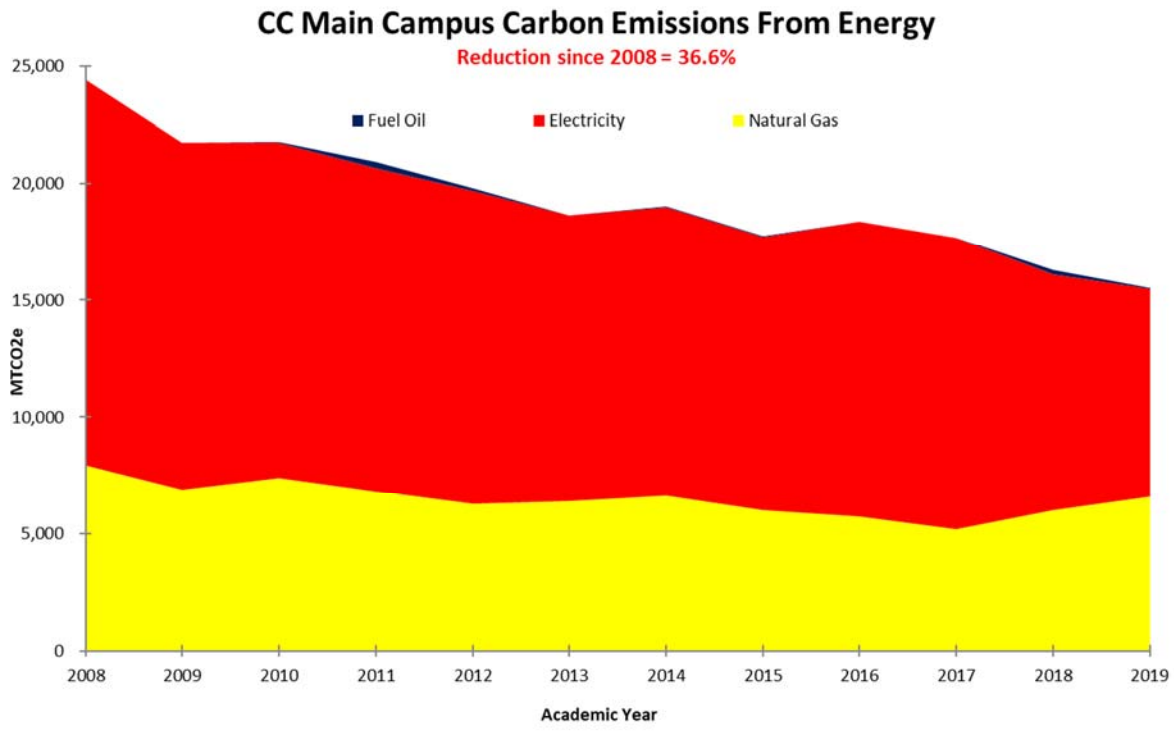
Avoided Cost

The cumulative campus utility cost avoidance compared to the campus baseline of 2008 is estimated at $6.6M. The avoided cost for the 2019 academic year is estimated at $857K. These numbers reflect combined utility savings, which include avoided electricity, natural gas, water, and waste water costs. Below is a graphical representation of overall avoided utility costs (area in blue).



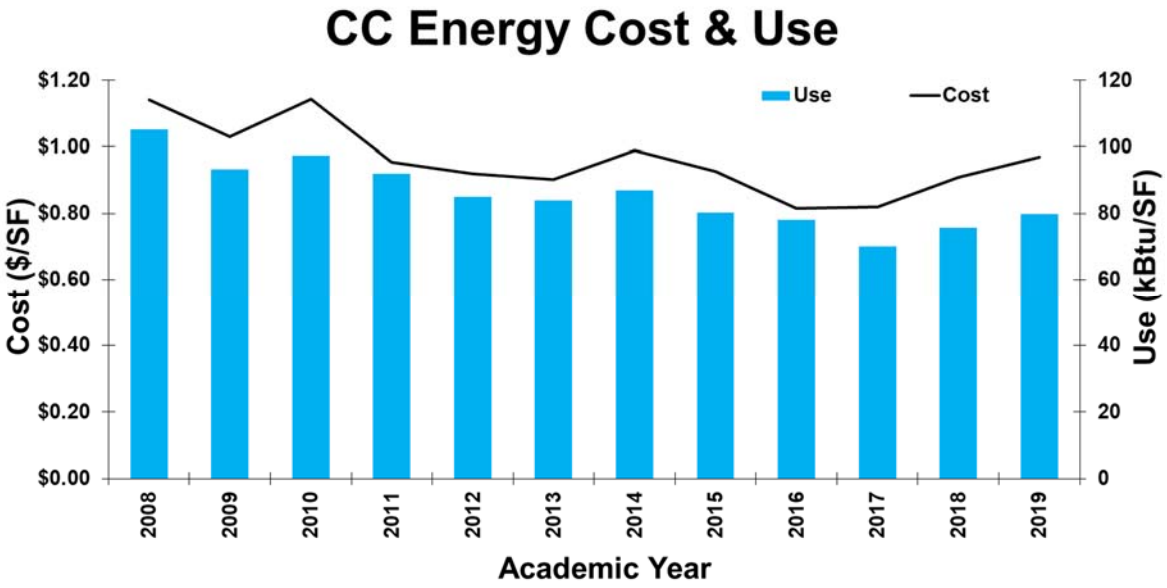
Carbon Footprint

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 CO_2 ($MTCO_2$). Since 2008, Colorado College has made steady progress toward its carbon neutrality commitment. For 2019, the College's carbon emissions from energy use are estimated at 15,500 $MTCO_2$ for a reduction of 36.6% compared to the 2008 baseline. The past 2 years carbon emissions decreased due to renewable energy credits and carbon offsets acquired to compensate for the additional carbon footprint of the Fine Arts Center. These measurements assume a consistent Colorado Springs Utilities (CSU) fuel mix and include emissions as charted below:



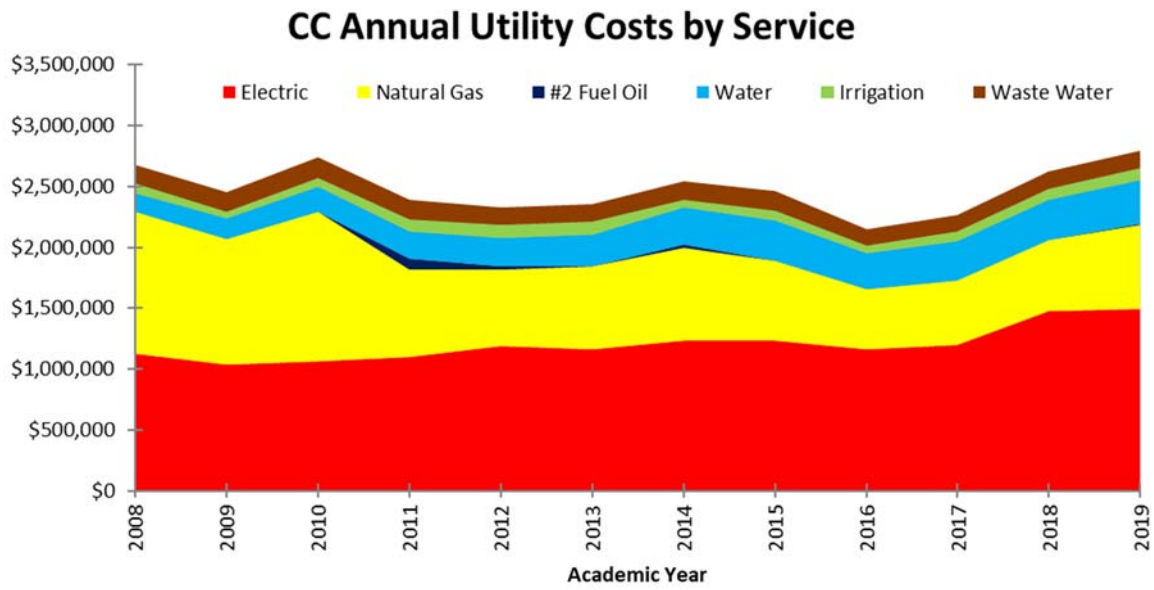
Benchmarking Colorado College

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 2018 average energy intensity for higher education facilities at 97 kBtu/SF/Yr. APPA lists the average utilities cost per square foot at $2.19 / SF. The chart below illustrates that CC's performance exceeds both figures with an average energy intensity of 80 kBtu/SF/Yr and energy cost of $0.97/SF.

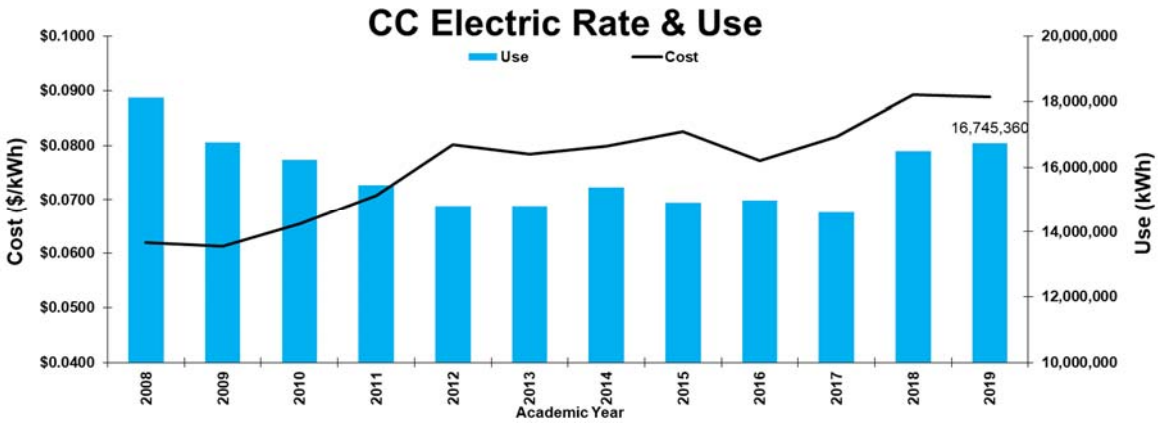


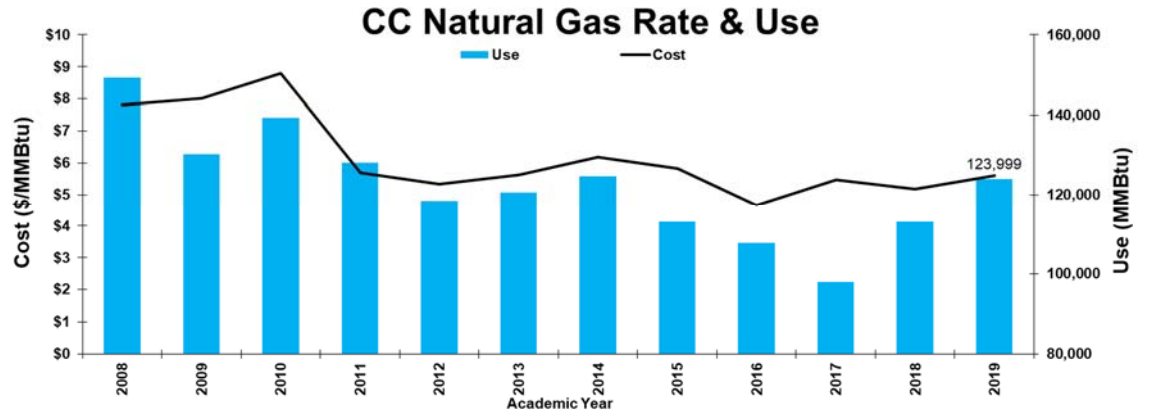
One factor that is unclear is what effect CC's block plan has on our overall energy use intensity. The block plan is thought to require more educational space because all spaces are used simultaneously. For comparison, the following annual kBtu/SF/Yr numbers were calculated using the most recent AASHE STARS data at comparable institutions:

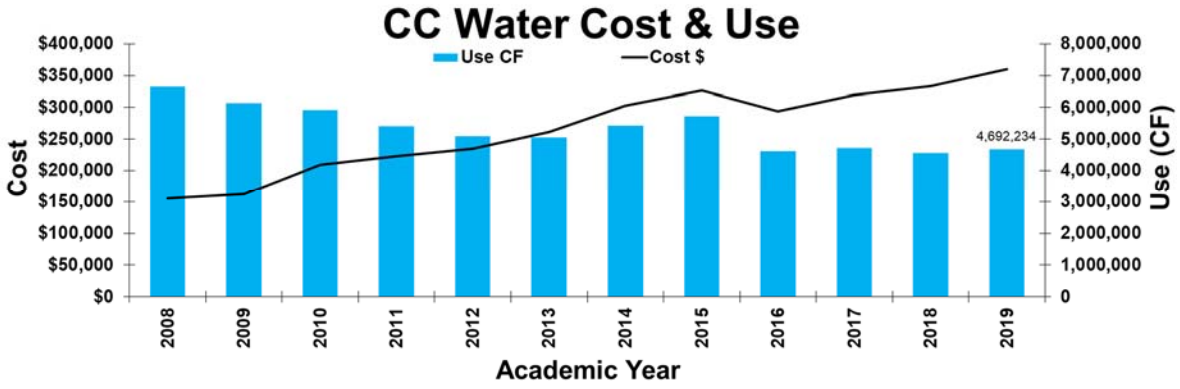
• Colby College	135 kBtu / SF	11/2018 data
• Colgate University	129 kBtu / SF	08/2017 data
• Middlebury College	177 kBtu / SF	06/2017 data
• Pomona College	114 kBtu / SF	10/2015 data
• University of Denver	104 kBtu / SF	02/2016 data
• University of Colorado Boulder	90 kBtu / SF	03/2018 data
• Williams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

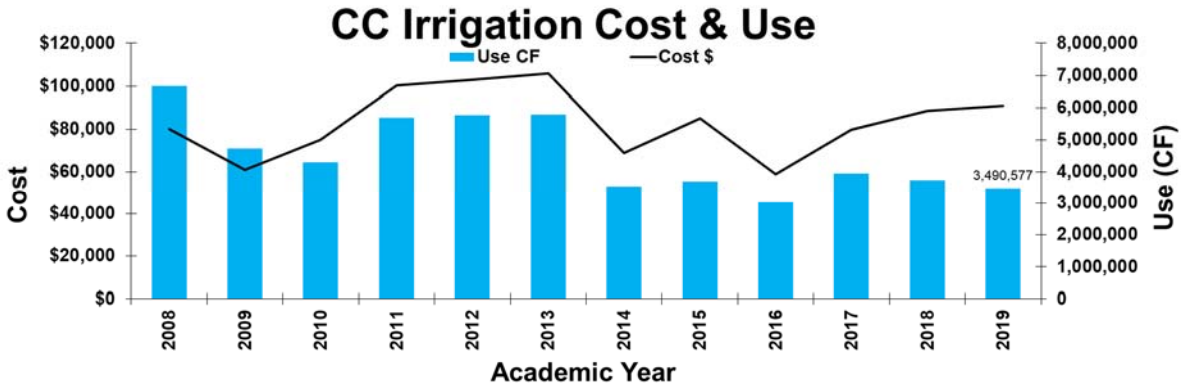


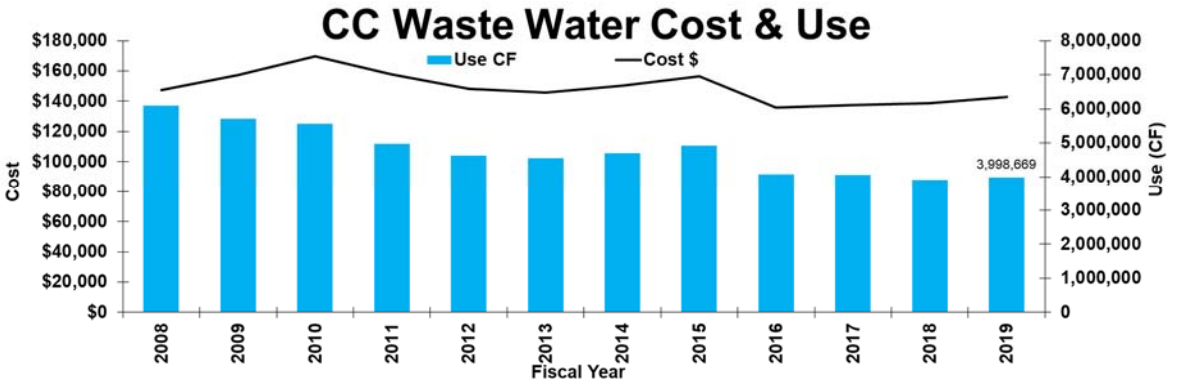
The chart above breaks down expenses by utility commodity. The most notable information is the continued increases in water and electricity rates. You will note large increases in 2018 energy consumption due to the addition of the Fine Arts Center at Colorado College. The charts below give more detail on these relationships.





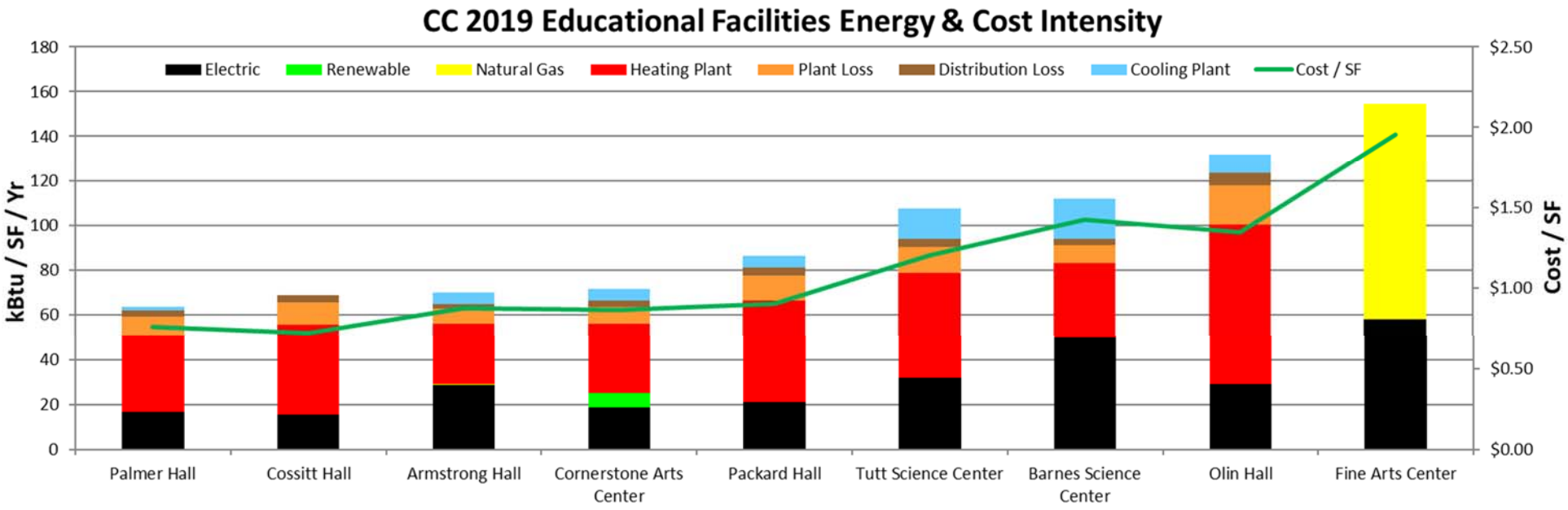


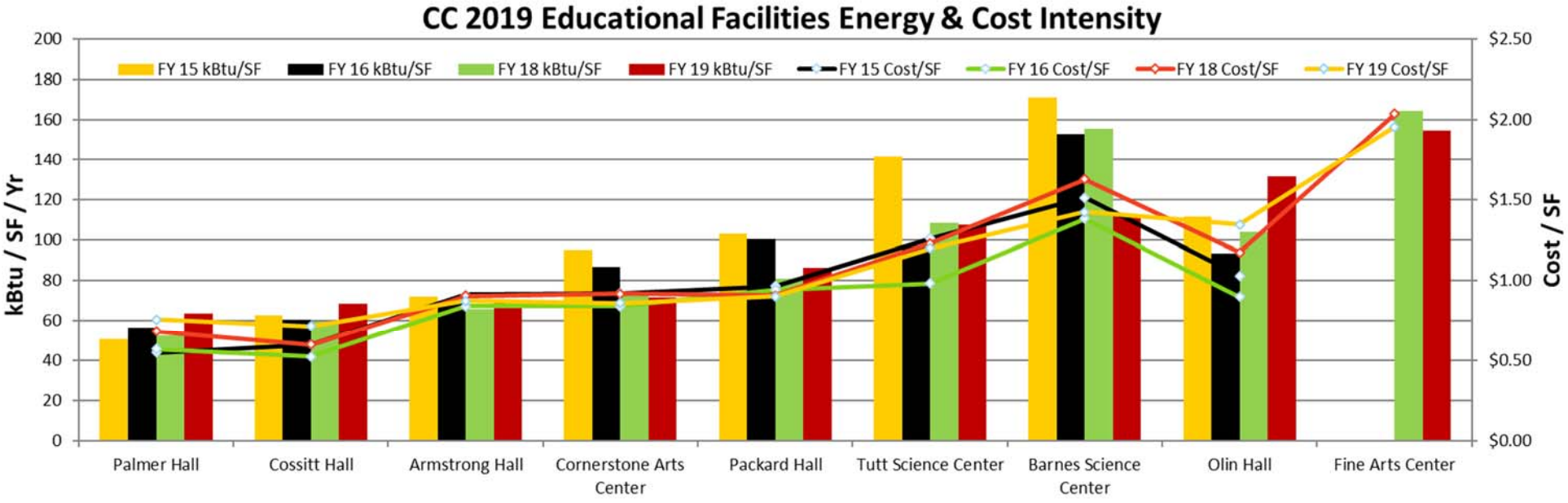




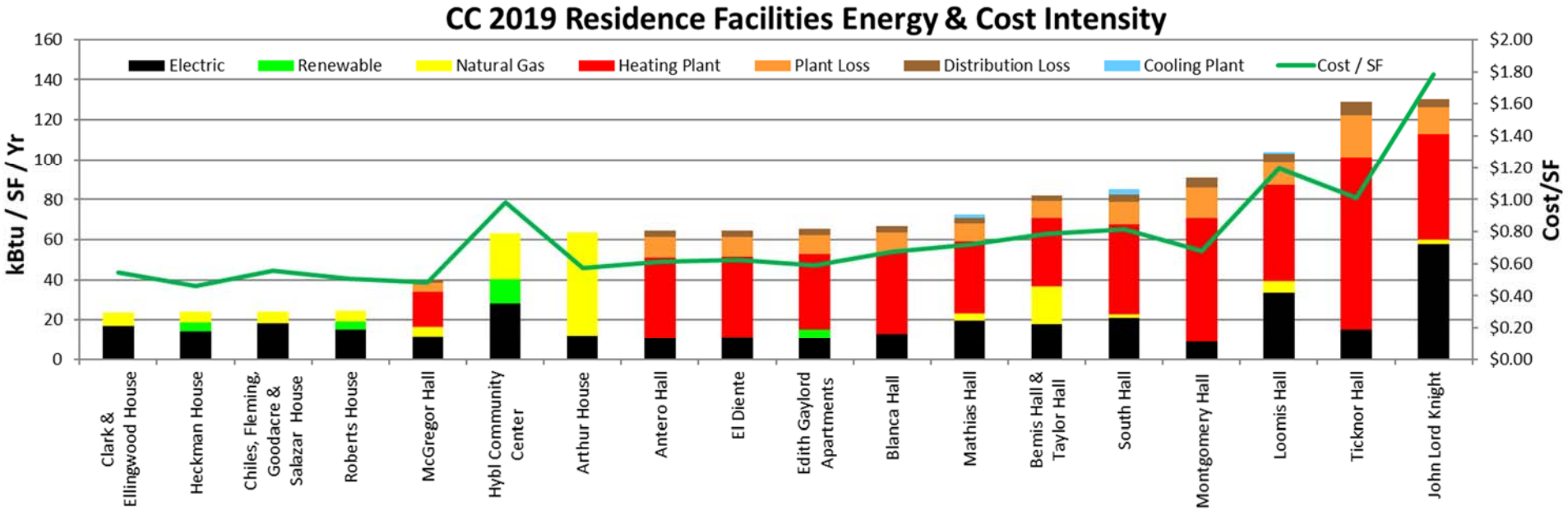
This is the seventh year for energy benchmarking at the building level. In 2011, thermal metering was installed. Thermal metering has enabled CC to measure the amount of heating and cooling energy flowing from the central plant to respective buildings. The following charts are the result of building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

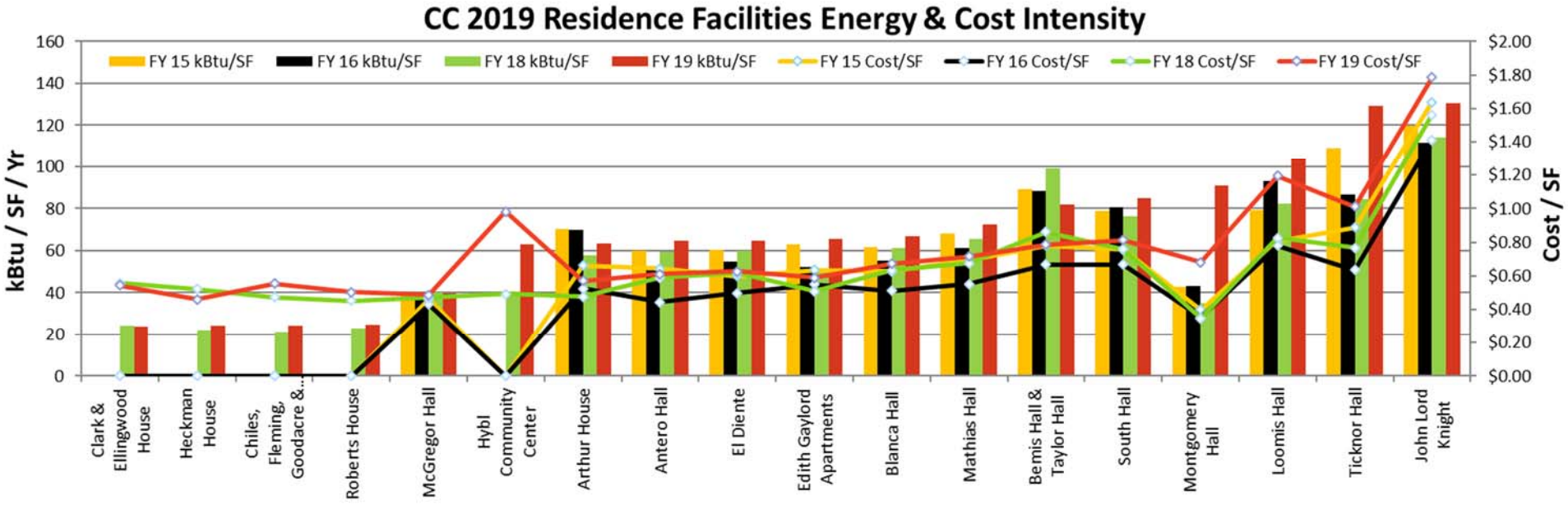
Benchmarking Educational Facilities



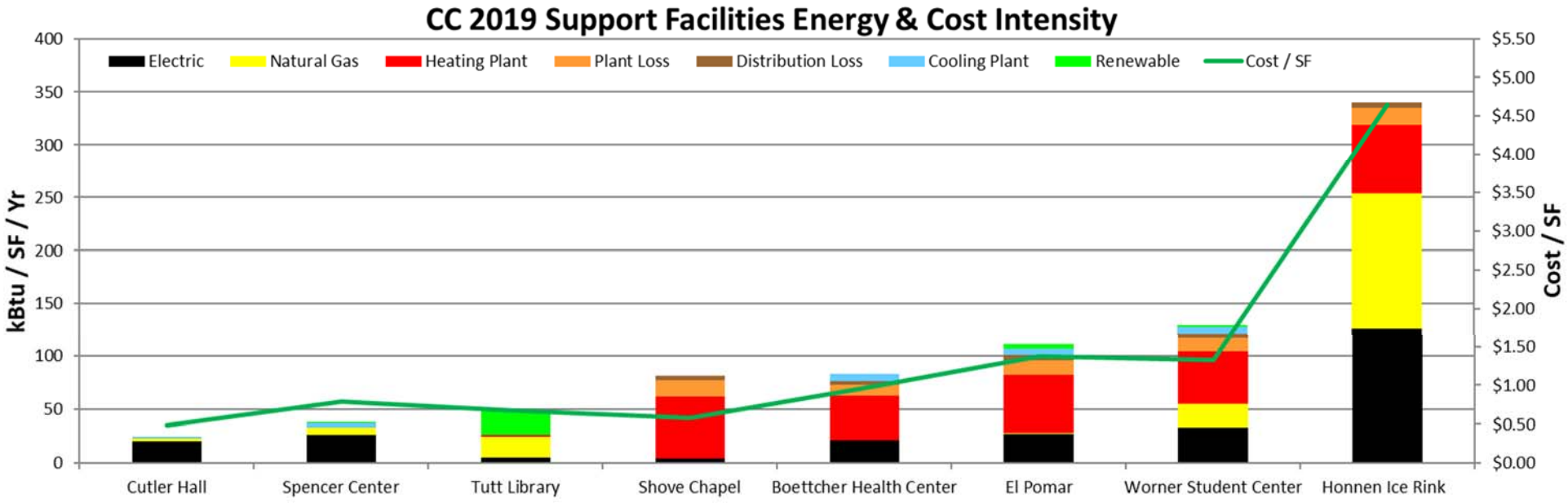


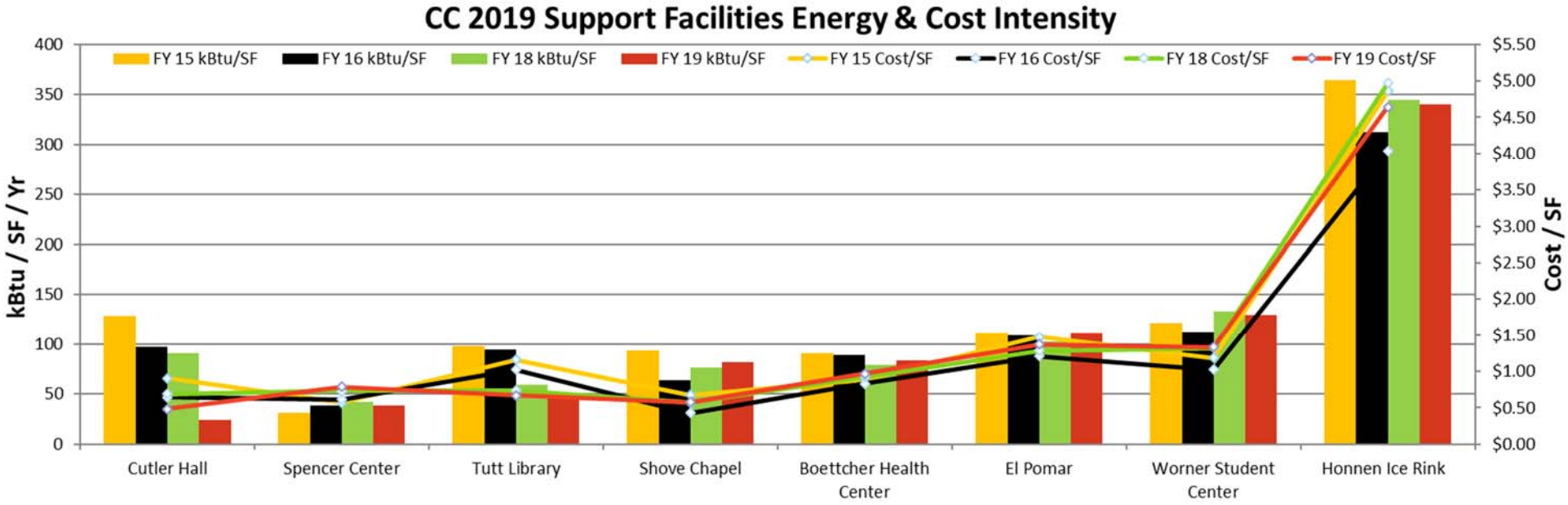
Benchmarking Residential Facilities





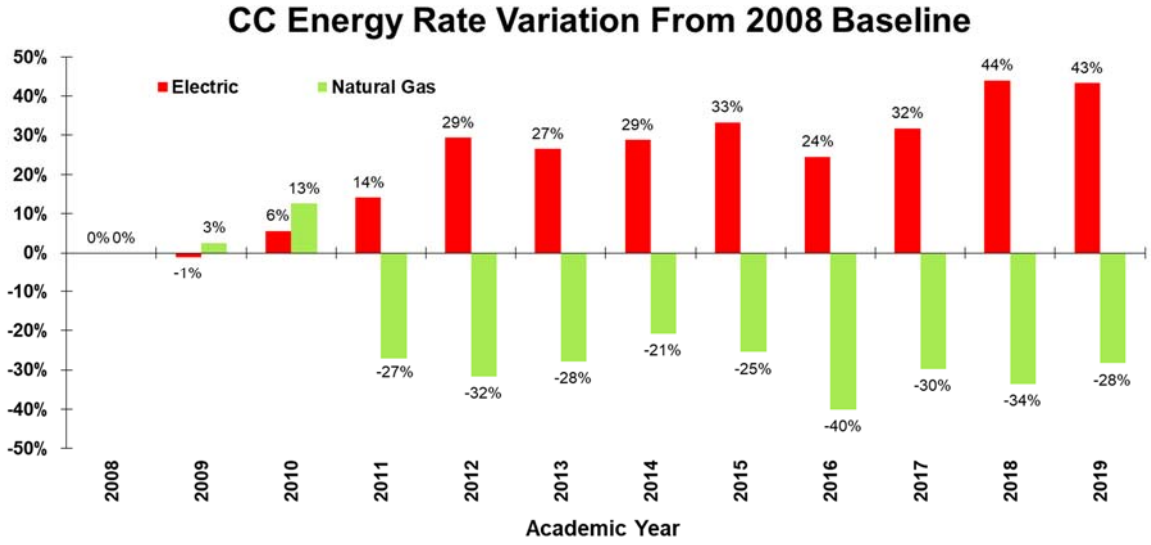
Benchmarking Support Facilities

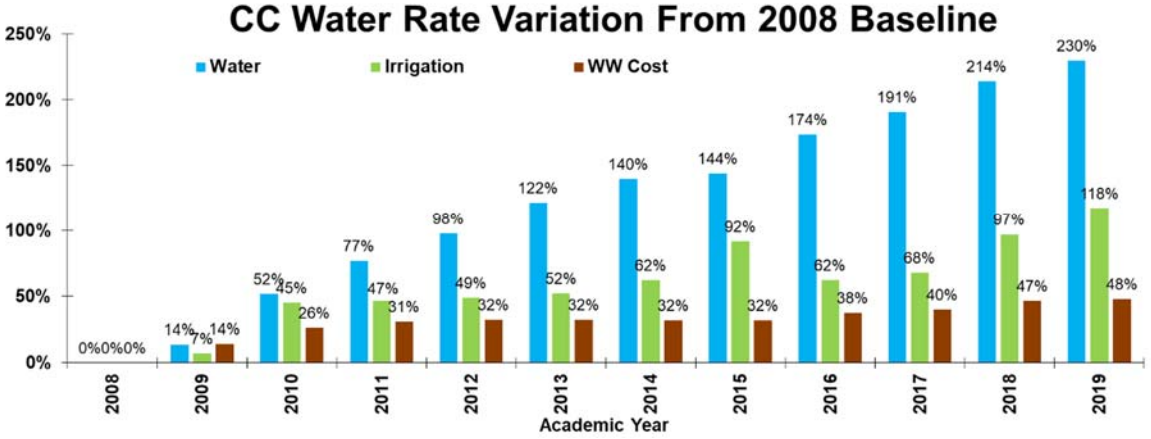




Utility Rates

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. 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.





For the 2019 academic year the campus experienced a 7.3% increase in natural gas rates over the previous year. Water rates increased by 4.8% for potable water and 9.4% for non-potable water over the 2018 academic year. On January 1, 2020 we are expecting Colorado Springs Utilities to change rates as follows:

- Potable Water 7.5% increase
- Non-Potable Water 11.8% increase

2019 Energy & Sustainability Projects

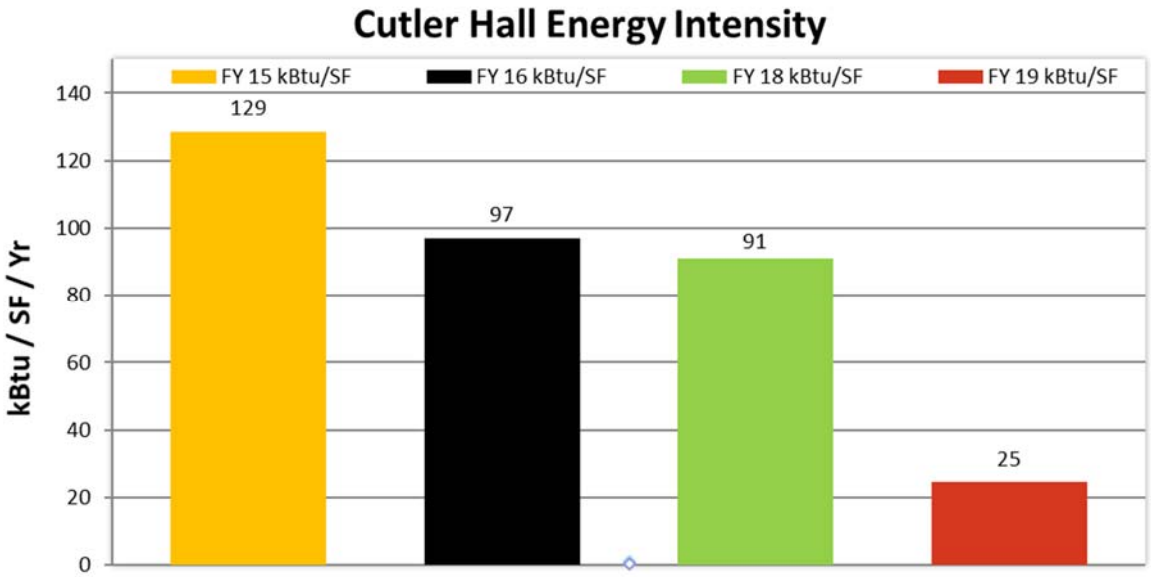
Cutler HVAC System Replacement Commissioning

Project Status: Complete

Project Description: This project commissioned the new HVAC system to ensure it performed as designed and satisfied occupant needs. The new system replaced a steam heating and ventilation system and added air conditioning at Cutler Hall. The previous system did not have good zone control, so as a result occupants were often too hot or too cold. The new system utilizes a new variable refrigerant flow heat pump system to maximize occupant comfort and efficiency while maintaining the historic characteristics of the building. The chart below illustrates actual energy performance at Cutler Hall of 25 kBtu/SF/Yr.

Project Highlights:

- Improved system reliability & efficiency
- Improved occupant comfort
- Cutler Hall the college's oldest building is now one of the most energy efficient buildings on campus.



Robson Arena Design

Project Status: Complete

Project Description: The Robson Arena design project worked on incorporating high performance design criteria provided by the college to the design team into the final design resulting in a net-zero design for the Robson Arena and associated future natatorium. The final design is a solar ready design. An agreement is in negotiation to provide renewable energy to the facility making it net-zero for its Scope 2 (purchased electricity) GHG emissions.

Schlessman Pool Heat Exchanger Replacement

Project Status: Complete
Project Description: The Schlessman Pool heat exchanger replacement project replaced a failing HTHW heat exchanger and associated valves servicing Schlessman Pool with a new heat exchanger and titanium tube bundle. The equipment replacements will reduce water and chemical treatment associated with the pool and central plant.

Packard Hall
High Temperature Hot Water Service Replacement Phase 2 of 2

Project Status: Complete
Project Description: This project replaced failing HTHW piping servicing Packard Hall from Worner Center across Cache La Poudre Street to Packard Hall. A new gas service was installed to Packard Hall. New HTHW piping is triple wall construction with a life expectancy of 50 years.
Project Highlights:

- Improved system reliability and resiliency

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.

Worner Center Kitchen Improvements

Project Status: Complete
Project Description: The Worner Center kitchen improvements project repaired energy issues at Worner Center. The scope included replacing HTHW valves service 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 currently programmed for replacement in FY 23.

Campus LED Lighting Upgrades

Project Status: Ongoing
Project Description: The campus LED lighting upgrade project is an ongoing project to replace lighting on campus with more efficient LED lighting. This project leverages utility rebates to assist with the restoration and replacement of campus lighting.
Project Highlights:

- Takes advantage of utility rebates
- Improves lighting levels

Fine Arts Center LED Lighting Upgrades

Project Status: Construction
Project Description: The Fine Arts Center LED lighting upgrade project replaced lighting at the Fine Arts Center with more efficient LED lighting. This project was funded through a generous donation and leverages utility rebates to assist with the replacement of lighting. The project is currently 95% complete. The remaining theatre house lights are scheduled to be replaced by the end of the year.
Project Highlights:

- Fund provided through generous donation
- Takes advantage of utility rebates
- Improves lighting levels

Barnes Water Main Repair

Project Status: Complete

Project Description: The Barnes water main repair project repaired a water main servicing Barnes Science Center. The repair was difficult due to the pipe being below the academic walk, which includes a hydronic snowmelt system, storm drainage, and campus HTHW lines. The repair was completed with an extremely short outage utilizing a temporary service connection.

2020 Energy & Sustainability Projects

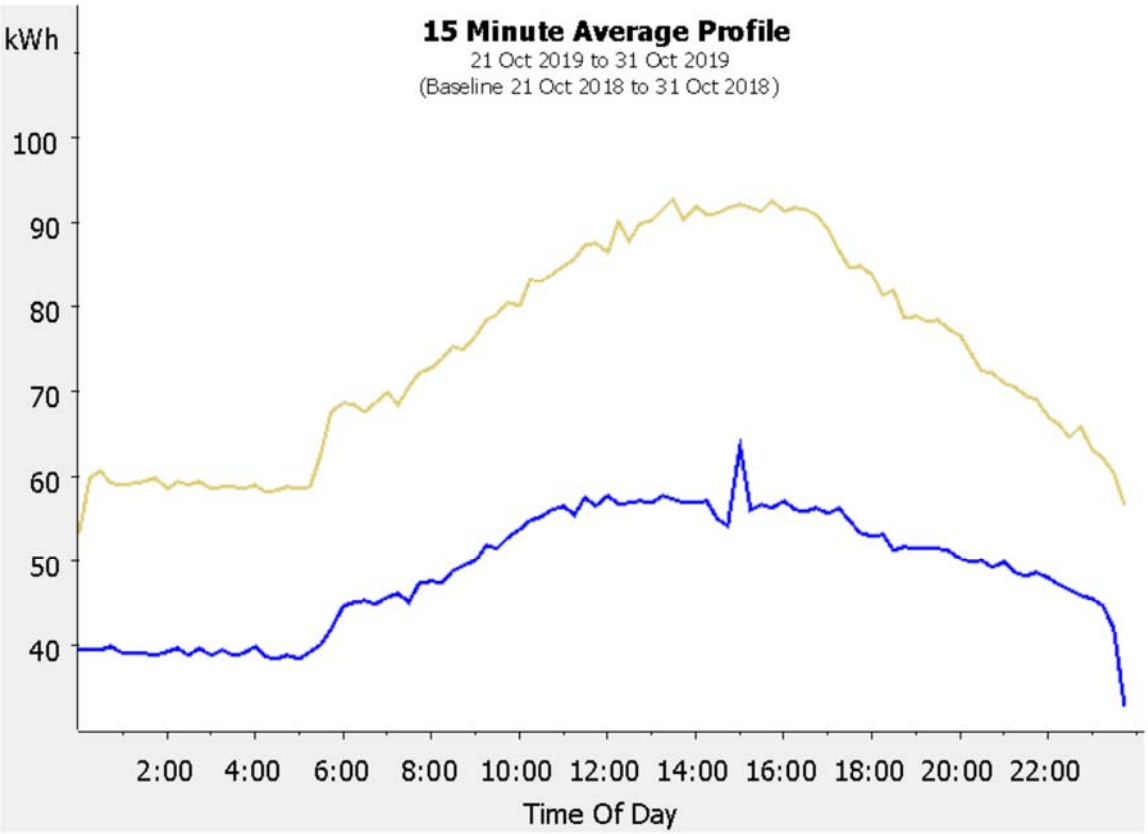
Fine Arts Center Chiller Replacement

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 collection, 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. The chart below compares the Fine Arts Center average daily electrical profile for 10 days of operation last year (gold line) to the same period this year (blue line). It shows a significant reduction from the LED lighting upgrades and the chiller replacement project.

Project Highlights:

- Improves reliability
- Improves efficiency



Robson Arena Utilities

Project Status: Construction
Project Description: The Robson Arena utilities project is a project to extend campus utilities to the site for the new 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.
- Removing 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 premium of approximately 10% for renewable power to make the arena net-zero.

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 is currently designed at 125,284 SF. 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 modest 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.

Robson Arena Commissioning

Project Status: Ongoing
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 early stages of commissioning. Our activities are focused on coordinating all aspects of the design to reduce issues during construction.

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.

Campus LED Lighting Upgrades

Project Status: Ongoing
Project Description: The campus LED lighting upgrade project is an ongoing project to replace lighting on campus with more efficient LED lighting. This project leverages utility rebates to assist with the restoration and replacement of campus lighting.
Project Highlights:

- Takes advantage of utility rebates
- Improves lighting levels

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 revised 2015 campus master plan. The plan will be completed in phases to complete condition assessments, identify future projects, and locate utilities in geographical information system format.