UCCS
Building Utility Report
FY2019

Produced by

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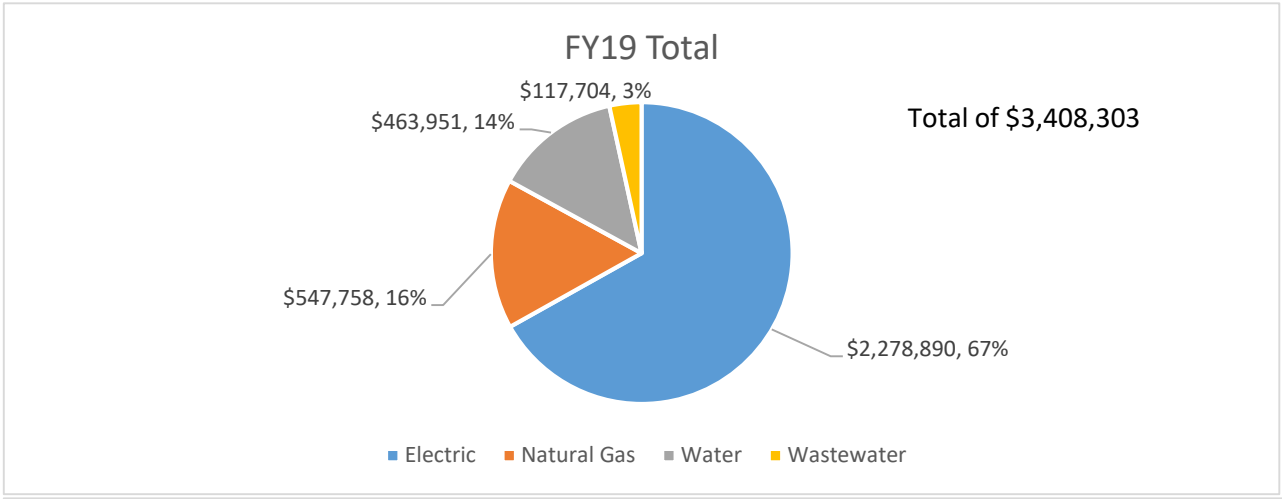
Contents

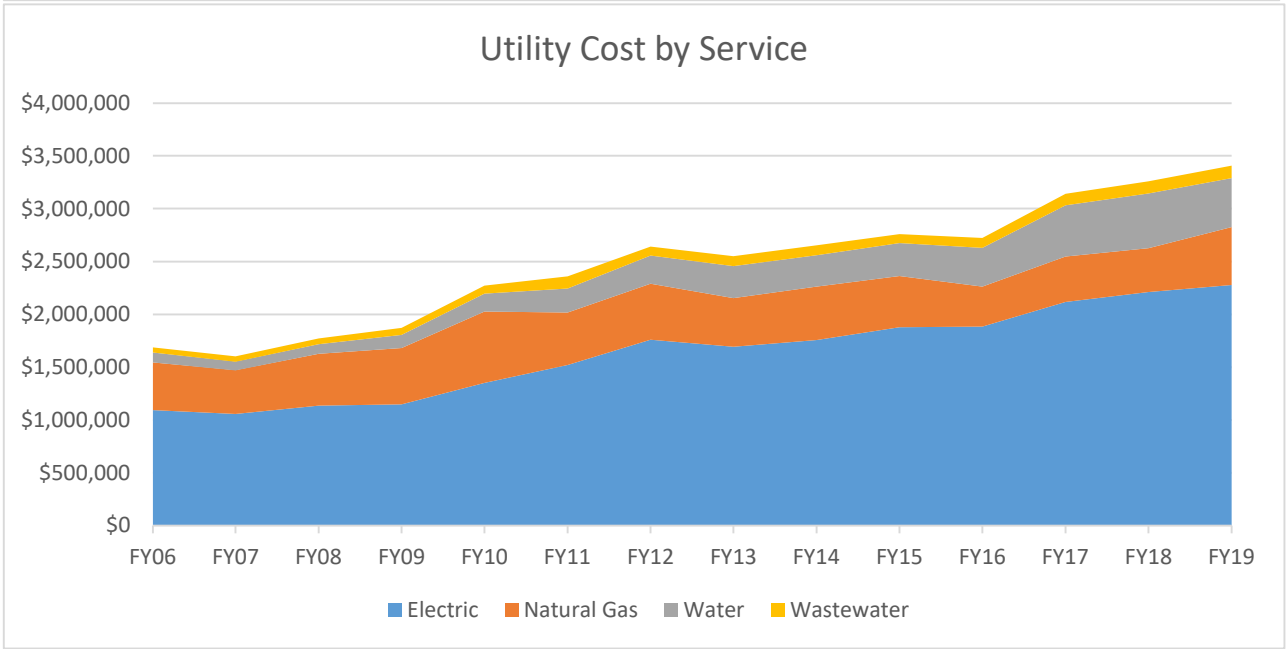
Executive Summary

Colorado Springs Utilities (CSU) provides all utilities for UCCS except for a transport gas contract from CenterPoint Energy that supplies natural gas for 9 buildings. Solar photovoltaic (PV) panels on and off campus provide energy and Renewable Energy Credits for buildings on campus as well. UCCS' growth in square footage, as well as student, staff and faculty members, accounts for continued increases in cost and usage of utilities. LEED Gold certification for new buildings, energy efficiency and conservation efforts, and increased renewables keeps costs and usage at a lower rate of increase than if they were absent.

Total Utility Costs

Total utility costs dues to both increases in use and rates have risen an average of 8% per year since 2006. The increase in total costs FY18 to FY19 was 4.6% or $150,053 for a total of $3,408,303. While daily use and rates differ, UCCS spends approximately $9,338 per day on utilities.





Compared to FY18, utility costs per unit in FY19 increased for electricity and natural gas. Water and wastewater costs both decreased.

Total Utility Use

Utility data includes 83 utility accounts or bills. Each account/bill can include up to 4 utilities: electric, natural gas, water and wastewater. The chart below displays the percentage change of each service compared to the previous fiscal year. Electricity consumption decreased 0.04% but cost per unit increased 3.1%. Natural gas use increased 23% and cost per unit increased by 7.7%. Water use decreased 8.1% and cost per unit decreased 2.7%. Wastewater decreased 2.8% and cost per unit increased 6.2%.

	FY18			FY19			% Change of Usage	% Change of $/Unit
Fuels	Usage (in each fuel's unit)	Utility Cost	$/Unit	Usage (in each fuel's unit)	Utility Cost	$/Unit		
Electric (kWh)	25,687,951	$2,211,858	$0.086	25,678,853	$2,278,890	$0.089	-0.04%	3.1%
Natural Gas (CCF)*	948,218	$413,510	$0.436	1,165,962	$547,758	$0.470	23.0%	7.7%
Water (CF)**	7,443,644.0	$518,850	$0.070	6,839,663	$463,951	$0.068	-8.1%	-2.7%
Wastewater (CF)**	3,734,110.0	$114,032	$0.031	3,630,206	$117,704	$0.032	-2.8%	6.2%

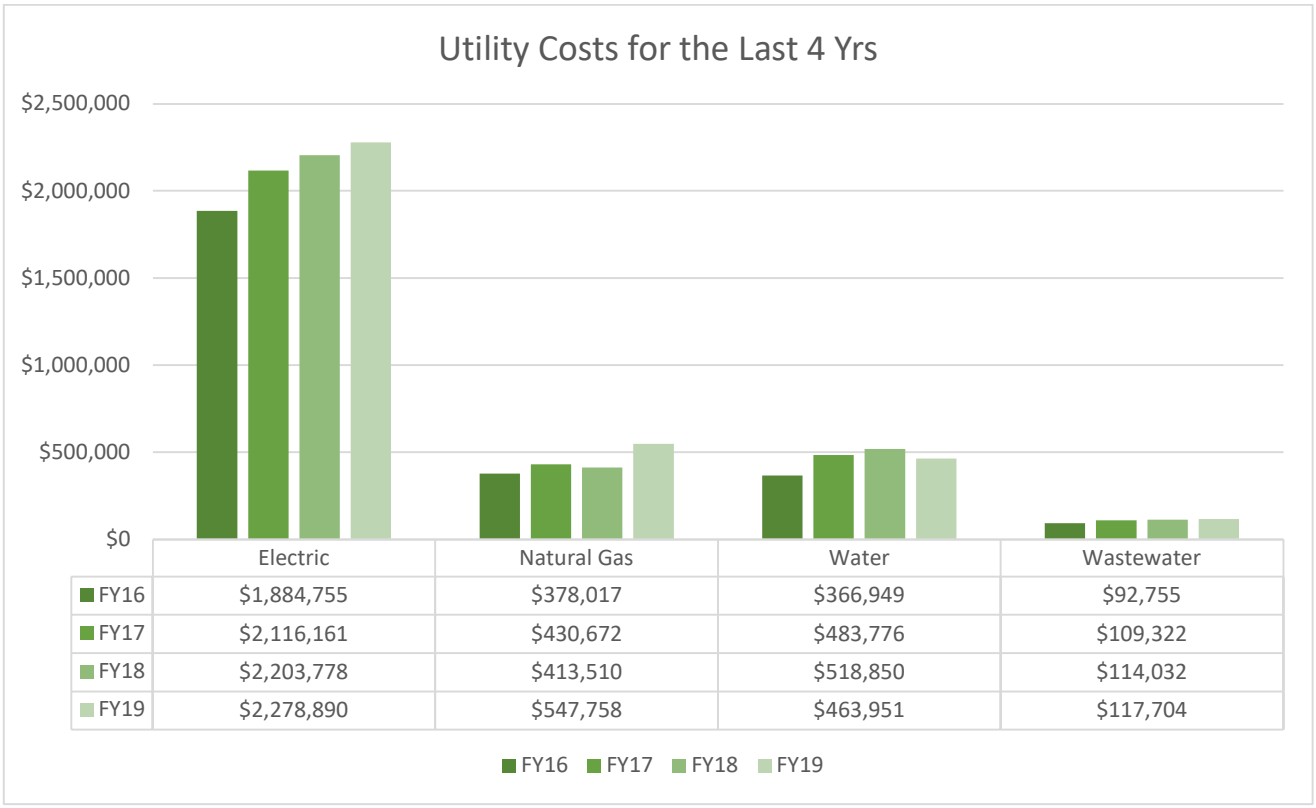
*Natural gas prices are more subjective to volatile changes based on market pricing.

** Water cost from CSU has historically increased in cost outpacing most utilities within the western United States.

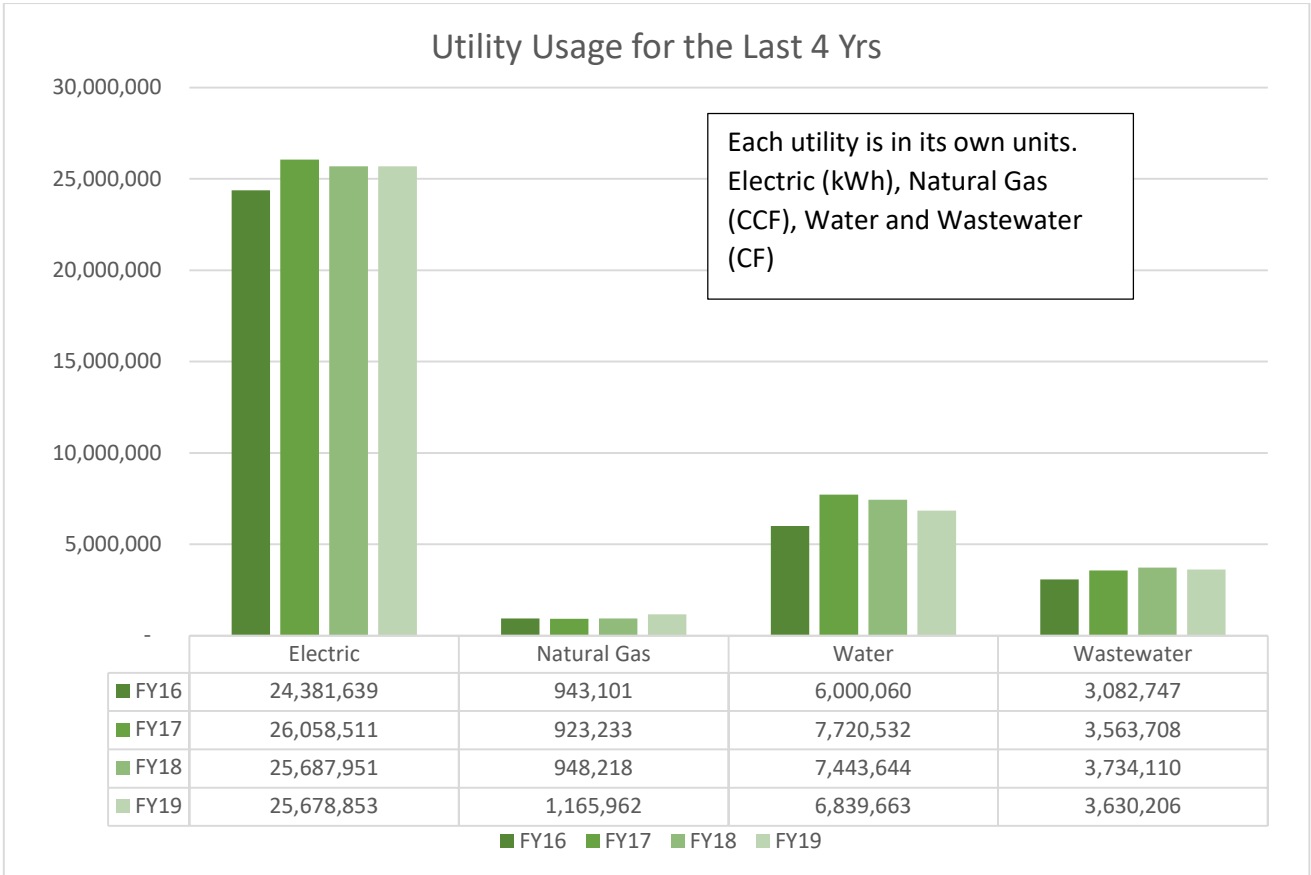
Water is comprised of domestic and irrigation water. Domestic water is water used within the building and irrigation water is used for landscaping. Once domestic water leaves the building it becomes wastewater. Of total water use, there was a 47%/53% split between irrigation and domestic water/wastewater respectively for FY19. In FY18, the split was 50% irrigation and 50% domestic water/wastewater.

According to the National Weather Service, the 2018-2019 winter was at or below normal temperatures and at or above precipitation in South Central Colorado. Heating Degree Days were the highest since FY15. This could explain some of why there was increased natural gas use and less water use. However, even looking at normalized natural gas, there is an increased usage of about 100,000 CCF. One reason for the increase is that Ent Center of the Arts was added in FY19 (first full year of operation) which used 31,345 CCF. That still leaves approximately 70,000 CCF that was more than expected. In FY19, 45 buildings had greater than 30% increase in natural gas usage compared to FY18 which makes up most of the additional 70,000 CCF.

The above chart and below graphs show the changes in spending for each utility. Below reflects total cost and usage for each of those utilities for the last 4 years. The gas consumption shown below is prior to weather normalization. Note that each utility has its own units for the Usage table.



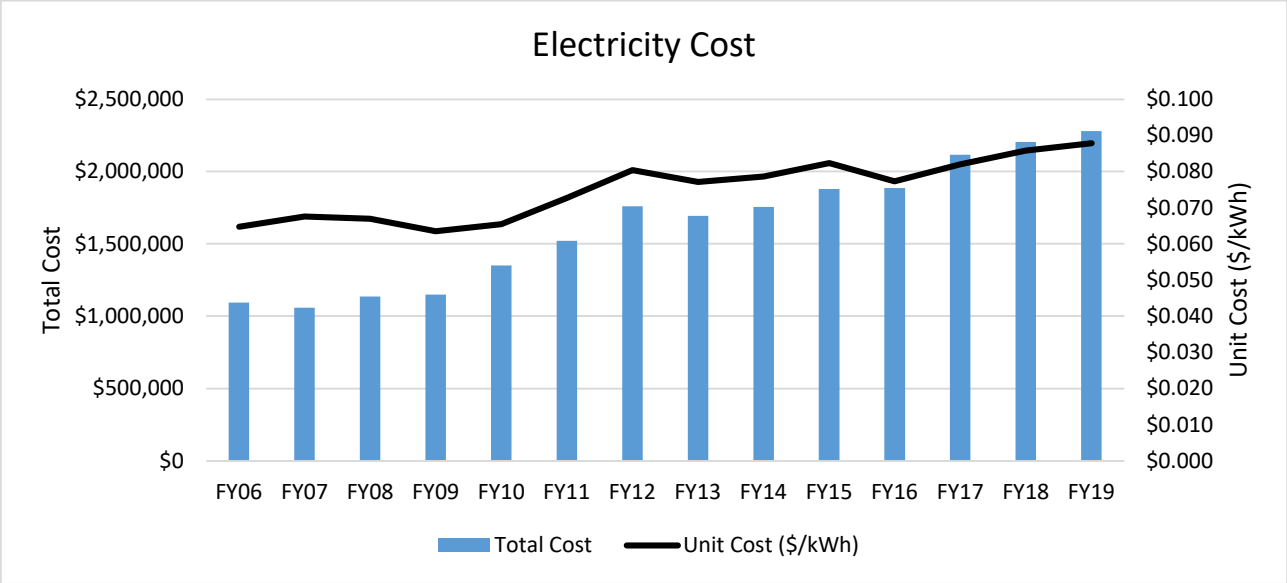
	Electric	Natural Gas	Water	Wastewater
FY16	$1,884,755	$378,017	$366,949	$92,755
FY17	$2,116,161	$430,672	$483,776	$109,322
FY18	$2,203,778	$413,510	$518,850	$114,032
FY19	$2,278,890	$547,758	$463,951	$117,704



	Electric	Natural Gas	Water	Wastewater
FY16	24,381,639	943,101	6,000,060	3,082,747
FY17	26,058,511	923,233	7,720,532	3,563,708
FY18	25,687,951	948,218	7,443,644	3,734,110
FY19	25,678,853	1,165,962	6,839,663	3,630,206

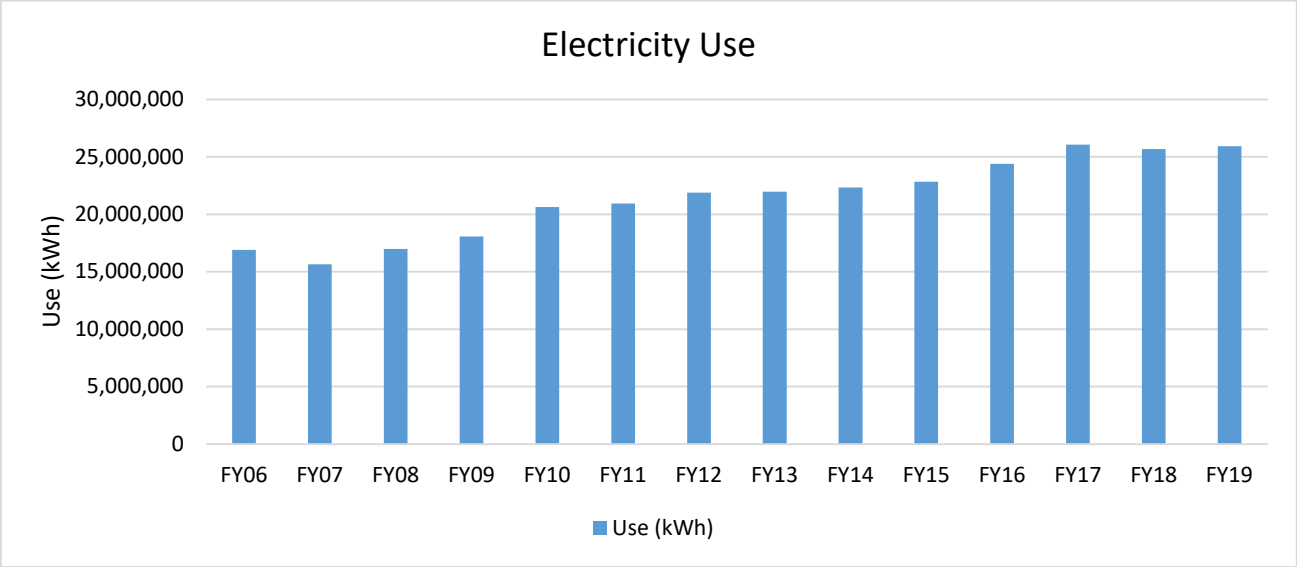
Electric Cost

The trend for total electricity cost on campus has increased an average of 6.02% per year since baseline FY 2006 with an average increased cost of $91,232/year.



Electric Use

The trend for total electricity consumption on campus has increased an average of 4.12% per year since baseline FY 2006 with an average increased use of 696,245 kWh/year. Electricity use increased 1.0% from FY18 to FY19.

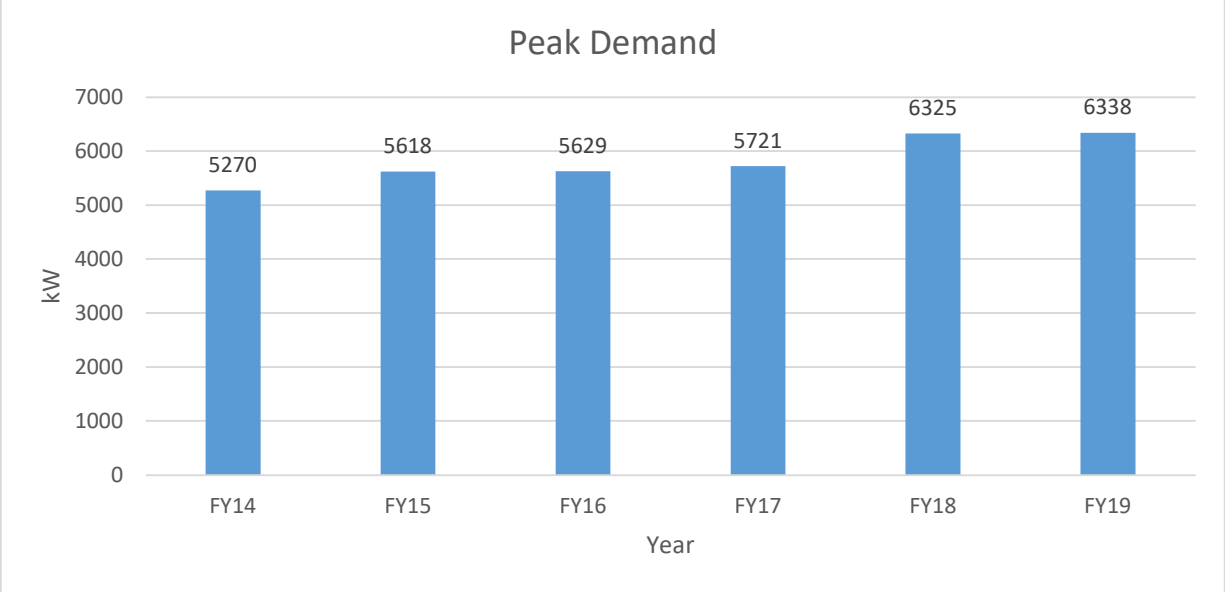


Electric Demand

Larger accounts are billed for electric demand, kW, as well as overall consumption, kWh. Electric used during On-Peak hours is more expensive than Off Peak. On-Peak hours for Summer are 11:00 a.m. to 6:00

p.m. For Winter, On-Peak hours are 4:00-10:00 p.m. **For our demand accounts, demand charges represent about 70% of the billing charge to UCCS.** The chart below shows the campus peak demand reached for the last four years. Demand has increased over a 1 MW (1,068 kW) since 2014 to 2018. For demand accounts where kW costs about $20-23/kW/month, this increase is substantial. In the summer of 2018, we identified that Osborne's thermal storage system could be optimized to run the chillers off peak. As part of the effort to optimize the chillers and storage, we identified other issues that limited the ice storage capacity. Once the changes were made, we started to see improvements in the demand costs. By the end of summer (into FY20) we saw savings of $20,500 for the storage system and average on peak demand was reduced 200-400 kW at Osborne. However, the peak for FY19 was set in September 2018, before changes to the thermal storage were fully implemented. We should continue to look at all chillers and other larger pieces of equipment and implement demand limited starts where possible and continue to fine tune our thermal storage system at Osborne.

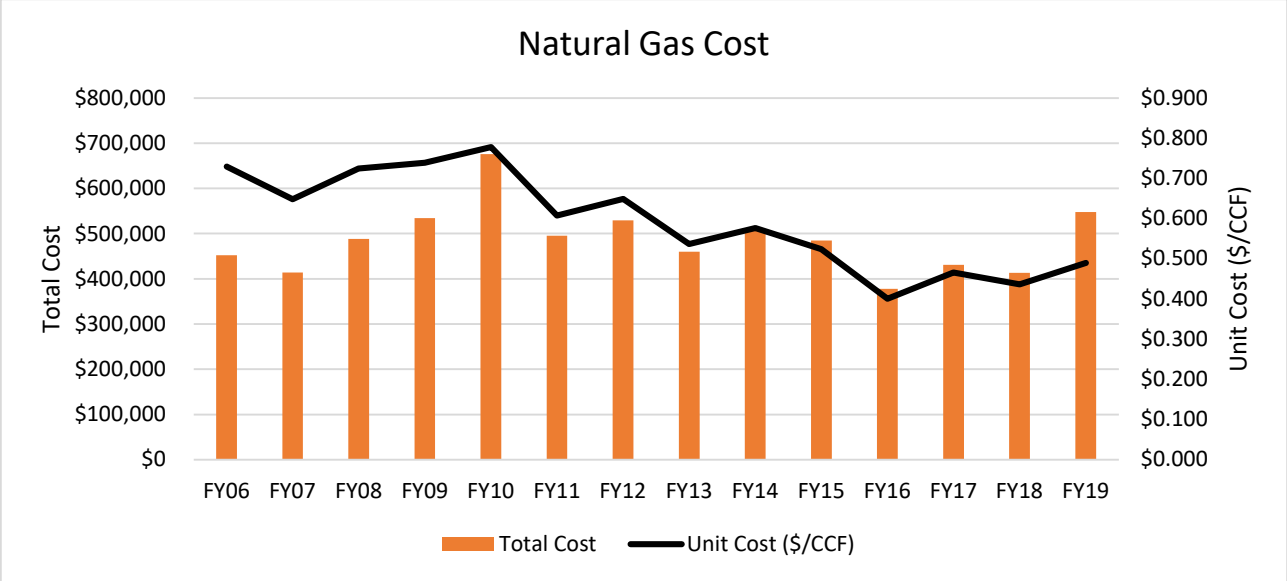
Year	Month	Peak Demand, kW	% Change in Demand from Previous Year
FY 14	September	5,270	
FY 15	September	5,618	7%
FY 16	May	5,629	0%
FY 17	October	5,721	2%
FY 18	September	6,235	9%
FY 19	September	6,338	2%



Natural Gas Cost

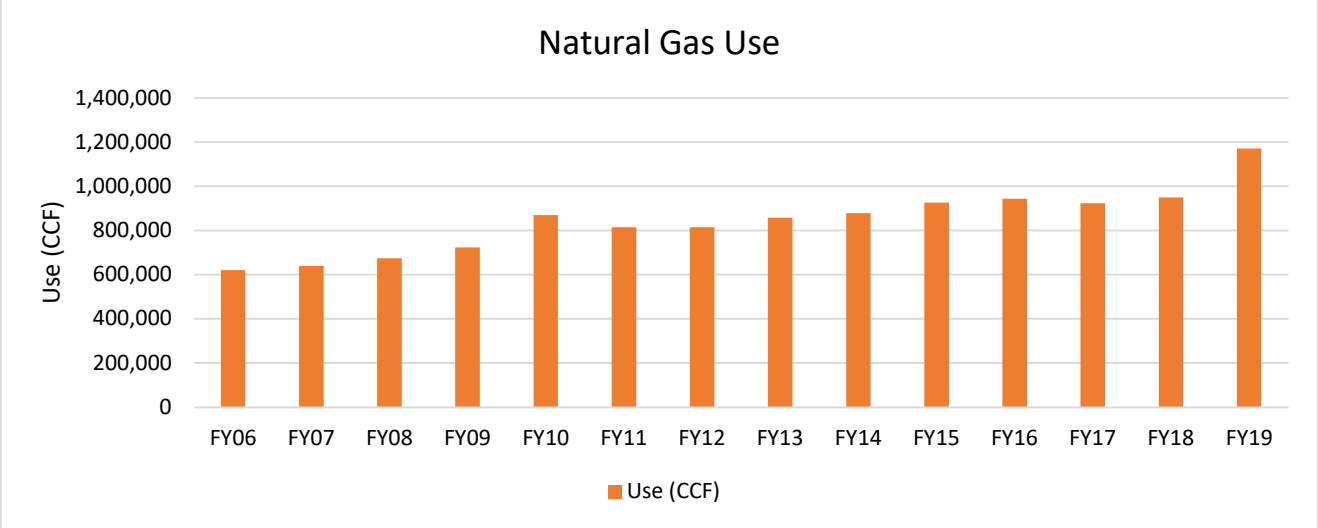
The graph below includes natural gas costs for all accounts, including transport gas. The trend for total gas cost on campus has decreased $38,569 since baseline FY 2006 to 2018. This is due to falling natural gas costs, not consumption, since campus natural gas use has increased since that time. With increased usage and higher unit cost for natural gas, FY19 was the second highest natural gas expenditure since 2010. The trend for per unit cost of natural gas has mainly decreased since FY06 but the last 4 years shows a flatter

cost if not on an upward trend. Natural gas tends to be a volatile market so predicting market costs is difficult. From FY18 to FY19 natural gas cost increased 32%.



Natural Gas Use

The graph below shows natural gas consumption. The trend for gas use on campus has increased an average of 6.8% per year since baseline FY 2006 with an average increased use of 38,417 CCF /year. Natural Gas CCF use increased 23% from FY18 to FY19.

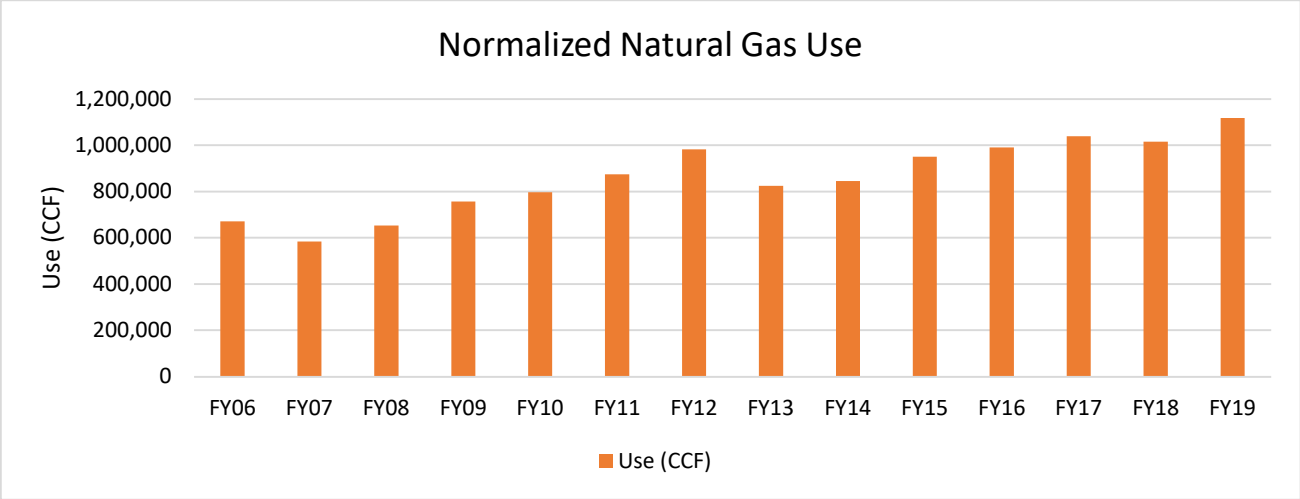


Normalized Natural Gas Use

It is also important to review natural gas use in respect to weather because most natural gas use is associated with heating whereas electric is not usually used for heating. Weather normalized natural gas is the natural gas your building would have used under average weather conditions. Weather normalization

was done by looking at one year and comparing it to the last 5 years of average heating degrees days (HDD). For example, the normalization factor for 2019 takes the HDD for 2019 and compares it to the average HDD for 2018, 2017, 2016 and 2015.

The graph below includes the data for all normalized natural gas use. The trend for total gas use on campus has increased an average of 5.11% per year since baseline FY06 with an average increased use of 34,377 CCF /year. Normalized natural gas use increased 9% from FY18 to FY19.

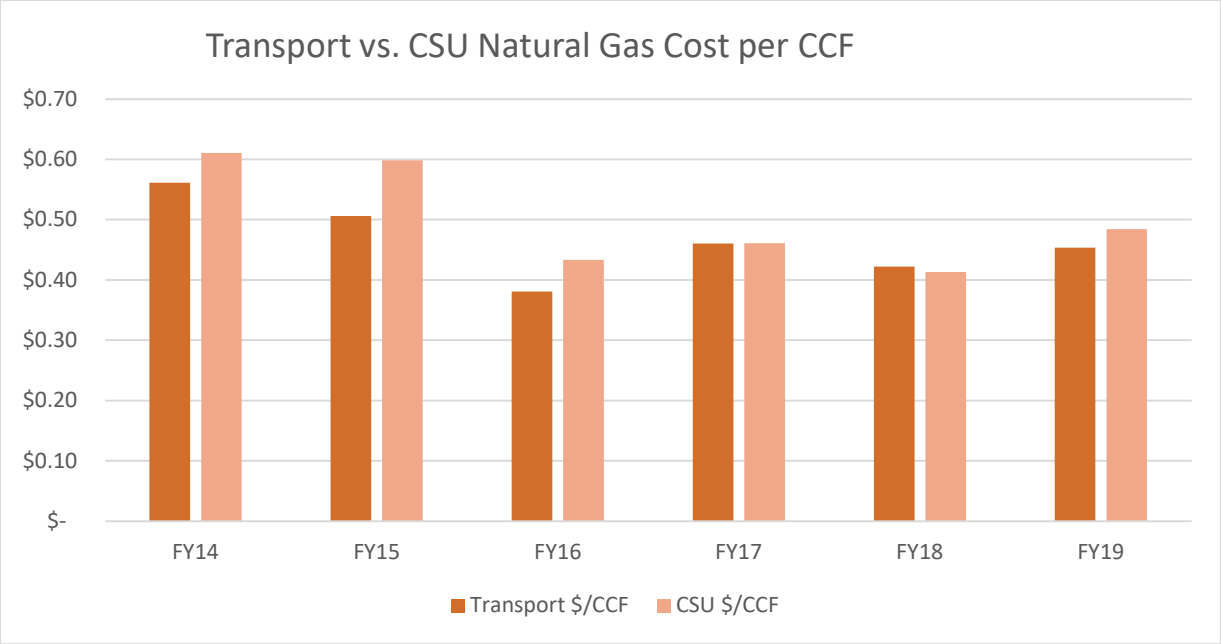


Natural Gas Providers

UCCS receives natural gas from the local utility company, CSU, and has a contract for transport gas from CenterPoint Energy for 9 buildings. The goal of pursuing transport gas is to diversify risks of increasing gas prices. It is important to constantly compare CSU and transport market prices so that savings can be achieved by purchasing transport gas, if cheaper. Additional cost savings may be achieved by locking into a price agreement for a portion of our transport gas, but in FY19, we chose not to pursue this option as the transport prices appeared to be very close to CSU pricing. Our current composition of natural gas is 59% from transport and the remaining from CSU.

Buildings on Transport Gas from Centerpoint	
Centennial Hall	Gallogly Recreation and Wellness Center
Cragmor and Main Hall (one gas meter)	Shavano House
Osborne Center for Science and Engineering	The Lodge
Kraemer Family Library	Summit Village (Monarch, etc.)
Columbine Hall	

This graph shows the difference in cost between transport provider, Centerpoint Energy, and CSU. Traditionally transport gas has been cheaper than buying from the local utility but is never guaranteed. For FY19, natural gas cost per unit was $0.03 more for CSU gas so that **transport gas saved UCCS $20,244.50. The rolling savings since FY14 are $134,297 as compared to costs we would have paid to CSU in since FY14**. We need to maintain diligence in checking real market pricing for transport gas to reap potential cost savings for the future.



Categories of Water on Campus

There are 3 different types of water on campus. UCCS is billed by CSU for the water that enters each building and at which point is split between two different streams: Wastewater and Irrigation.

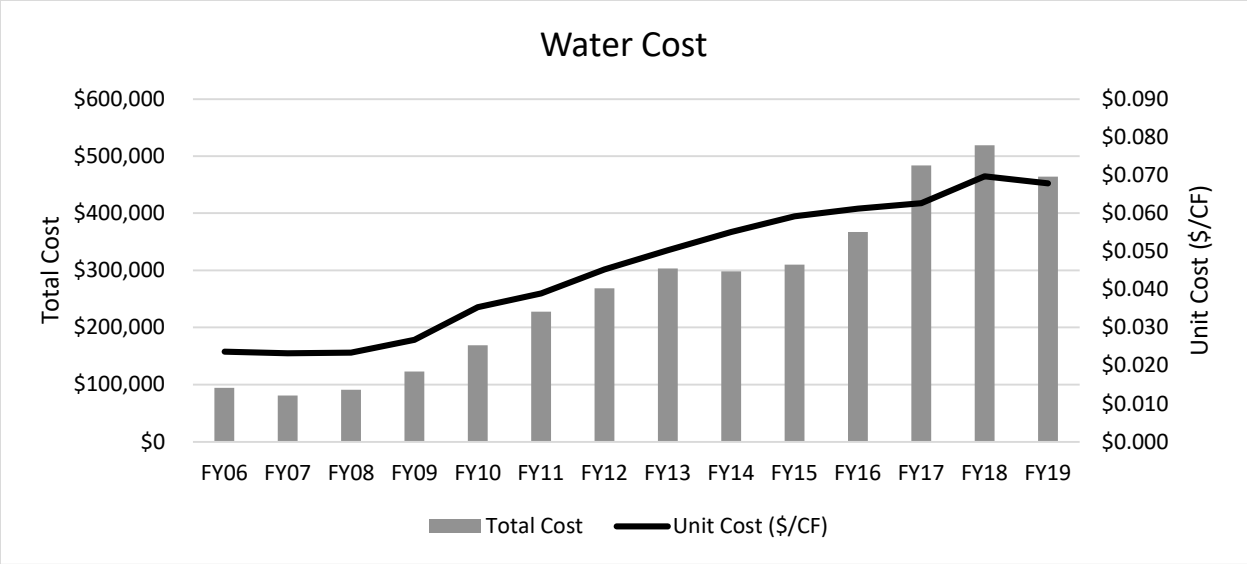
Wastewater is defined as any water that leaves the campus that needs to be treated; mainly domestic water. For wastewater, UCCS pays charges for the water costs and the sewer costs to CSU because CSU must treat the water for drinking and domestic use and also clean the wastewater for discharge after use.

FY18 to FY19, water usage decreased by 8.1%, wastewater decreased by 2.8% and irrigation decreased by 13.2%. The reason for overall water reduction is due to reduction of irrigation water by 490,000 CF and a smaller decease of wastewater of 104,000 CF.

Water CF			Wastewater CF			Irrigation CF		
FY18	FY19	% Change	FY18	FY19	% Change	FY18	FY19	% Change
7,443,644	6,839,663	-8.11%	3,734,110	3,630,206	-2.78%	3,701,509	3,211,436	-13.24%

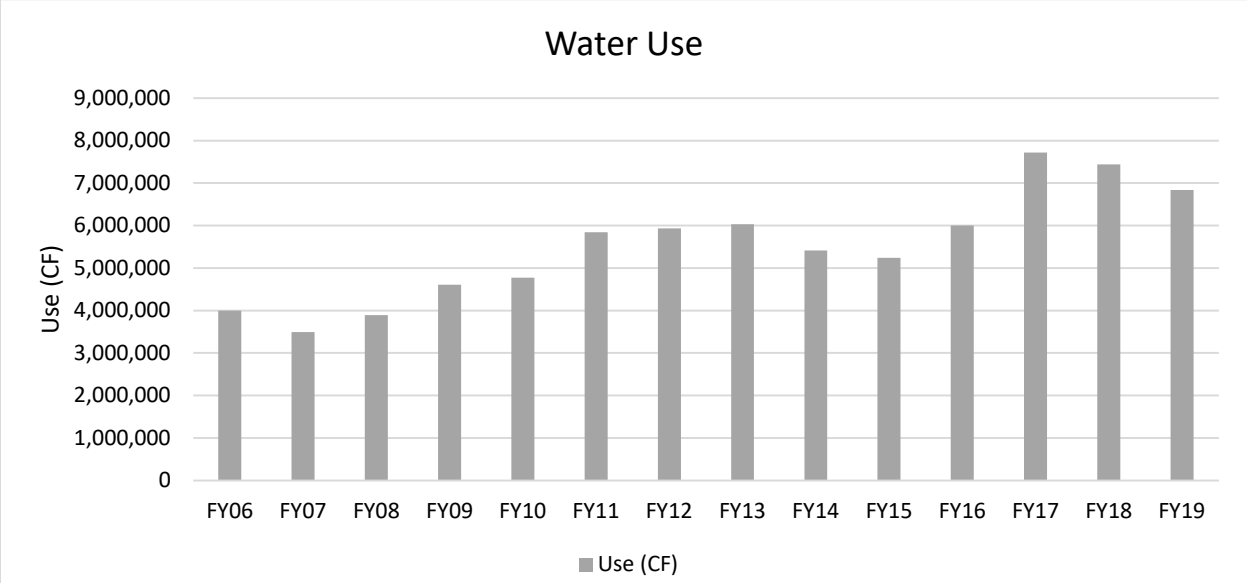
Water Costs

Water costs have sharply increased since FY06. Costs increased from $94,420 to $463,951 which is a 391% increase. The cost per CF of water increased from $0.024 to $0.068 which is a 187% increase since FY06. Water, over all other utilities, has the fastest growing unit cost.



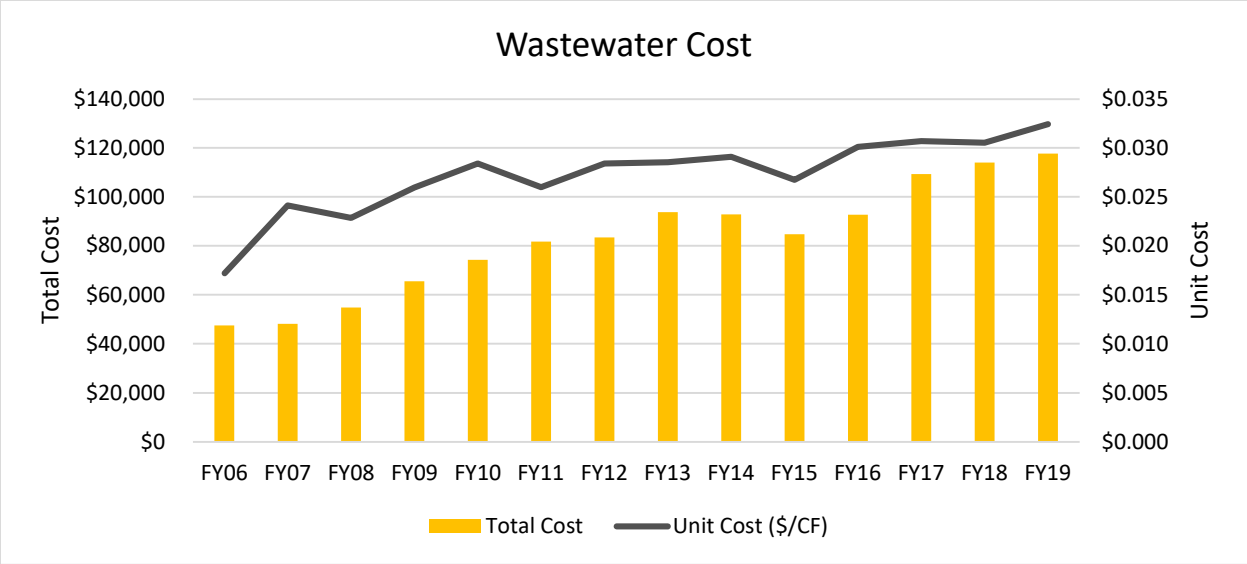
Water Use

Since FY06, water use on campus has also sharply increased. In FY06, UCCS used 3,997,572 CF compared to FY19 where UCCS used 6,839,663 CF which is an 71% increase. Campus has expanded over that time which explains part of the picture for the increased water use. More metrics need to be created to look at water per SF or acreage based on land types or to compare to other campuses.



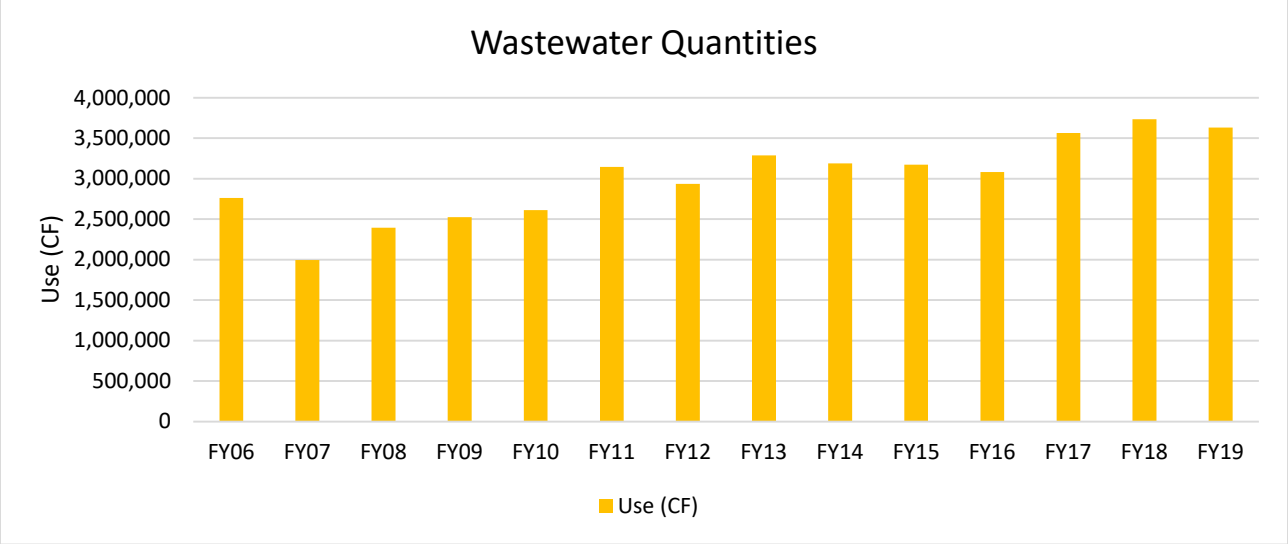
Wastewater Costs

The cost of wastewater has increased 6.8% per year since FY06. Cost of wastewater increased by $0.001 from $0.031 to $0.032 in FY19. According to CSU, September 2019, wastewater costs are projected to rise 3.6% in 2020.



Wastewater

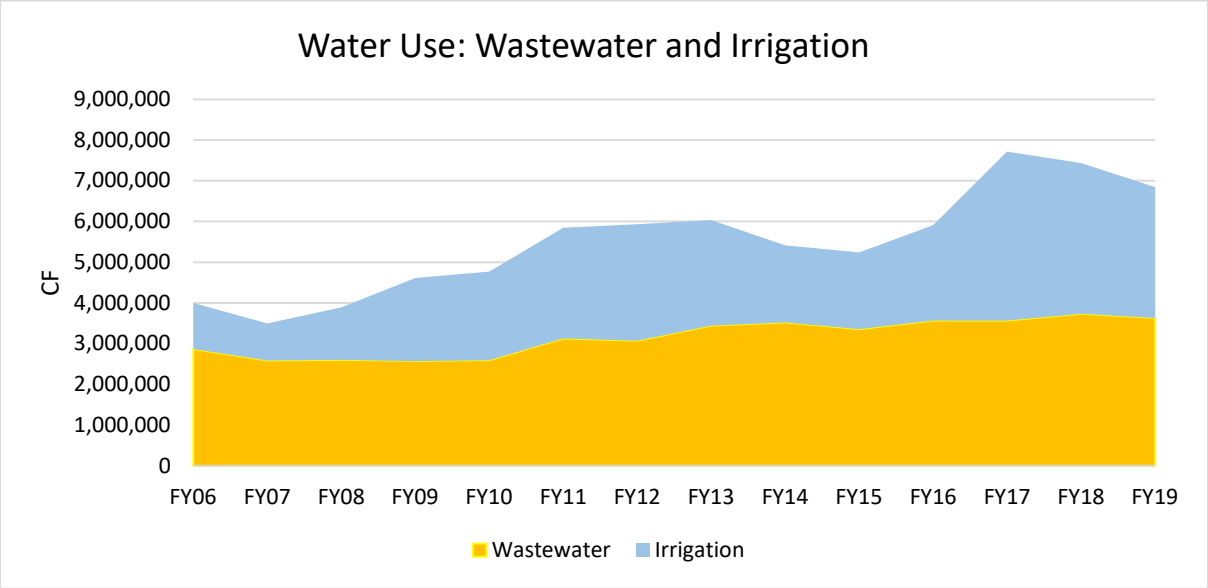
Wastewater decreased by 103,904 CF or 2.8% for FY18 to FY19. On average wastewater use has increased 2.4% each year since FY06.

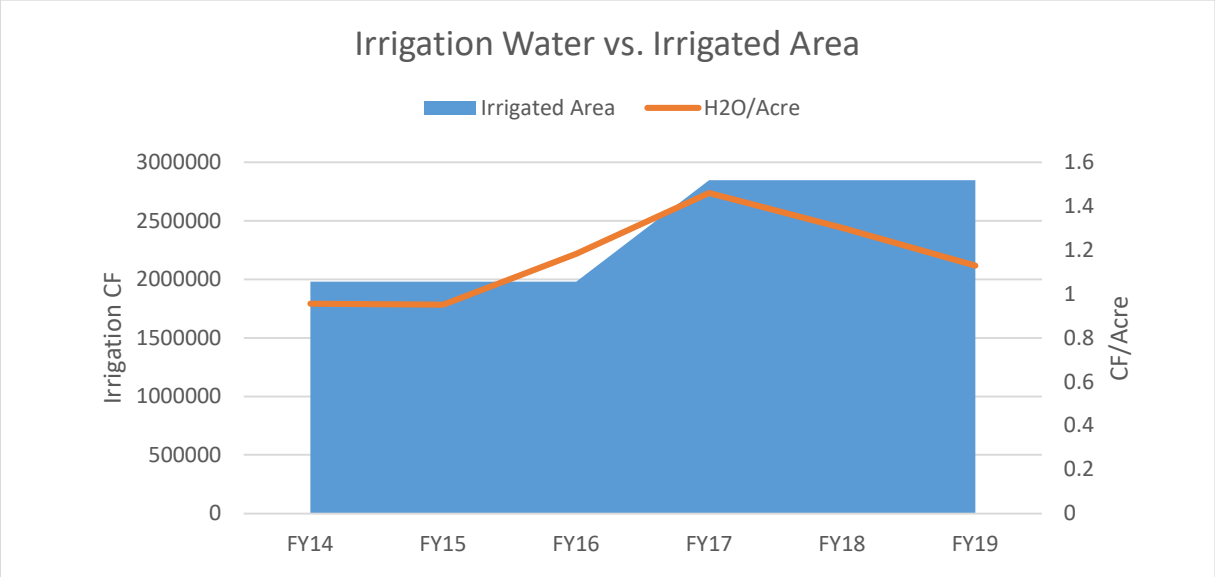


Irrigation

Irrigation water is used for landscaping. Currently, UCCS requires potable water on campus so all irrigation water is charged water fees from CSU but not wastewater fees. Some buildings on campus do not have their own irrigation meter which means that **UCCS is paying wastewater fees for water that is used for irrigation**. One example is La Plata. For similar dorms, La Plata consumed 240,000 CF more water than San Juan and Cucharas. Using FY19 wastewater rates, this amounts to about $6,800/yr. CSU can install irrigation meters free of charge so we are looking at retroactively pursuing whether installation can be feasible in the locations that use the most irrigation.

Both wastewater and irrigation has increased since FY06, 27% and 185% respectively. Overall water use increased 71%. The chart below generally shows the campus area and irrigation water. The spike in FY17 reflects the addition of the North Nevada Irrigation (NNI) system. After FY17 the irrigation water drops despite constant area. This could be due to many reasons, such was extra water needed to establish plants in FY17 and weather.



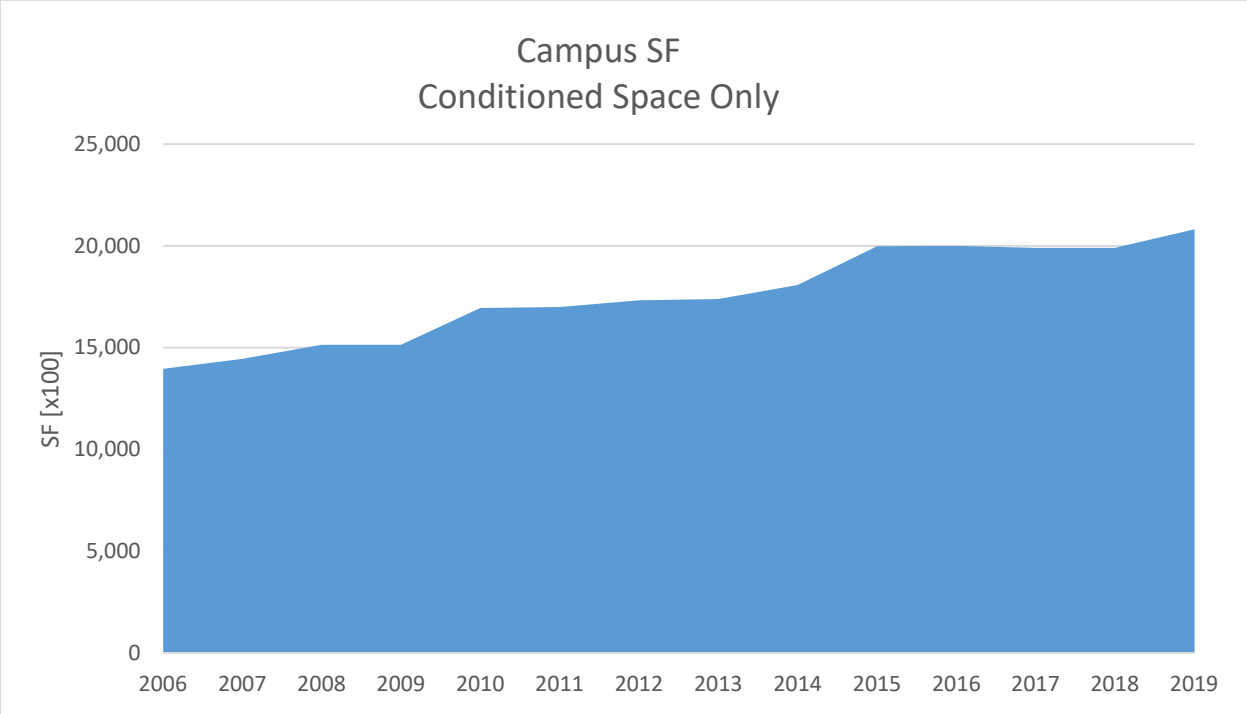


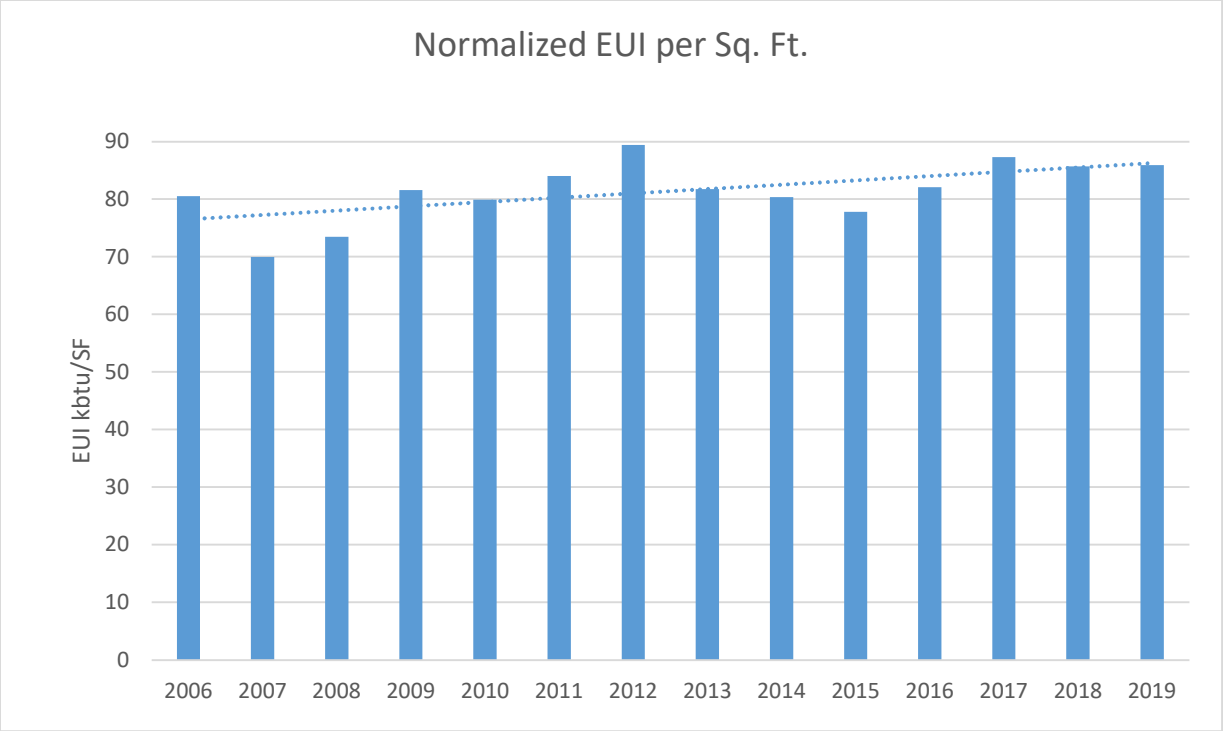
Energy Use Intensity

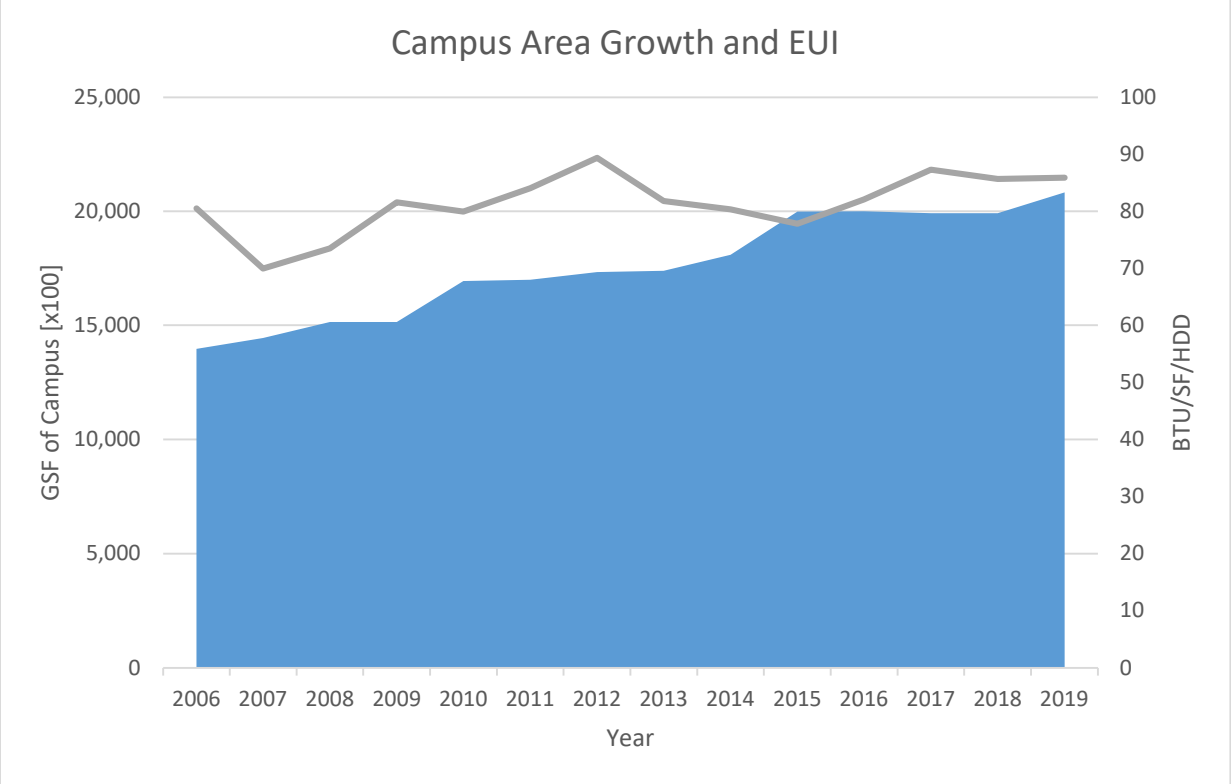
The student population increase, represented by Full Time Equivalent, FTE, for FY19 was 1.9% or 200 FTE for a total of 10,864. Measurements of Energy Use Intensity, EUI, and Energy Use per FTE (students) can

communicate some approximation of efficiency when both total energy and total costs are rising. Last year the additional square footage of the Ent Center was included in the EUI but it should not have been. At the end of FY18, we did not have a full year of energy data so it should not have calculated into the EUI metric. Energy Use Intensity per square foot from FY18 to FY19 stayed at 86. Energy Use Intensity per FTE increased from 15,993 in FY18 to 16,468 in FY19 which represents a 3% increase.

Campus-wide EUI is an important metric to see how the campus is doing with respect to itself in other years. It should be noted that campus EUI should not be used in determining performance against other campuses due to how different all campuses are. Overall, UCCS is maintaining its EUI in the upper 70s and 80s range. FY11 and FY12 were higher but lots of construction was on going at that time and may not reflect a truly accurate EUI since it does drop back down in FY14. The implementation of energy efficiency projects and requiring new buildings to be LEED certified is significant in keeping these metrics low. Colorado College has a EUI of 76 kBtu per square foot, as stated in its 2018 energy report, up 6 kBtu/SF from 2017; however, CC does not have evening classes. Most colleges in Colorado have a EUI in the 100's. The table below shows the total energy used on campus over the last four fiscal years.




Normalized EUI per Sq. Ft.
EUI kbtu/SF
90
80
70
60
50
40
30
20
10
0
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019


Campus Area Growth and EUI
GSF of Campus [x100]
25,000
20,000
15,000
10,000
5,000
0
BTU/SF/HDD
100
90
80
70
60
50
40
30
20
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0
2006
2007
2008
2009
2010
2011
2012
2013
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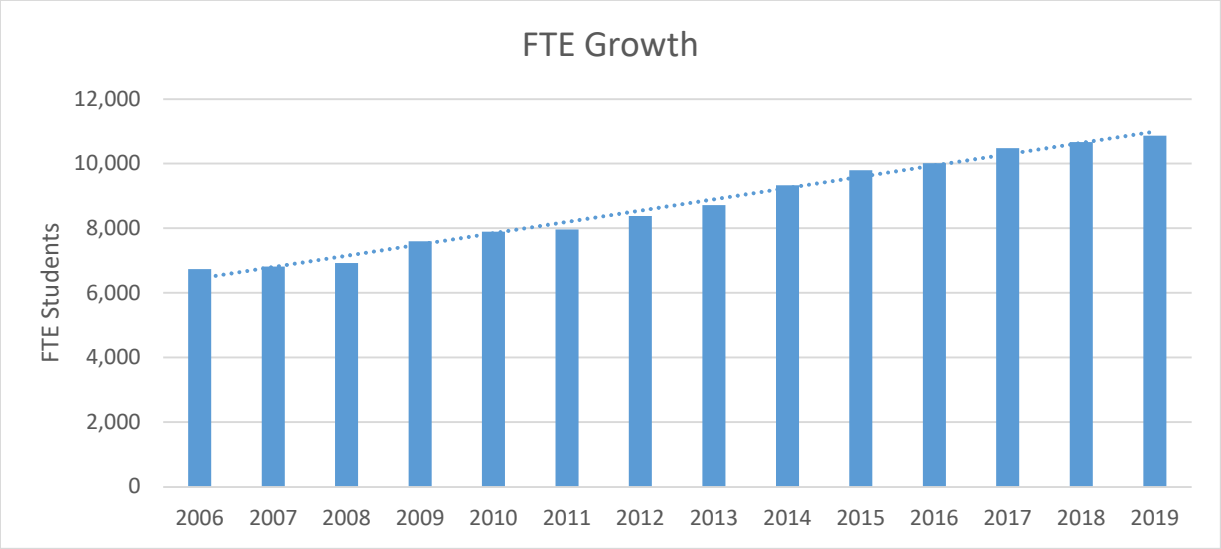
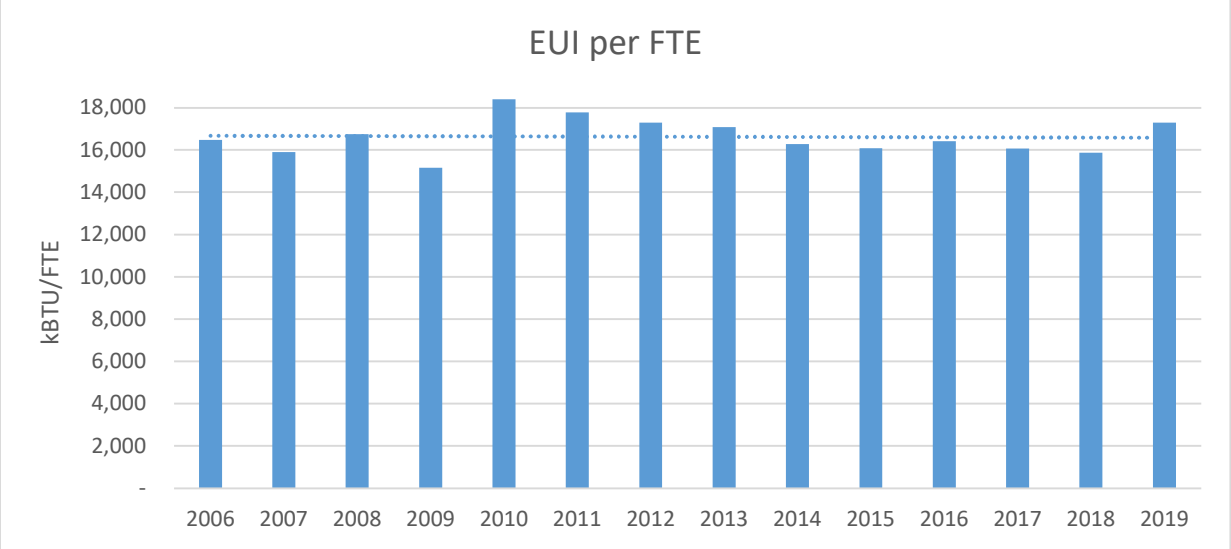
2015
2016
2017
2018
2019
Year





Energy Conservation Measures

In FY19, UCCS completed several lighting projects. The projects took place at the University Center (UC), Recreation and Wellness Center (Rec Center), and Columbine. For the projects at the UC and the Rec Center, final paperwork is not available but preliminary estimates are being used to estimate what was installed. Final paperwork is not available due to the person managing the projects leaving UCCS.

In the UC, 216 CFLs, T8s and incandescent lamps were replaced with LEDs. Total estimated kWh savings is 51,624. With an estimated cost of $17,400 the payback was 3.2 yrs and cost savings of $5,472 per year. CSU provided a preliminary estimate of an incentive of $5,214. **If the incentive had been applied for in time, the payback would have been reduced to 2.2 yrs.**

In the Rec Center 98 T5s, T8s and metal halide lamps were replaced with LED. Total estimated kWh savings is 112,459 kWh. With an estimated cost of $33,919 the payback was 2.6 yrs and cost savings of

$11,921per year. CSU provided a preliminary estimate of an incentive of $9,332. **If the incentive had been applied for in time, the payback would have been reduced to 2.1 yrs.**

On the General Fund side, Columbine also had a lighting upgrade. 628 CFLs, T8s and metal halides were replaced with LED lamps. The project resulted in savings of 84,887 kWh and cost savings of $5,942 per year. The project had a short payback of 1.1 yrs and received an incentive of $3,236 from CSU.

UCCS also reviewed the operation of the thermal storage system at Osborne in FY18 and determined that its operation could be improved so the chillers run at a minimal load throughout the on peak period. The ice storage containers were not filling properly for maximum ice storage so programming and new valves were installed. As of July 2019, the system has been running more optimized. Savings are being tracked and will be reported in FY20 but in **one month we saw about $12,000 less in demand charges**.

Supports for both air handlers at the Kraemer Family Library were in house fabricated and installed. This allows the AHUs to pull in cool outside and provide that as cooling to the building. This reduces the amount of return air the AHUs need to mechanically cool. This project saves 26,664 kWh. Since the supports were fabricated in house the cost was only $962 giving a payback of 0.5 yrs.

Lastly, no-loss air drains were installed on the air compressor at Main Hall. This project saves 3,422 kWh which is $291 per year. At a cost of $900, this project will payback in just over 3 years.

Renewable Energy

UCCS renewables include on-site solar photovoltaic, an on-site solar thermal system, purchase agreements in local off-site solar photovoltaic gardens, and the purchase of Renewable Energy Credits. The percentage of electricity from on-site solar is 1.4%. The percentage of electricity from off-site solar is 5.8%. With the addition of RECS, the percentage of UCCS electricity offset by renewables for FY19 was approximately 75%. UCCS purchases RECS to cover 100% of electricity for all new LEED Buildings and most larger buildings on campus also have 100% of electricity offset.

In October 2017 UCCS installed its largest on-site photovoltaic system to date, 150kW (AC). Situated on the Gallogly Event and University Centers roofs, the PV systems makes it almost net zero. FY19 was the first full year of generation and it provided 92% of the building energy which is very significant since it does not have any battery storage. Based on the FY19 generation the system should pay back in 11.4 years, well within the life of the solar panels. Typical estimated useful life is 20 years so the system should provide 8.6 years of savings which, estimated on FY19 generation and current utility rates, is $211,484.

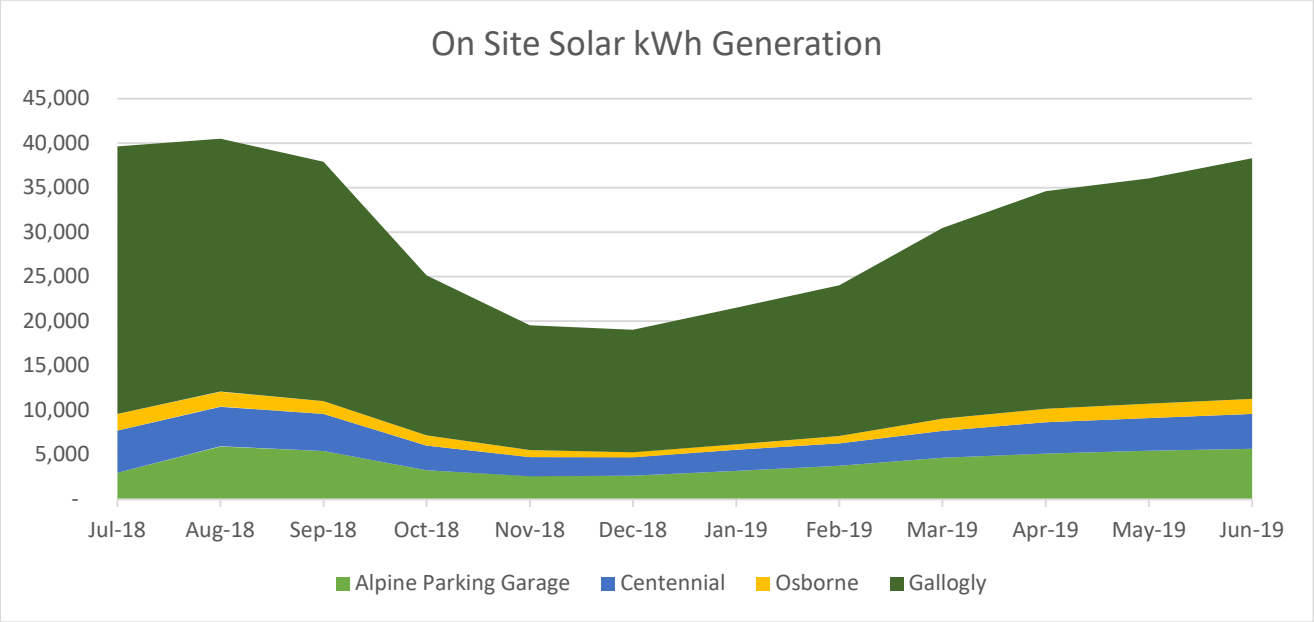
The solar thermal system on top of the Recreation Center has been deteriorating due to scale up of the heat exchanger and design issues on the system. UCCS is currently completing an analysis of the system and may cover it in the meantime until we can determine if it will become more feasible to repair in the future.

Building	Type	FY2019 Electric Consumption	FY2019 Solar Production	% of elec. from Renewables	RECs that UCCS can claim*
Alpine Parking Garage	On-site	254,000 kWh	50,604 kWh	20%	40% = 69,151 kWh/yr
Gallogly Events Center	On-site	21,700 kWh	261,609 kWh	92%	
Centennial Hall	On-site	1,427,400 kWh	39,361 kWh	3%	0%
Osborne Center	On-site	4,330,298 kWh	15,062 kWh	Less than 1%	0%
Total On-site			**549,075 kWh**		
Columbine Hall	Off-site	1,498,400 kWh	244,833 kWh	16%	100% = 244,833 kWh/yr.
Heller Center	Off-site	10,736	Est. 4,629 kWh	58%	0% - Offset by RECpurchase from Sunshare
Engineering - 1	Off-site	1,964,382 kWh	271,559 kWh	48%	100% = 187,060
Engineering - 2	Off-site		689,247 kWh		1,000,000 kWh/yr. – RECS from Sunshare
Total Off Site			**1,173,529 kWh**		

- Due to rebates received from CSU, UCCS cannot claim all attributes from on-site systems. For Engineering-2, and Heller, Sunshare must purchase RECS for the university each year as part of contract.

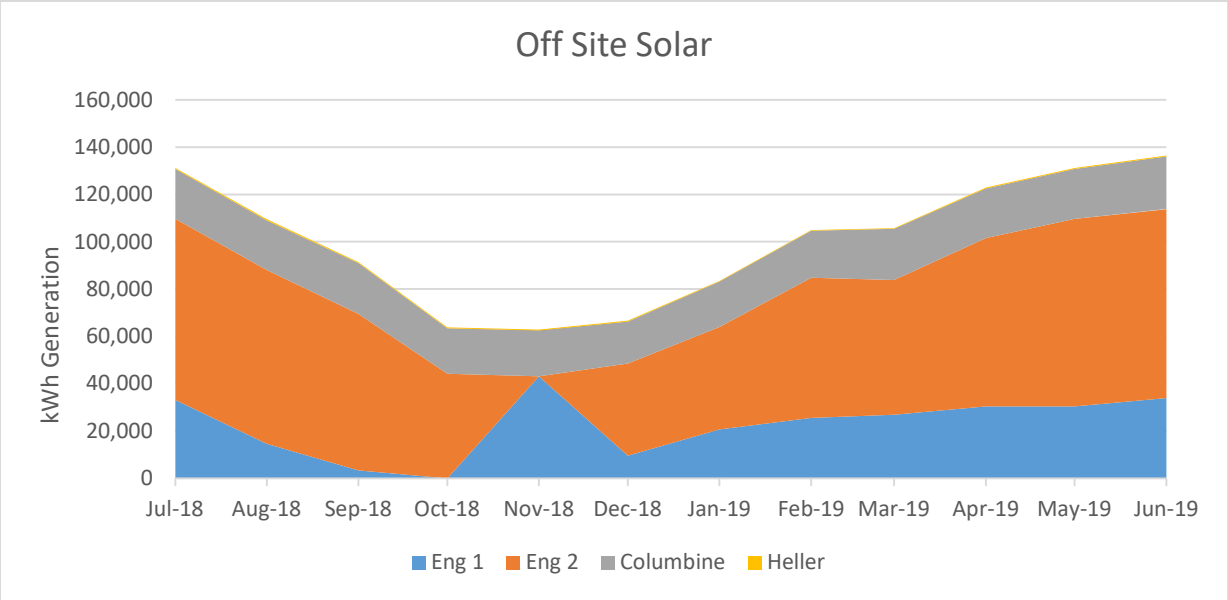
On-Site Solar

This graph represents the amount of energy produced by campus' on-site solar panels. The inverted bell shape is expected as there is less sunshine during the winter months.



Off-Site Solar (Solar Gardens)

In 2015, UCCS entered into 3 contracts for solar electricity production in local solar gardens. These are 20 year purchase agreements and the electricity is credited to Engineering and Columbine Hall. The increase in November 2018 is due to accounting of the generation. There was zero kWh billed to us for Engineering in October for Engineering 1 so the generation was lumped into November. There is a very small contract for Heller Center for 4kW. The graph below shows total offsite production.



Recommendations for FY20

UCCS has several potential projects that would reduce energy on campus.

1. Start an energy efficiency project fund. This fund would collect the cost savings from energy projects and use them to pay for future projects.
2. Expand BAS/DDC to all buildings so that buildings can be better controlled and analyzed. This also means that we do not have to pay for costly pneumatic parts for replacement.
3. Hire an Energy Performance Contractor (EPC) to do an Investment Grade Audit and Guaranteed Energy Savings Contract so that building conditions are well known, and new energy savings project opportunities identified.
    - Supply EPC with list of already identified energy projects.
4. Go to a totalized electrical bill for our demand accounts with CSU. This will put our electrical demand accounts into a larger rate class and will generate cost savings.
5. Determine how much transport gas should be purchased and whether we should consider a rate lock for FY21. The current rate lock is through June 2020 at 80% of purchased volumes.

6. Coordinate with class scheduling and match building HVAC schedules to the building schedules. This could mean setting back some AHUs sooner than others in a building if there aren't active classes that the AHU serves.
7. Create an occupant guide for dorms and the new Hybl building so that occupants are aware of best practices for conserving energy usage (e.g. plug loads, thermostat temperatures, using windows, etc).
8. Implement demand reduction/limit strategies for large pieces of equipment so that UCCS pays less in demand costs.
9. Campus wide LED adoption. Several projects were completed this last year including UC, Rec Center, Columbine lighting but this effort should be continued. Buildings/areas with higher wattage lamps should be retrofitted to LED. This includes the Spine walkway, roadways and Gateway Garage.
10. As costs permit change buildings to CSU's solar rate.
11. Retro-commission LEED buildings that are not operating as expected. Retro-commission energy intensive non-LEED buildings such as KFL.
12. Pursue Green Lab Certification. Through assessment and certification, we can identify how to reduce energy and water in these energy intensive spaces.
13. Take a closer look at storm water costs and see if there are any totalization opportunities for storm water from CSU.
14. Review water consumption on campus and reduce where possible. Water rates are expected to rise faster than other utilities and should be made a priority. Building water fixtures should be low flow types in most places so most effort should be placed on reviewing irrigation consumption and calculating evaporation losses from our evaporative cooling equipment.
15. Expand solar installations. The library is a good candidate for solar should the new roof project funding be approved so that the solar can be installed alongside the roof. The library occupants including the Dean have advocated for solar especially since there is a grant program for library solar systems. The new Hybl and Ent set shop would be good candidates for solar with their new roof systems. Other systems should be evaluated as roofs are being evaluated.

Total Energy Use per Building Yearly Comparisons

This chart displays the changes in energy use from FY18 to FY19. Since this is a working document, there may be explanations that Facilities Services can provide for significant changes in some buildings.

Building	Sq. Ft.	2018 KBTU	2018 KBTU/Sq.Ft.	2019 KBTU	2019 KBTU/Sq.Ft.	% Change
1861 Austin Bluffs PkWy	4,000	227,934	57	242,189	61	6%
1867 Austin Bluffs PkWy	8,247	442,376	54	388,168	47	-14%
Academic Office Building	40,172	1,954,489	49	2,305,968	57	15%
Alpine Garage	472,484	769,973	2	866,648	2	11%
Antero	39,963	1,182,865	30	1,562,344	39	24%
Campus Services Building	24,578	1,528,666	62	1,592,887	65	4%
Centennial Hall	69,824	9,498,955	136	9,110,718	130	-4%
Columbine Hall	107,532	9,354,719	87	8,901,907	83	-5%
Copper	33,294	3,656,473	110	3,523,234	106	-4%
Cragmor Hall	25,073	1,808,310	33	1,941,669	77	7%
Crestone	50,149	1,741,413	35	1,989,026	40	12%
Cucharas	56,300	2,671,418	47	2,800,205	50	5%
Cyber Security	134,592	4,327,322	32	4,881,001	36	11%
Dwire	43,972	3,632,291	83	3,622,925	82	0%
Eldora	34,304	361,900	11	311,851	9	-16%
Engineering	74,019	11,014,236	149	10,618,350	143	-4%
Ent Center	92,000		-	5,413,681	59	
Family Development	11,871	1,088,728	92	1,146,003	97	5%
Farmhouse	3,756	277,556	74	259,787	69	-7%
Fine Arts	3,117	462,081	148	430,653	138	-7%
Forster House	1,749	134,993	77	167,811	96	20%
Francis House Rental	3,628	150,980	42	140,763	39	-7%
Gallogly Events Center	25,165	871,140	35	902,730	36	3%
Gateway Garage	225,765	55,279	0	51,643	0	-7%
Gateway Hall	14,768	1,949,214	132	1,750,356	119	-11%
Greenhouse	3,000	144,487	48	159,992	53	10%
Heller Guest House	1,821	196,930	108	181,423	100	-9%
Heller Main House	3,050	176,866	58	178,014	58	1%
Innovation House	2,979	258,426	87	196,453	66	-32%
La Plata	47,980	2,510,991	52	2,651,938	55	5%
Lane Center	54,419	3,335,193	61	3,312,154	61	-1%
Kraemer Family Library & El Pomar Center	173,660	16,036,911	92	14,751,005	85	-9%
Lodge	45,171	8,119,651	180	7,585,389	168	-7%
Main Hall	48,780	5,249,435	108	5,368,499	110	2%
Osborne	155,472	29,341,969	189	27,881,155	179	-5%
Recreation and Wellness Center	97,085	12,332,455	127	11,872,934	122	-4%
Roaring Fork	35,612	10,058,997	282	10,453,824	294	4%
ROTC	12,160	893,523	73	752,687	62	-19%
San Juan	69,447	3,046,876	44	3,225,063	46	6%
Shavano	49,896	4,996,138	100	4,796,833	96	-4%
Summit Village	141,763	12,027,214	85	10,899,245	77	-10%
Sustainability Demonstration House	4,328	102,584	24	96,138	22	-7%
University Center	44,702	4,958,229	111	5,246,513	117	5%
University Hall	87,263	6,237,474	71	6,338,027	73	2%

Building Electric

The following table shows the change in electricity (kWh) use over the last four years for larger buildings on campus.

	2015	2016		2017		2018		2019	
Building	kWh	kWh	% Change	kWh	% Change	kWh	% Change	kWh	% Change
1861 University Office Park	30,363	25,228	-17%	25,488	1%	24,563	-4%	25,845	5%
1867 University Office Park	36,940	39,206	6%	40,640	4%	39,196	-4%	56,417	44%
4010 Regent Circle						8,141		8,115	0%
Academic Office Building	288,570	294,450	2%	284,100	-4%	272,250	-4%	317,550	17%
Alpine Garage and Field	332,800	245,400	-26%	212,200	-14%	225,600	6%	254,000	13%
Alpine Village Pump	100	100	0%	100	0%	100	0%	100	0%
Antero House	200,560	179,400	-11%	179,320	0%	163,160	-10%	172,160	6%
Bus Lights	33,161	39,139	18%	14,064	-64%	17,641	20%	7,511	-57%
Campus Services	144,320	164,480	14%	168,160	2%	182,000	8%	191,360	5%
Cellsite D	3,960	3,820	-4%	6,378	67%	5,617	-14%	4,444	-21%
Centennial Hall	1,469,550	1,501,200	2%	1,413,900	-6%	1,454,250	3%	1,427,400	-2%
Columbine Hall	1,414,800	1,446,800	2%	1,523,600	5%	1,498,400	-2%	1,415,600	-6%
Copper House	411,660	479,640	17%	482,520	1%	477,900	-1%	514,860	8%
Cragmor Hall	235,440	236,360	0%	242,560	3%	241,840	0%	233,480	-3%
Crestone House	355,560	292,920	-18%	291,600	0%	263,760	-11%	275,040	4%
Cucharas House		237,600		309,600	30%	295,200	-5%	276,900	-6%
Cyber Security	132,400	165,200	25%	399,200	142%	441,700	10%	491,700	11%
Dwire Hall	651,600	660,000	1%	650,400	-1%	616,200	-6%	611,100	-1%
Eagle Rock (ROTC)	277,720	273,800	-1%	236,440	-14%	261,800	10%	220,600	-16%
Engineering and Applied Science	1,997,666	1,955,637	-2%	2,036,781	4%	1,964,382	-4%	1,909,322	-3%
Ent Center								836,100	
Ent Center Storage and Restrooms	67,919	46,912	-31%	42,040	-10%	44,572	6%	43,676	-2%
Family Development Center	152,880	149,440	-2%	137,960	-8%	144,280	4%	141,440	-2%
Farmhouse	7,438	9,919	33%	11,035	11%	12,586	12%	13,379	6%
Fine Arts	21,500	21,763	1%	31,809	46%	36,707	13%	36,854	0%
Forster	7,687	6,733	-12%	2,875	-57%	4,907	41%	5,339	9%
Francis House Rental	216	5,835	2601%	5,990	3%	4,768	-26%	5,170	8%
Frontage Road Lights	51,217	45,744	-11%	46,468	2%	43,874	-6%	42,028	-4%
Gallogly Events Center	246,800	243,100	-1%	231,400	-5%	12,552	-1744%	21,700	73%
Gateway Garage	7,051	6,602	-6%	8,504	29%	5,004	-70%	4,576	-9%
Gateway Hall	537,450	533,550	-1%	487,950	-9%	519,000	6%	513,000	-1%
Greenhouse	24,936	29,494	18%	31,988	8%	33,984	6%	33,362	-2%
Heller Guest House	8,082	8,704	8%	8,893	2%	10,088	12%	10,478	4%
Heller Main House	10,572	9,958	-6%	10,736	8%	8,692	-24%	9,335	7%
Innovation House	5,835	4,912	-16%	6,298	28%	5,311	-19%	3,533	-33%
Kraemer Family Library & El Pomar Center	2,879,192	2,916,198	1%	2,938,998	1%	2,749,725	-7%	2,396,506	-13%
La Plata House		297,000		417,300	41%	363,900	-15%	394,500	8%
Lane Center	455,250	486,300	7%	505,950	4%	475,650	-6%	485,250	2%
Main Hall	713,800	692,000	-3%	627,400	-9%	604,200	-4%	586,400	-3%
North Nevada Monument Sign	1,462	1,470	1%	1,140	-22%	1,620	30%	1,553	-4%
Osborne Center	4,064,296	4,127,491	2%	4,393,784	6%	4,370,662	-1%	4,330,298	-1%
Parking Lot 224	208,500	214,098	3%	206,400	-4%	193,050	-7%	171,450	-11%
Parking Lot 540				34,421		46,352	26%	44,437	-4%
Parking Lot 570	31,316	20,626	-34%	19,772	-4%	20,326	3%	13,902	-32%
Parking Lot 580	31,622	32,299	2%	37,152	15%	61,993	40%	24,930	-60%
Recreation and Wellness	1,097,700	1,377,300	25%	1,495,800	9%	1,491,900	0%	1,437,600	-4%
Roaring Fork Dining Hall		699,750		1,073,100	53%	1,161,675	8%	1,250,550	8%
ROTC Parking Lot Lights	9,968	10,312	3%	8,121	-21%	6,467	-26%	2,968	-54%
San Juan				343,800		363,720	5%	383,460	5%
Shavano House	328,200	308,800	-6%	330,600	7%	316,800	-4%	334,400	6%
Soccer Field Lights		59,644		77,264	30%	95,217	19%	84,456	-11%
Softball Field Lights	1,628	1,509	-7%	2,107	40%	4,688	55%	2,613	-44%
Summit Lodge	831,000	683,600	-18%	759,200	11%	643,320	-18%	729,000	13%
Summit Village	1,103,800	1,108,200	0%	1,118,200	1%	1,087,200	-3%	1,080,800	-1%
Sustainability Demonstration House	3,700	5,193	40%	5,197	0%	4,947	-5%	4,854	-2%
University Center	612,000	634,400	4%	637,600	1%	637,600	0%	644,800	1%
University Hall	1,093,000	1,144,800	5%	1,179,000	3%	998,000	-18%	1,097,600	10%
VAPA Parking Lot Lights		23,325		28,445	22%	30,101	6%	30,601	2%
West Lawn Lightings	12,772	12,232	-4%	10,463	-14%	11,304	7%	12,451	10%

Building Natural Gas

The following table shows the change in natural gas use over the last four years for the larger buildings on campus. Main Hall and Cragmor Hall are under the same natural gas meter so each building's natural gas usage was measured by distributing the total natural gas between both buildings based on their square footage. Buildings with larger square footage have a greater natural gas use.

	2015	2016		2017		2018		2019	
Building	CCF	CCF	% Change	CCF	% Change	CCF	% Change	CCF	% Change
1861 University Office Park	1,794	1,637	-9%	1,671	2%	1,441	-14%	1,885	31%
1867 University Office Park	2,679	2,106	-21%	3,330	58%	3,086	-7%	3,387	10%
4010 Regent						941		1,295	38%
Academic Office Building	16,356	12,188	-25%	13,534	11%	10,253	-24%	14,963	46%
Alpine Garage and Field									
Antero House	18,935	10,884	-43%	6,256	-43%	6,260	0%	11,933	91%
Campus Services	9,199	10,191	11%	9,427	-8%	9,075	-4%	11,505	27%
Centennial Hall	54,282	49,054	-10%	43,458	-11%	45,356	4%	51,902	14%
Columbine Hall	49,513	47,336	-4%	36,515	-23%	42,407	14%	49,839	18%
Copper House	14,108	21,807	55%	20,595	-6%	20,254	-2%	21,622	7%
Cragmor Hall	9,983	10,290	3%	10,154	-1%	11,432	13%	14,015	23%
Crestone House	21,010	14,775	-30%	18,657	26%	8,412	-55%	12,859	53%
Cucharas House		20,746		15,342	-26%	16,639	8%	22,710	36%
Cyber Security	34,621	31,956	-8%	34,309	7%	28,198	-18%	39,208	39%
Dwire Hall	17,761	16,946	-5%	14,464	-17%	15,292	6%	18,823	23%
Eagle Rock (ROTC)									
Eldora House	3,609	3,785	5%	3,589	-5%	3,619	1%	3,817	5%
Engineering and Applied Science	38,306	35,309	-8%	37,636	6%	43,098	15%	50,229	17%
Ent Center								31,345	
Family Development Center	8,206	8,104	-1%	5,785	-40%	5,963	3%	8,120	36%
Farmhouse	2,614	2,443	-7%	2,260	-7%	2,346	4%	2,621	12%
Fine Arts	3,337	3,566	7%	3,019	-15%	3,705	23%	3,735	1%
Forster House	1,459	1,471	1%	1,392	-5%	1,375	-1%	1,831	33%
Francis House Rental		1,971		1,378	-30%	1,347	-2%	1,507	12%
Gallogly Events Center	14,257	12,160	-15%	13,562	10%	8,283	-39%	10,143	22%
Gateway Garage	199	489	146%	409	-16%	382	-7%	441	15%
Gateway Hall	545	719	32%	2,155	200%	1,779	-17%	1,583	-11%
Greenhouse	977	352	-64%	711	102%	285	-60%	565	98%
Heller Guest House	1,599	1,606	0%	1,469	-9%	1,625	11%	1,783	10%
Heller Main House	1,451	1,738	20%	1,403	-19%	1,472	5%	1,789	22%
Innnovation House	1,880	2,315	23%	2,282	-1%	2,403	5%	2,257	-6%
Kraemer Family Library & El Pomar Center	73,887	65,039	-12%	54,830	-16%	66,521	18%	80,466	21%
La Plata House		14,395		13,845	-4%	12,690	-8%	15,984	26%
Lane Center	20,056	19,902	-1%	18,960	-5%	17,118	-10%	20,275	18%
Main Hall	19,424	20020	3%	19754	-1%	22,241	11%	27,207	22%
Osborne Center	138,089	125,754	-9%	132,290	5%	144,249	8%	160,417	11%
Recreation and Wellness Center	50,247	82,419	64%	61,707	-25%	72,406	15%	85,285	18%
Roaring Fork Dining Hall		48,700		60,829	25%	60,942	0%	75,727	24%
San Juan				17,318		18,055	4%	23,460	30%
Shavano House	59,352	40,220	-32%	42,455	6%	39,149	-8%	44,747	14%
Summit Lodge	75,223	55,552	-26%	64,620	16%	59,240	-9%	62,399	5%
Summit Village	98,880	85,746	-13%	79,536	-7%	83,166	4%	88,268	6%
Sustainability Demonstration House	867	930	7%	873	-6%	857	-2%	974	14%
University Center	26,658	31,212	17%	26,470	-18%	27,821	5%	37,288	34%
University Hall	33,226	26,182	-21%	24,984	-5%	28,313	13%	31,738	12%

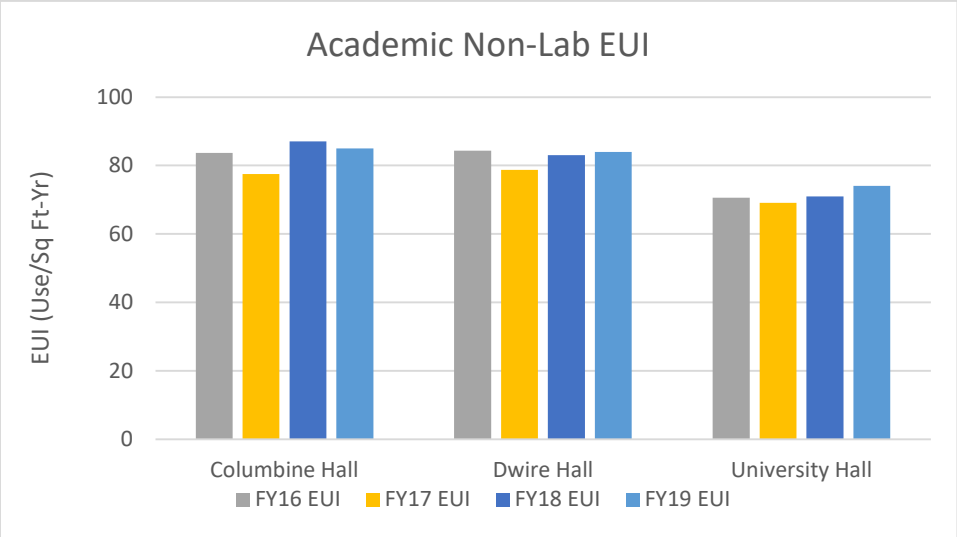
Building Highlights

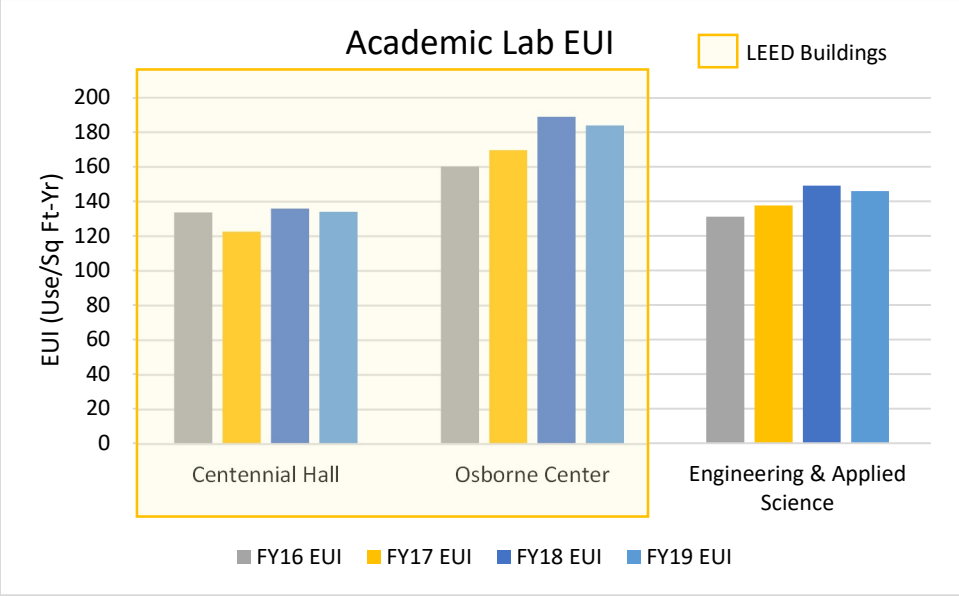
The sections below focus on the campus buildings that are most energy intensive. The buildings have been separated and compared to buildings of similar type. The four main types of buildings on campus are academic, office, residential halls, and support facilities.

Since September 2007, all new buildings on campus are LEED certified. These buildings are designed to perform better with regard to resource use.

Academic

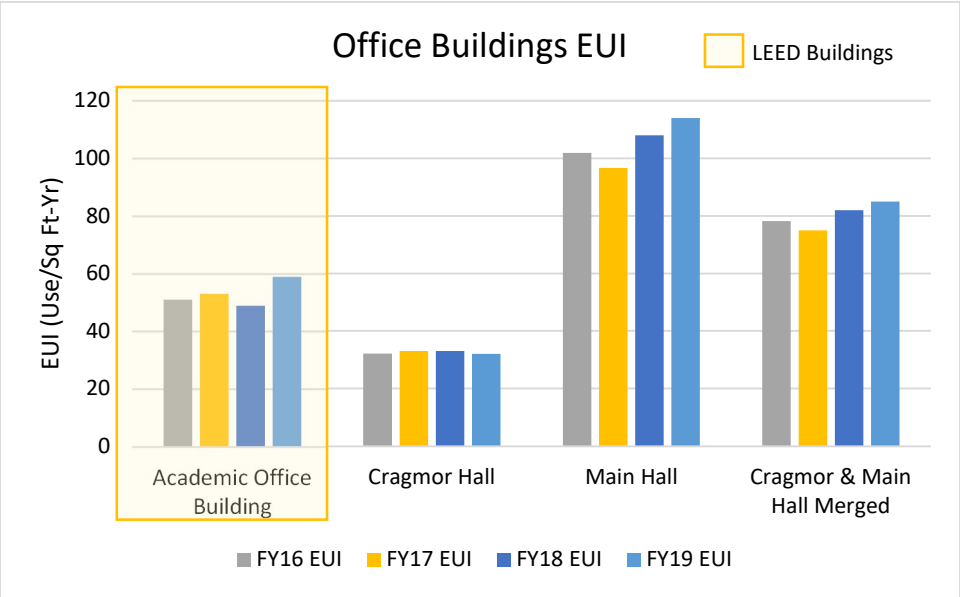
Academic buildings are primarily used for classrooms or laboratories. Some do include offices; however, that is not their primary purpose. There are two different kinds of academic buildings: non-lab and lab. The reasoning for this is the buildings that include labs are far more energy intensive than those without labs.





Office Buildings

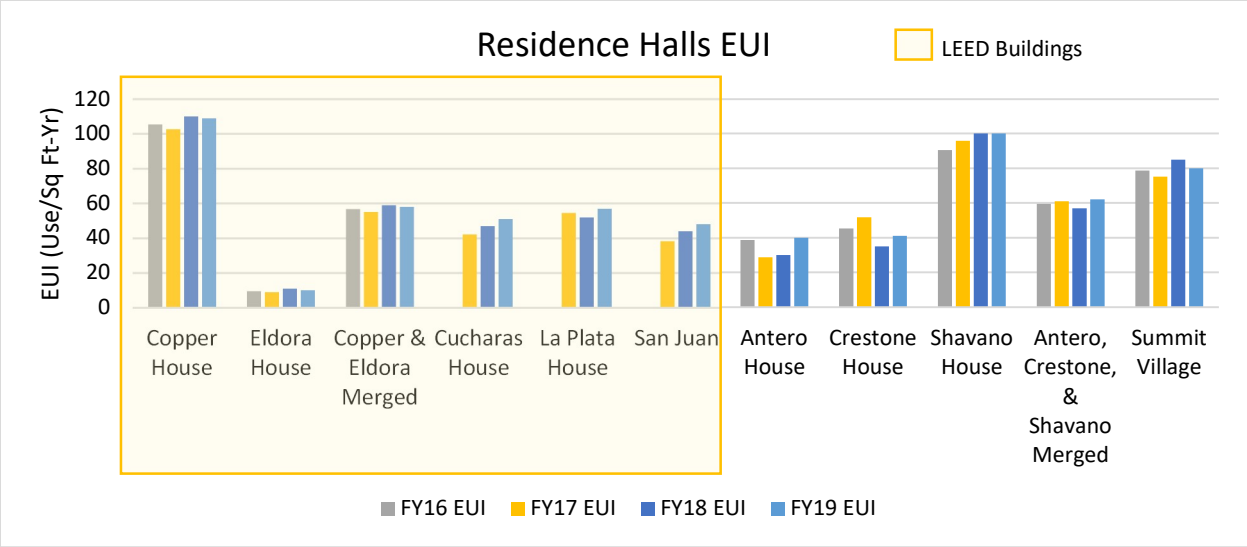
Office buildings consist entirely of offices for faculty and staff. These buildings have moderate EUI's as each office is occupied every day during the work week. Main Hall appears to have a large EUI; however, its EUI also includes the natural gas for Cragmor Hall. This means that the EUI for each building is slightly lower and higher, respectively. Academic Office Building still has a higher than expected EUI since its construction. Work will continue to be done to bring it down to expected levels. Despite this, it has the lowest EUI of all the main office buildings on campus.



Residential Halls

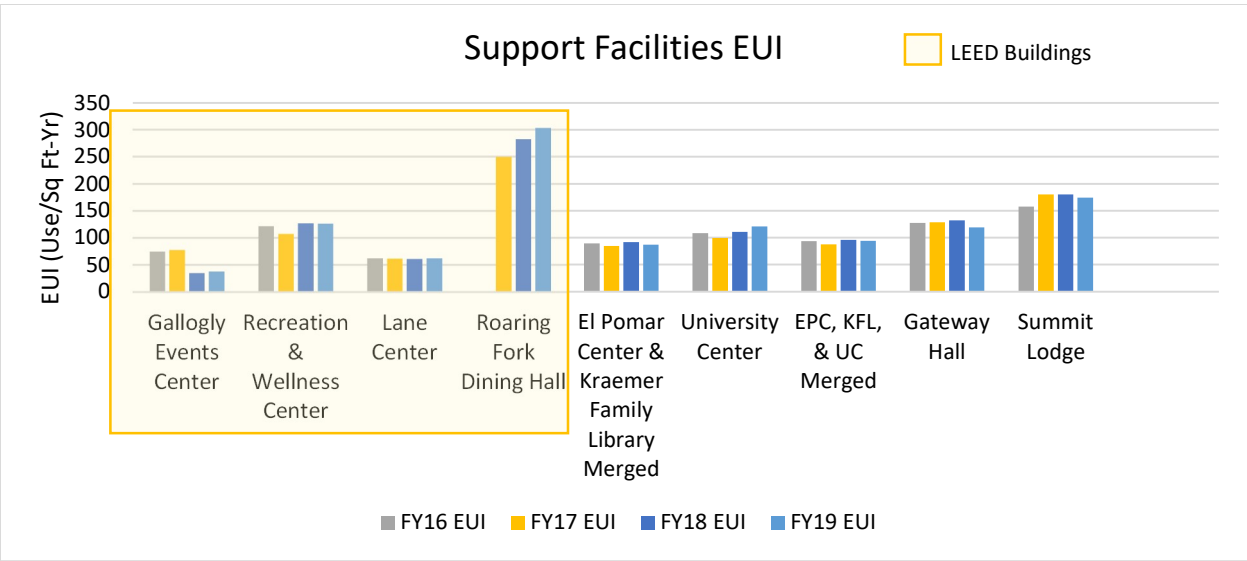
Campus residents have the greatest impact on GHG emissions. The buildings they occupy are used daily for most of the year. The buildings are not fully occupied during breaks in between semesters. To reduce emissions, these are the buildings that should be focused on. It should be noted that Eldora's natural gas is on Copper's bill; therefore, Eldora's EUI is slightly larger while Copper's is less. This is the first year that San Juan has been occupied.

Campus residents contribute the most to GHG emissions. The graph below compares the residence halls to each other. It should be noted that the natural gas for Eldora is on Copper’s bill which is why they have been merged. La Plata has a slightly higher EUI than Cucharas as the air conditioning for both buildings comes from La Plata. Shavano contains the boiler and laundry facilities for itself, Antero, and Crestone; therefore, its EUI is higher.



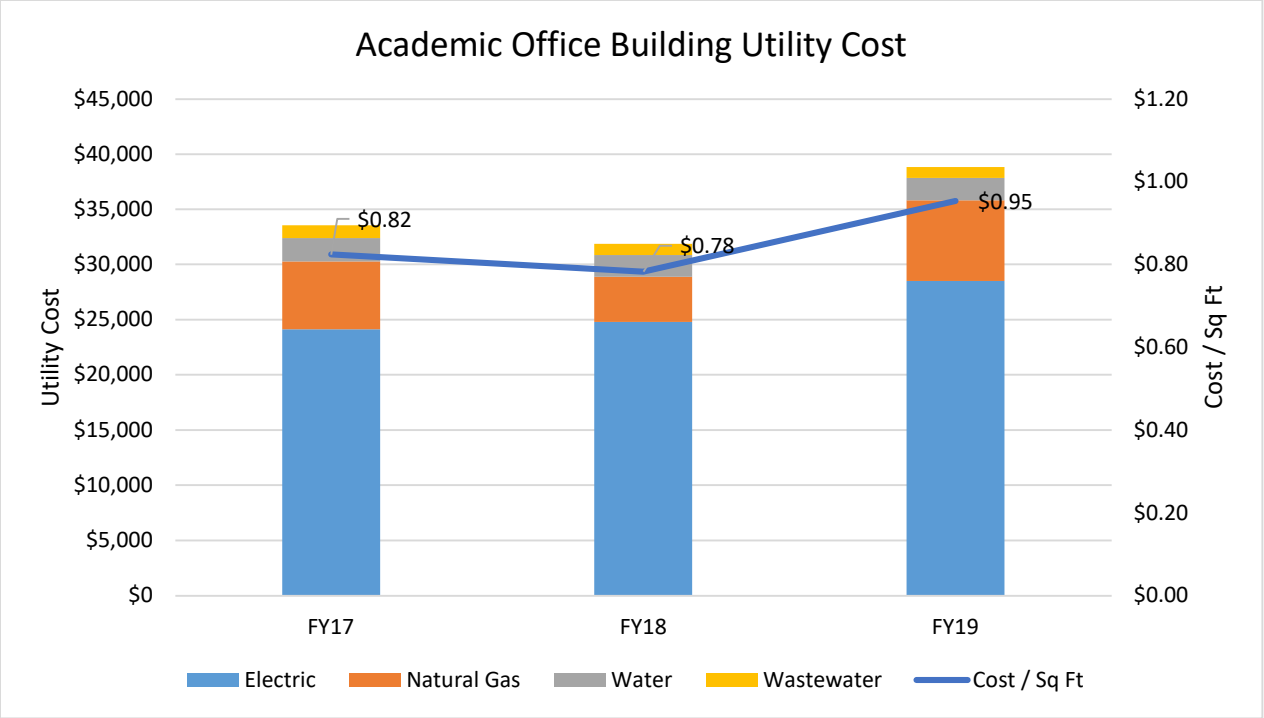
Support Facilities

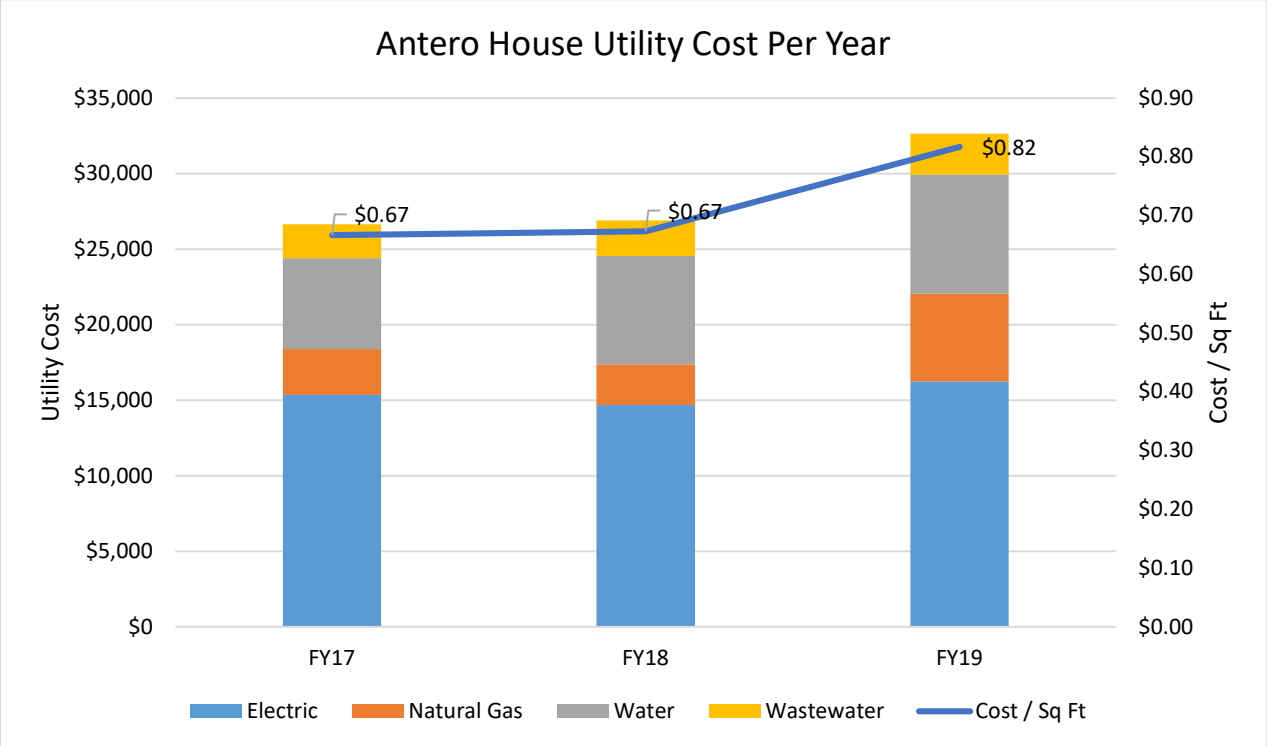
Support facilities are buildings that provide extra services for the community, students, faculty, and staff. All of these buildings vary in use, so it is difficult to compare them to other buildings.

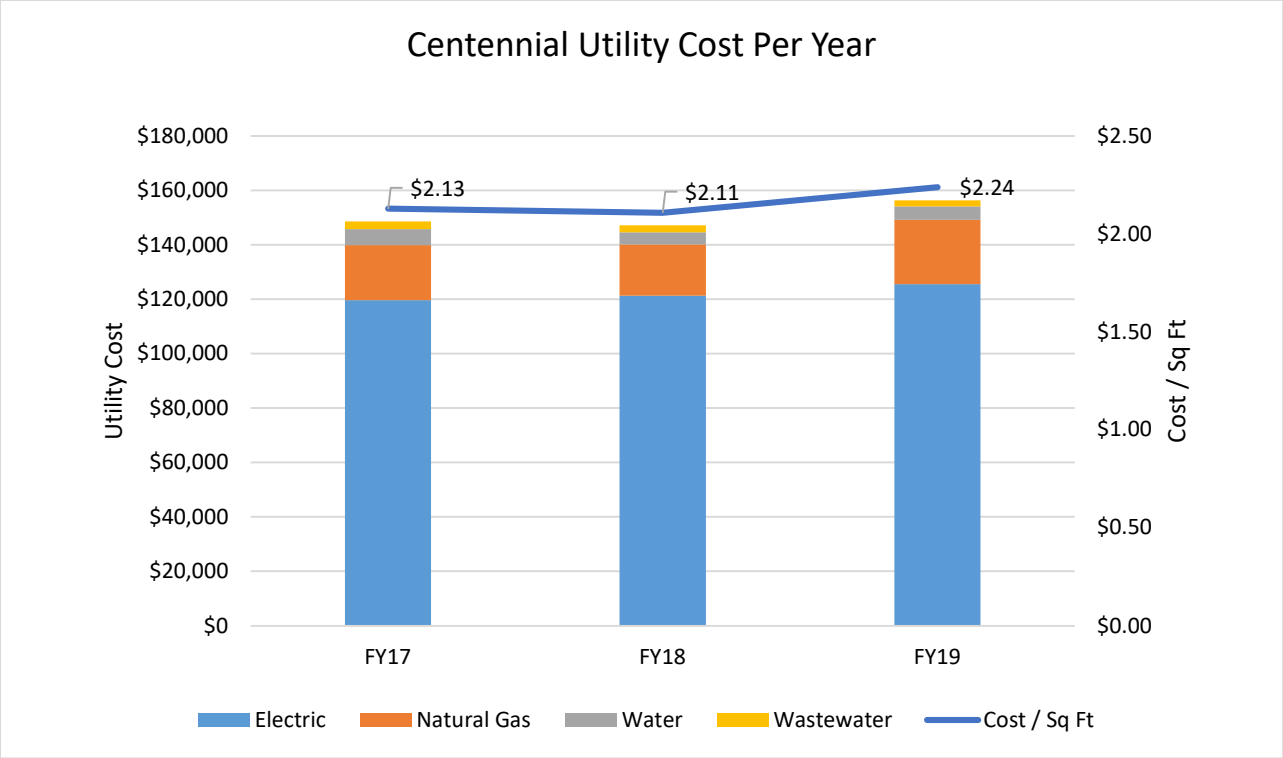


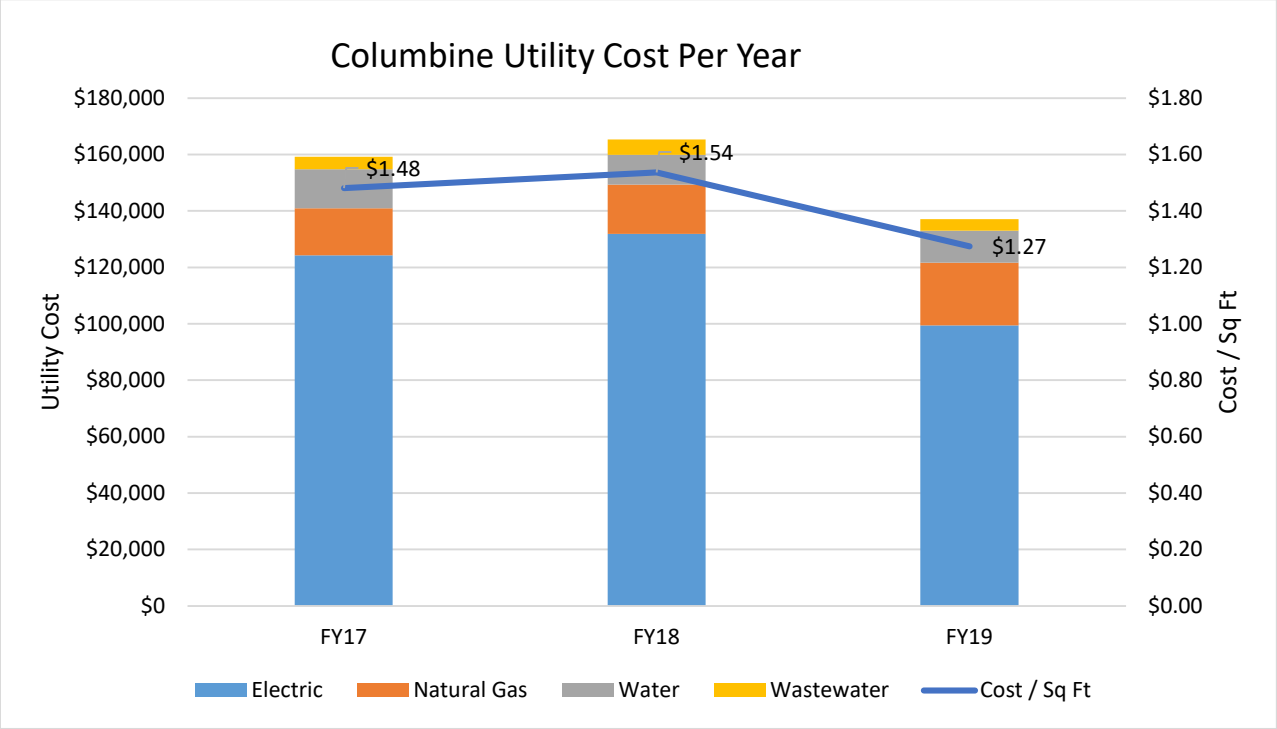
Appendix

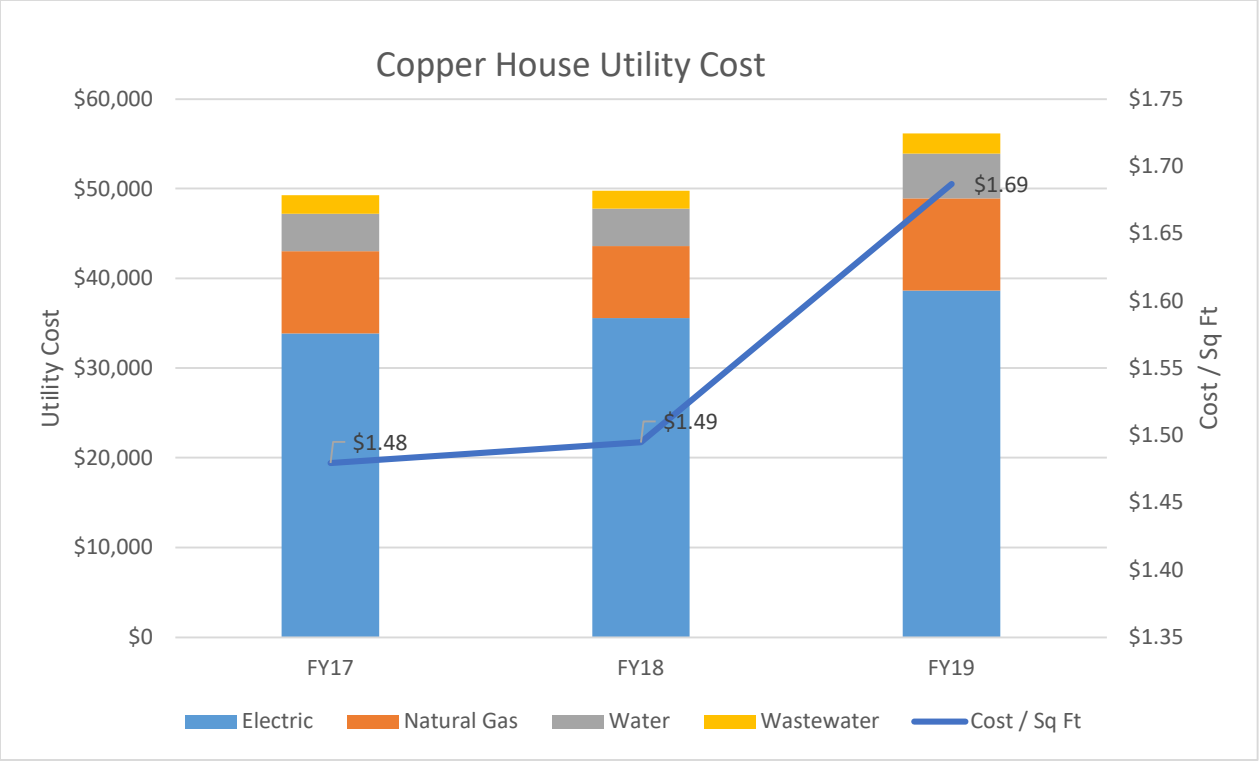
This section provides additional, more detailed data on the buildings from the Building Highlights section. The graphs below show the usage of each commodity versus the total cost of the commodities per square foot.

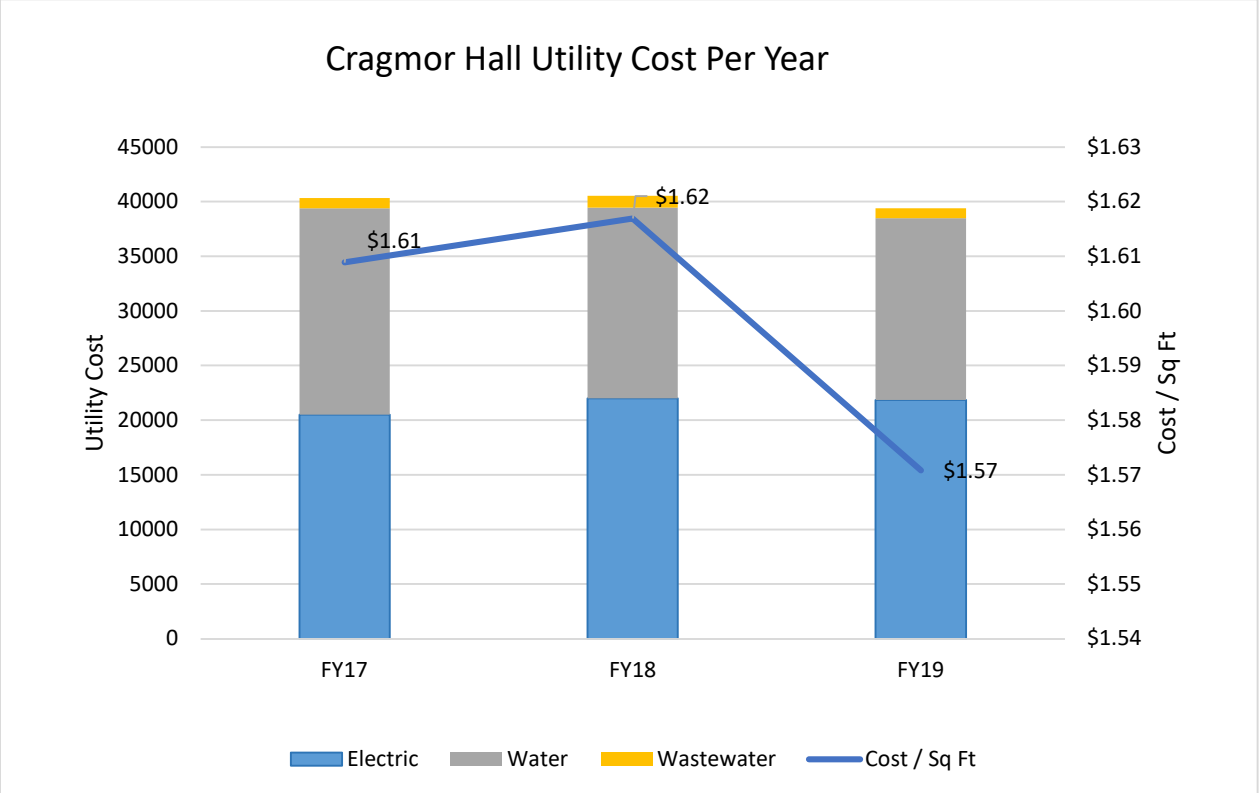

Academic Office Building Utility Cost
$45,000
$40,000
$35,000
$30,000
$25,000
$20,000
$15,000
$10,000
$5,000
$0
Utility Cost
$1.20
$1.00
$0.80
$0.60
$0.40
$0.20
$0.00
Cost / Sq Ft
$0.82
$0.78
$0.95
FY17
FY18
FY19
Electric
Natural Gas
Water
Wastewater
Cost / Sq Ft

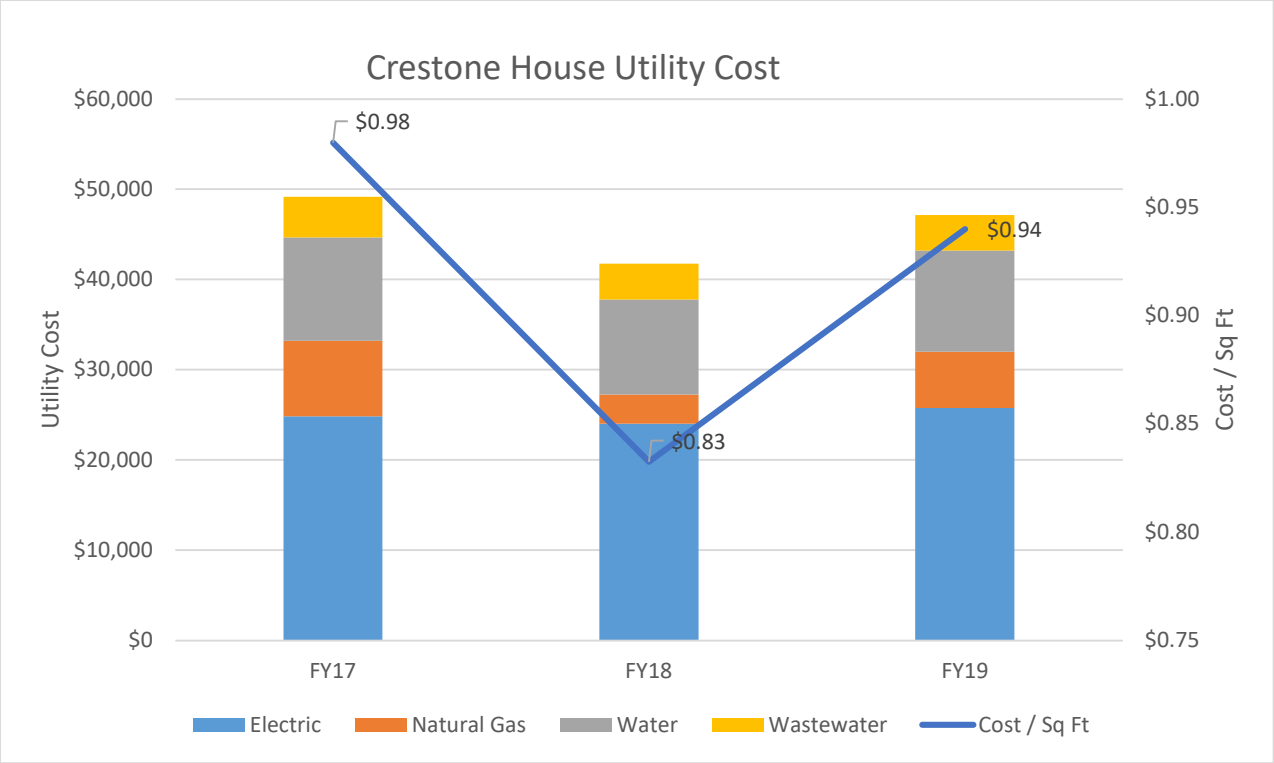

Antero House Utility Cost Per Year
$35,000
$30,000
$25,000
$20,000
$15,000
$10,000
$5,000
$0
Utility Cost
$0.90
$0.80
$0.70
$0.60
$0.50
$0.40
$0.30
$0.20
$0.10
$0.00
Cost / Sq Ft
$0.67
$0.67
$0.82
FY17
FY18
FY19
Electric
Natural Gas
Water
Wastewater
Cost / Sq Ft

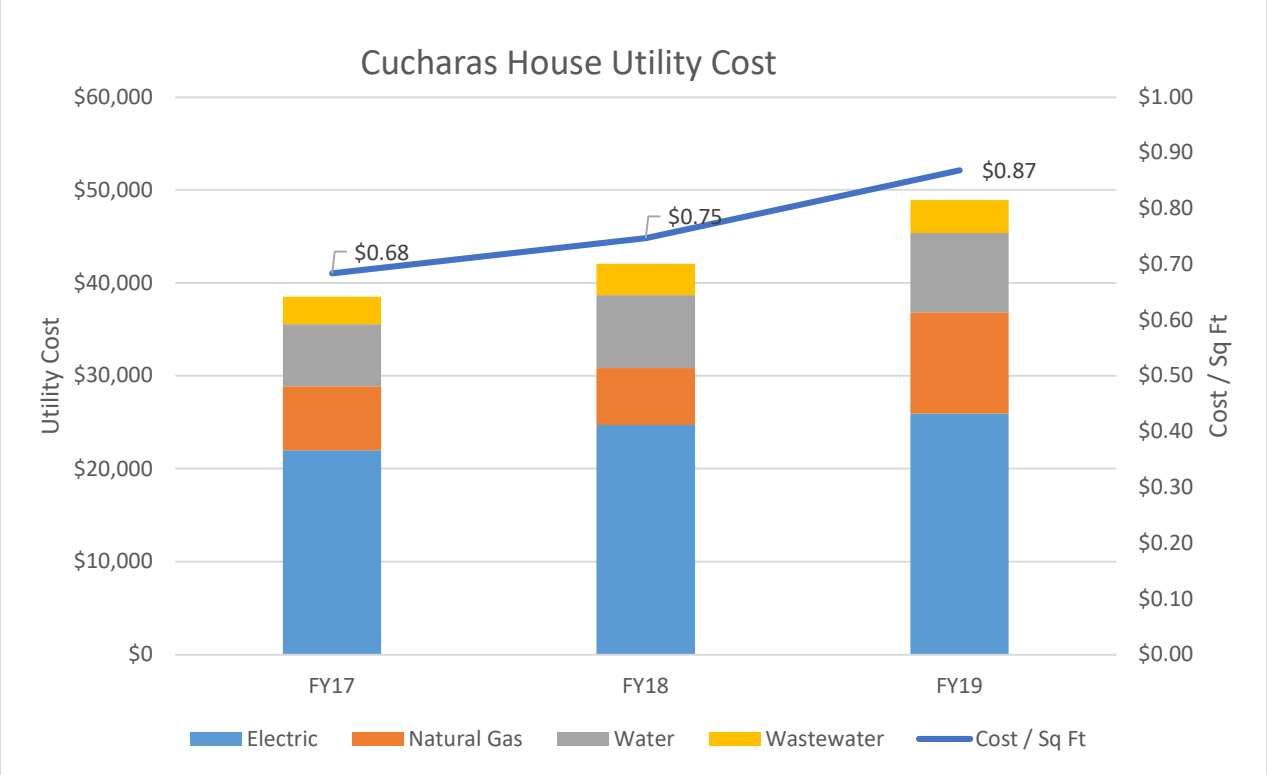

Centennial Utility Cost Per Year
$180,000
$160,000
$140,000
$120,000
$100,000
$80,000
$60,000
$40,000
$20,000
$0
Utility Cost
$2.50
$2.00
$1.50
$1.00
$0.50
$0.00
Cost / Sq Ft
$2.13
$2.11
$2.24
FY17
FY18
FY19
Electric
Natural Gas
Water
Wastewater
Cost / Sq Ft

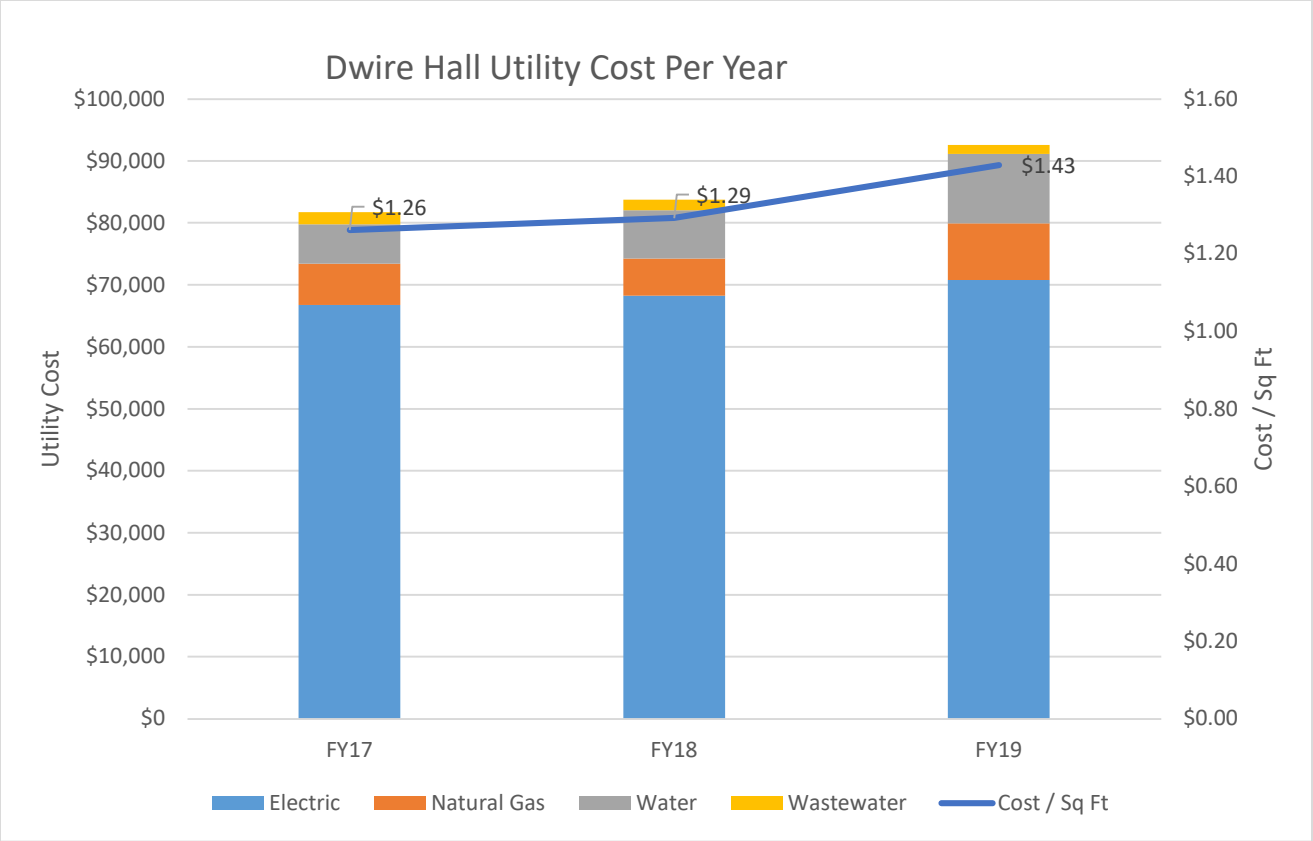

Columbine Utility Cost Per Year
$180,000
$160,000
$140,000
$120,000
$100,000
$80,000
$60,000
$40,000
$20,000
$0
Utility Cost
$1.80
$1.60
$1.40
$1.20
$1.00
$0.80
$0.60
$0.40
$0.20
$0.00
Cost / Sq Ft
$1.48
$1.54
$1.27
FY17
FY18
FY19
Electric
Natural Gas
Water
Wastewater
Cost / Sq Ft

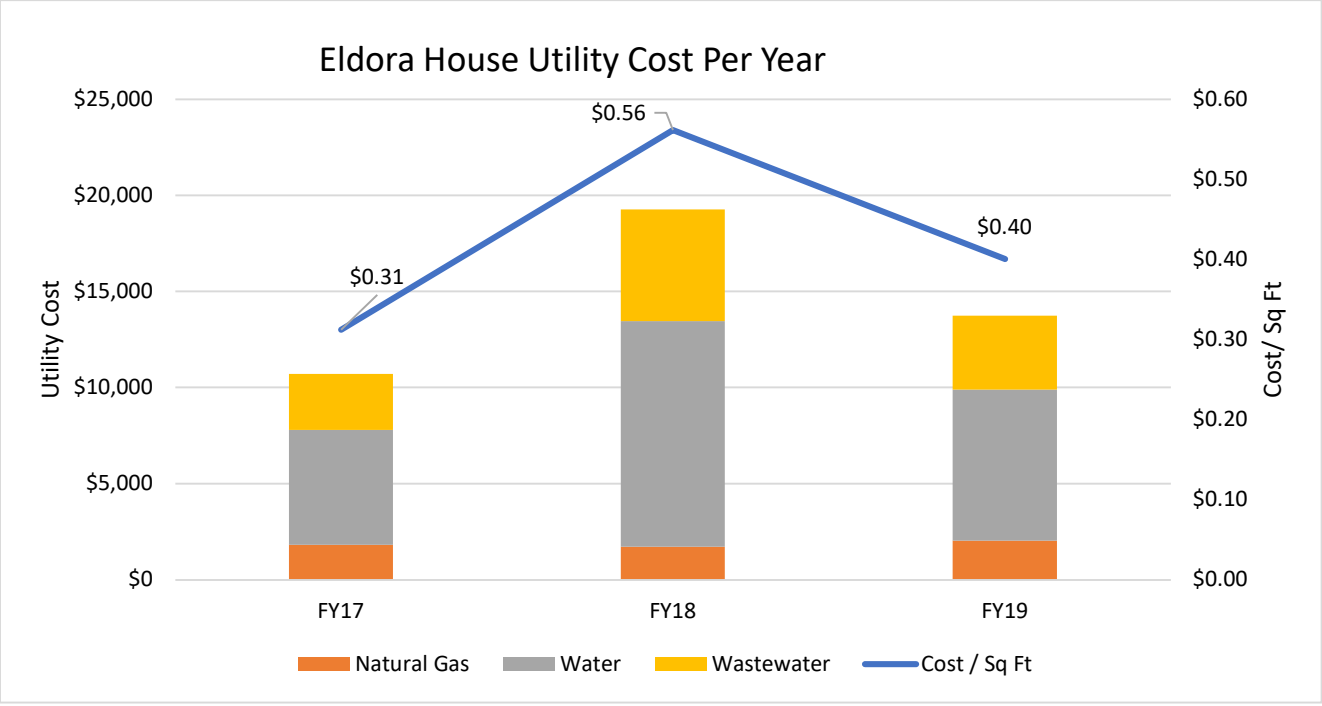

Copper House Utility Cost
$60,000
$50,000
$40,000
$30,000
$20,000
$10,000
$0
Utility Cost
$1.75
$1.70
$1.65
$1.60
$1.55
$1.50
$1.45
$1.40
$1.35
Cost / Sq Ft
$1.48
$1.49
$1.69
FY17
FY18
FY19
Electric
Natural Gas
Water
Wastewater
Cost / Sq Ft

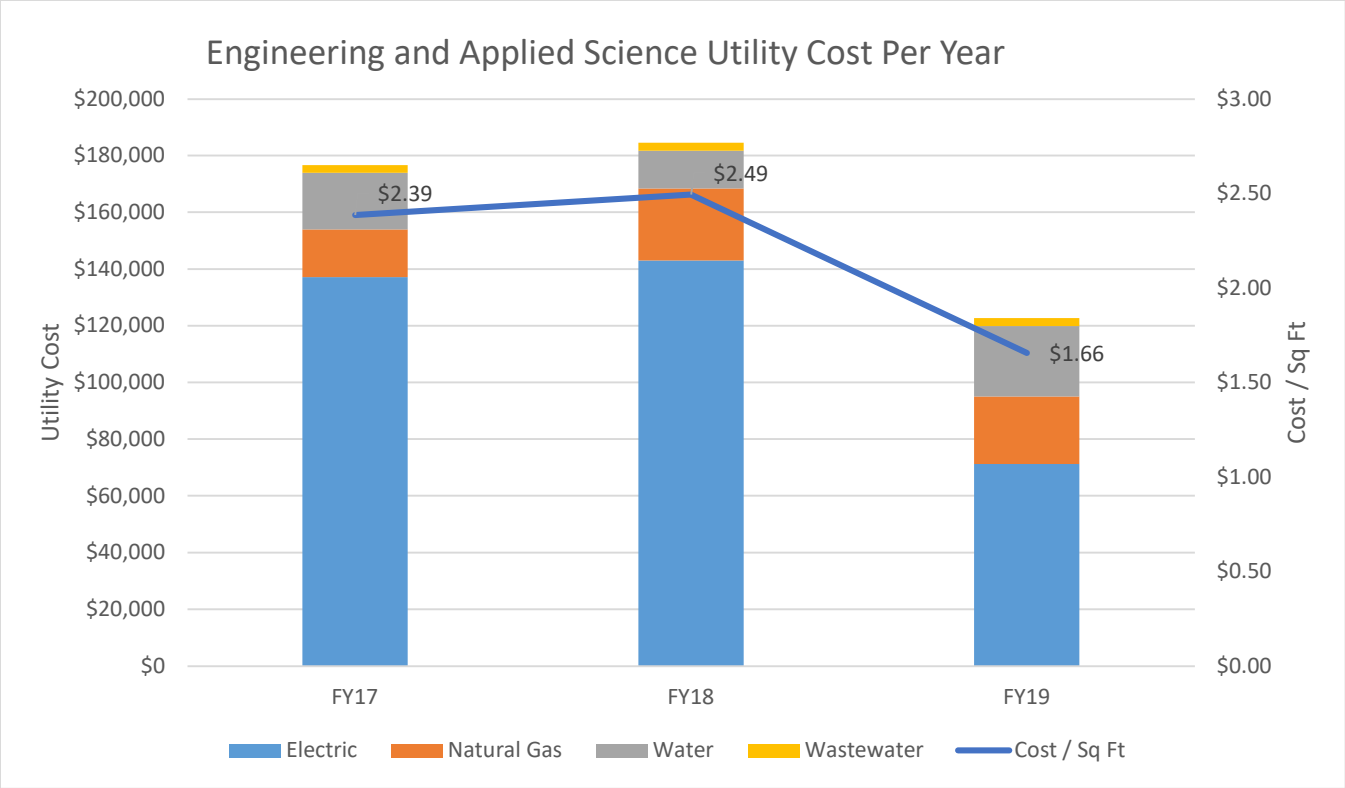

Cragmor Hall Utility Cost Per Year
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
Utility Cost
$1.63
$1.62
$1.61
$1.60
$1.59
$1.58
$1.57
$1.56
$1.55
$1.54
Cost / Sq Ft
$1.61
$1.62
$1.57
FY17
FY18
FY19
Electric
Water
Wastewater
Cost / Sq Ft

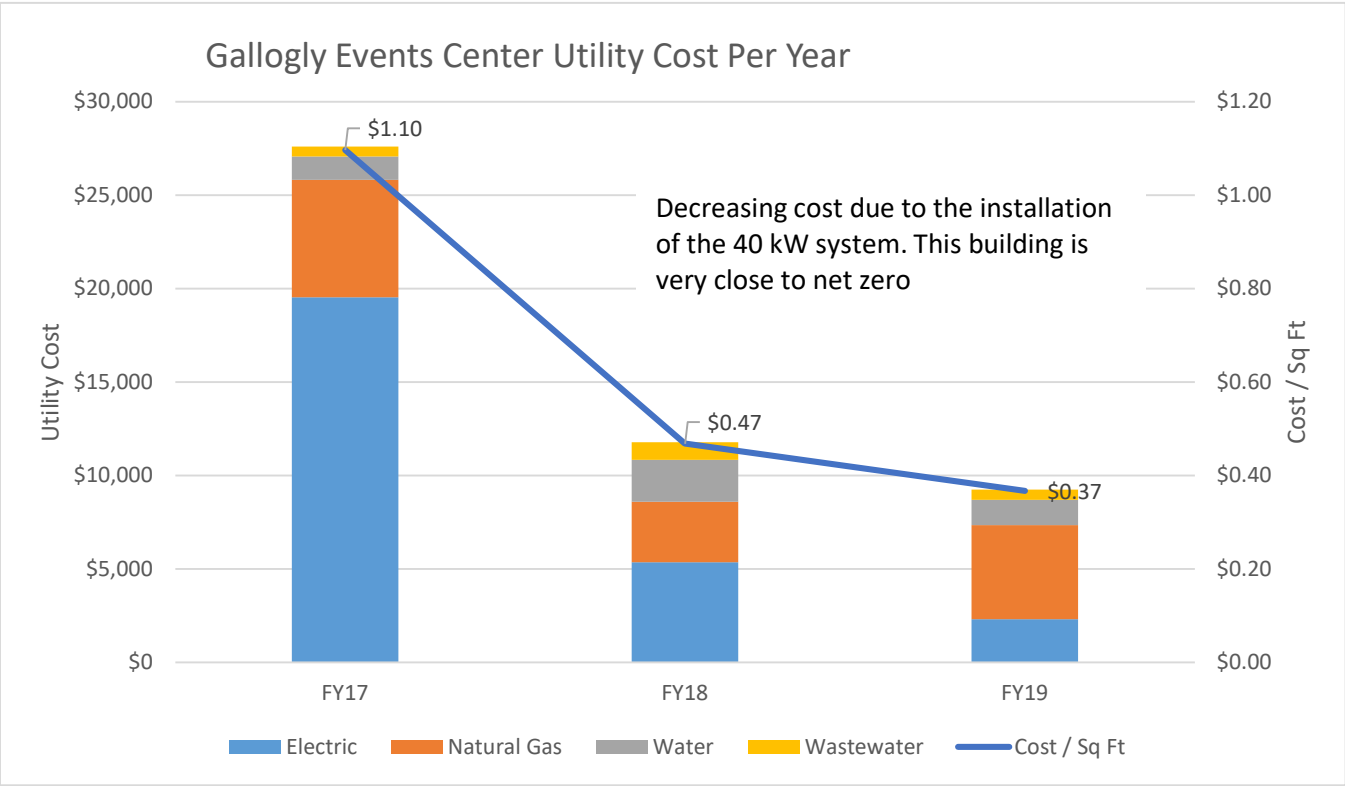

Crestone House Utility Cost
$60,000
$50,000
$40,000
$30,000
$20,000
$10,000
$0
Utility Cost
$1.00
$0.95
$0.90
$0.85
$0.80
$0.75
Cost / Sq Ft
$0.98
$0.83
$0.94
FY17
FY18
FY19
Electric
Natural Gas
Water
Wastewater
Cost / Sq Ft

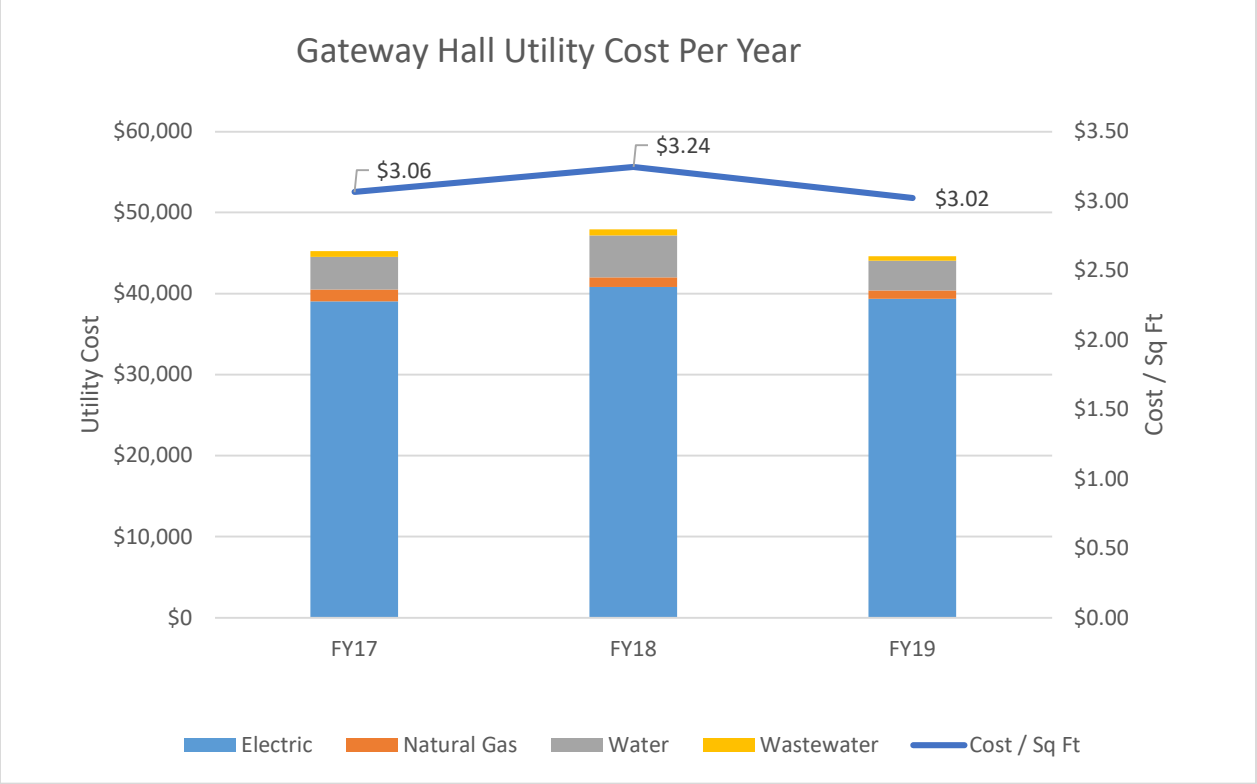

Cucharas House Utility Cost
$60,000
$50,000
$40,000
$30,000
$20,000
$10,000
$0
Utility Cost
$1.00
$0.90
$0.80
$0.70
$0.60
$0.50
$0.40
$0.30
$0.20
$0.10
$0.00
Cost / Sq Ft
$0.68
$0.75
$0.87
FY17
FY18
FY19
Electric
Natural Gas
Water
Wastewater
Cost / Sq Ft

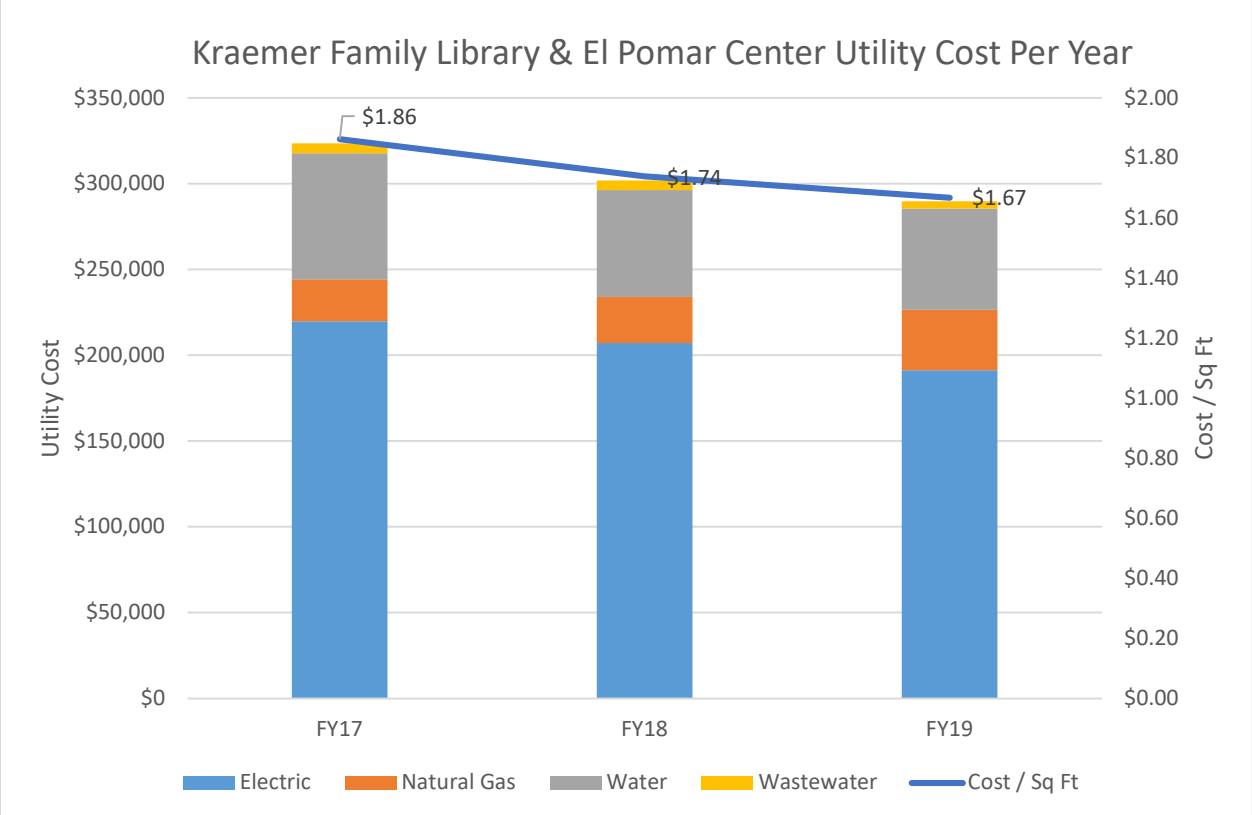

Dwire Hall Utility Cost Per Year
$100,000
$90,000
$80,000
$70,000
$60,000
$50,000
$40,000
$30,000
$20,000
$10,000
$0
Utility Cost
$1.60
$1.40
$1.20
$1.00
$0.80
$0.60
$0.40
$0.20
$0.00
Cost / Sq Ft
$1.26
$1.29
$1.43
FY17
FY18
FY19
Electric
Natural Gas
Water
Wastewater
Cost / Sq Ft

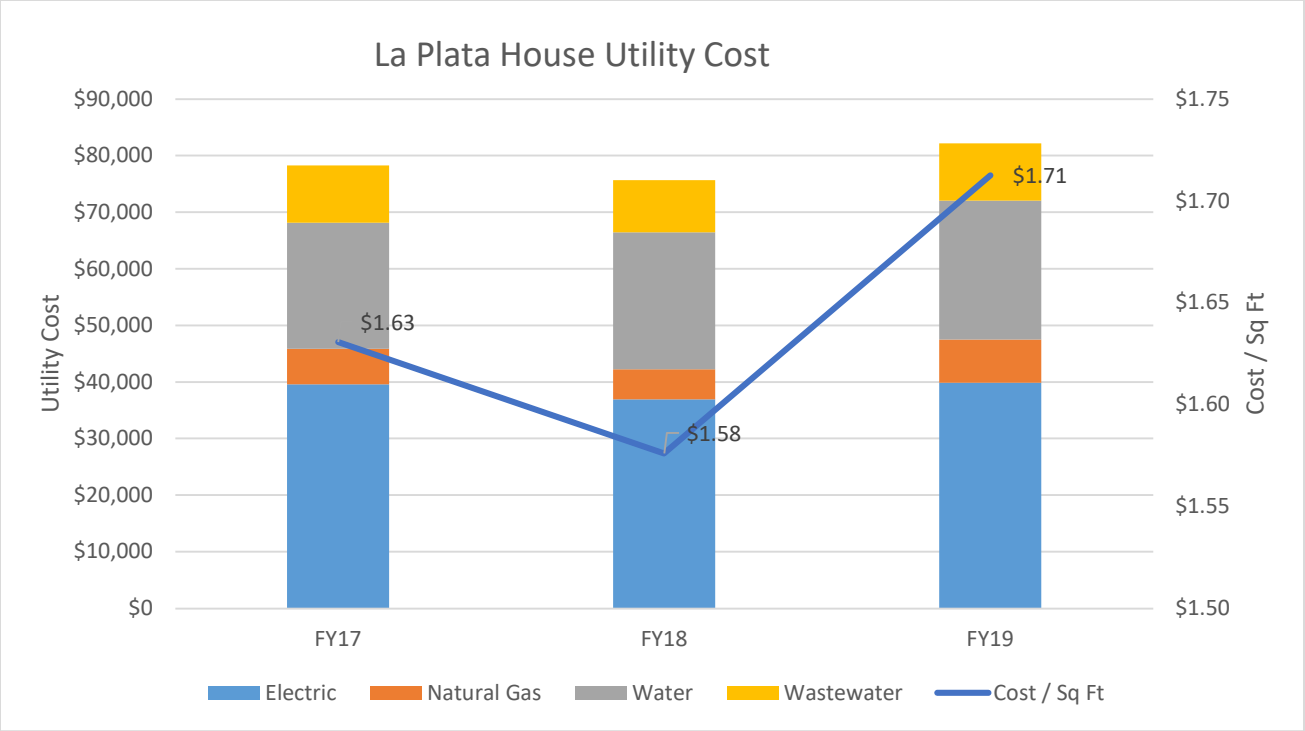

Eldora House Utility Cost Per Year
$25,000
$20,000
$15,000
$10,000
$5,000
$0
Utility Cost
$0.60
$0.50
$0.40
$0.30
$0.20
$0.10
$0.00
Cost/ Sq Ft
$0.31
$0.56
$0.40
FY17
FY18
FY19
Natural Gas
Water
Wastewater
Cost / Sq Ft

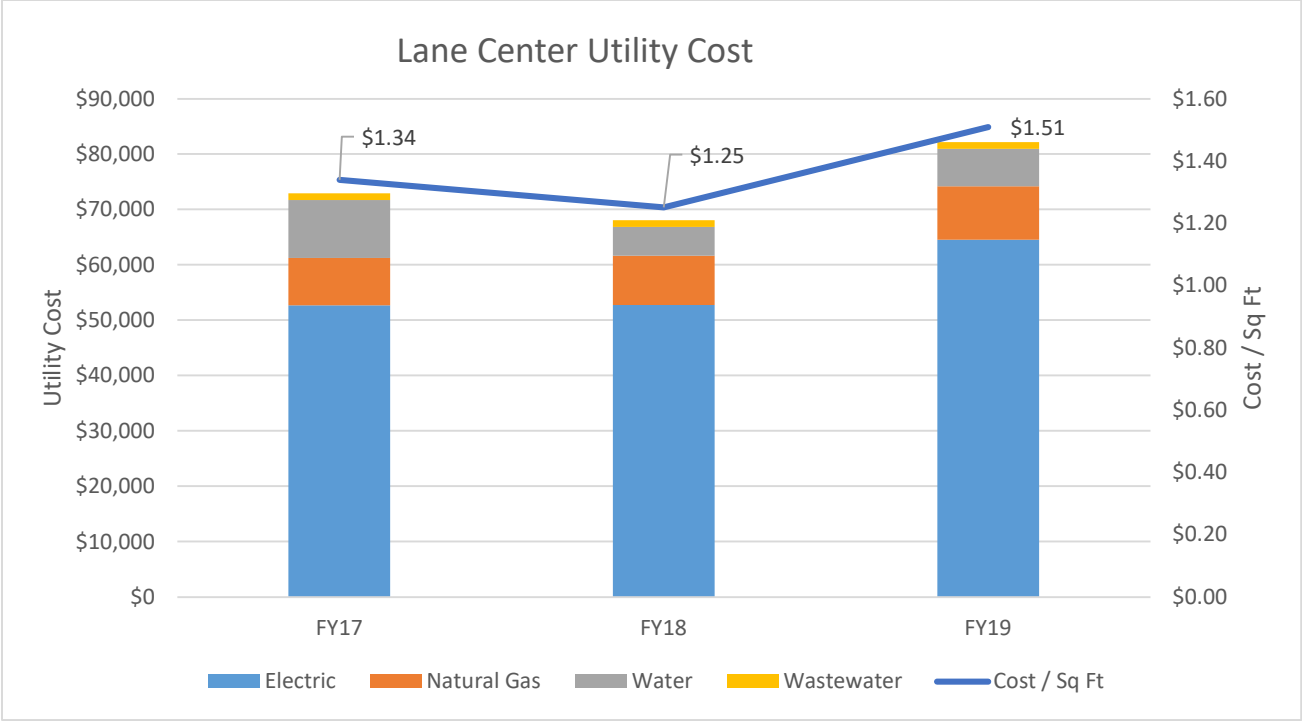

Engineering and Applied Science Utility Cost Per Year
$200,000
$180,000
$160,000
$140,000
$120,000
$100,000
$80,000
$60,000
$40,000
$20,000
$0
Utility Cost
$3.00
$2.50
$2.00
$1.50
$1.00
$0.50
$0.00
Cost / Sq Ft
$2.39
$2.49
$1.66
FY17
FY18
FY19
Electric
Natural Gas
Water
Wastewater
Cost / Sq Ft

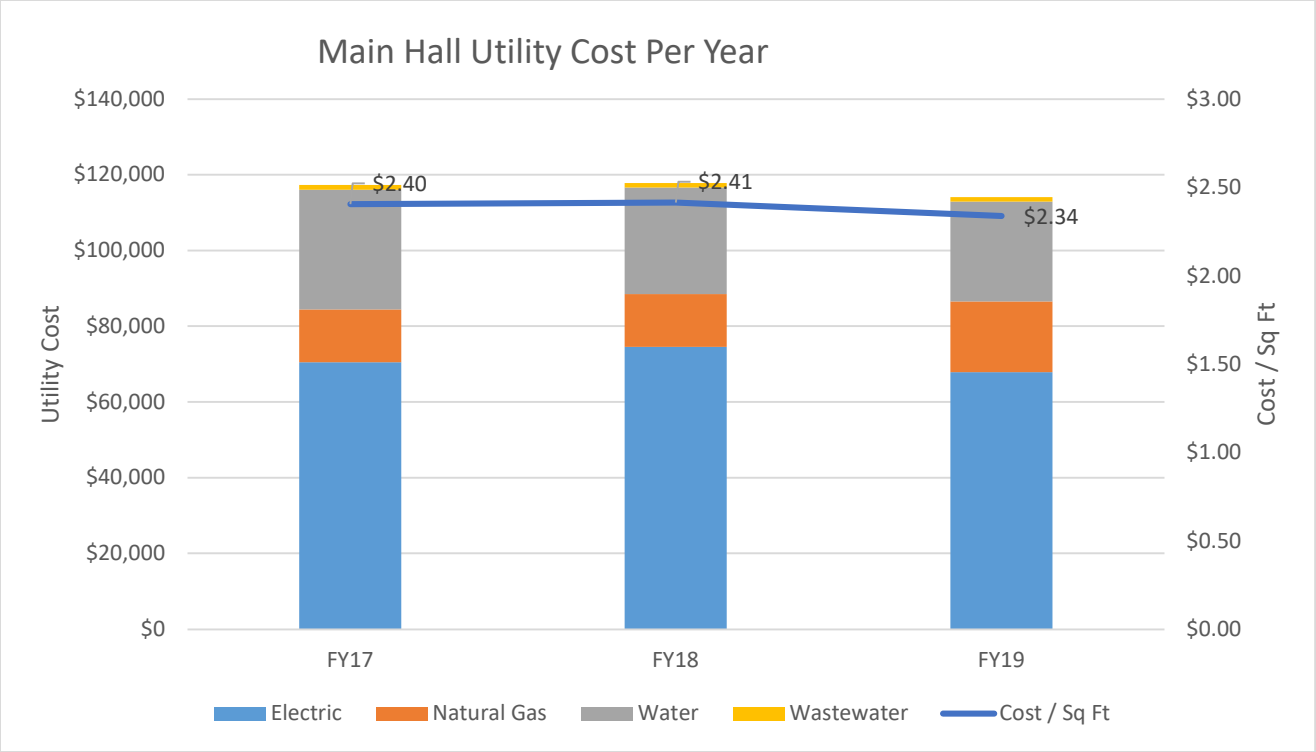

Gallogly Events Center Utility Cost Per Year
$30,000
$25,000
$20,000
$15,000
$10,000
$5,000
$0
Utility Cost
$1.20
$1.00
$0.80
$0.60
$0.40
$0.20
$0.00
Cost / Sq Ft
$1.10
$0.47
$0.37
Decreasing cost due to the installation of the 40 kW system. This building is very close to net zero
FY17
FY18
FY19
Electric
Natural Gas
Water
Wastewater
Cost / Sq Ft

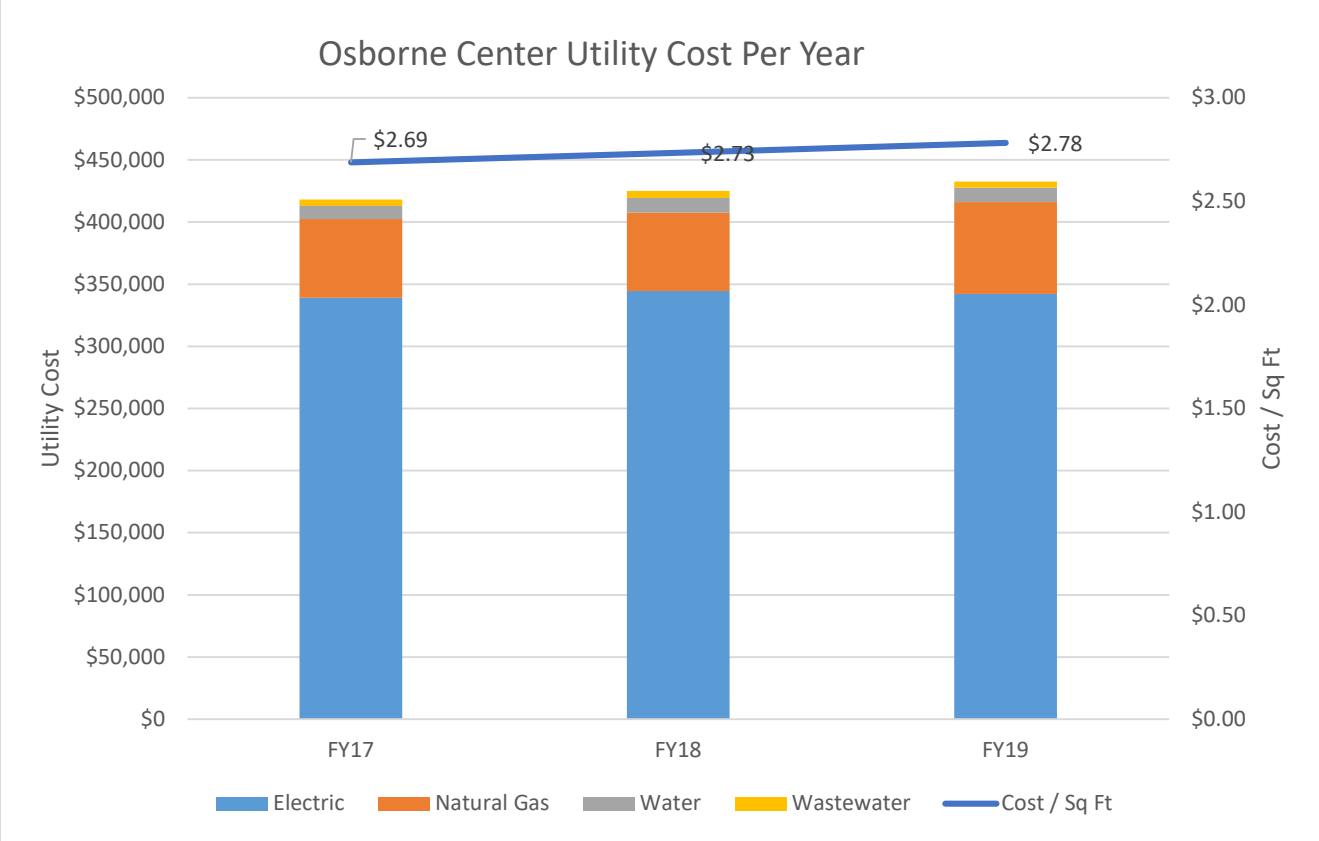

Gateway Hall Utility Cost Per Year
$60,000
$50,000
$40,000
$30,000
$20,000
$10,000
$0
Utility Cost
$3.50
$3.00
$2.50
$2.00
$1.50
$1.00
$0.50
$0.00
Cost / Sq Ft
$3.06
$3.24
$3.02
FY17
FY18
FY19
Electric
Natural Gas
Water
Wastewater
Cost / Sq Ft

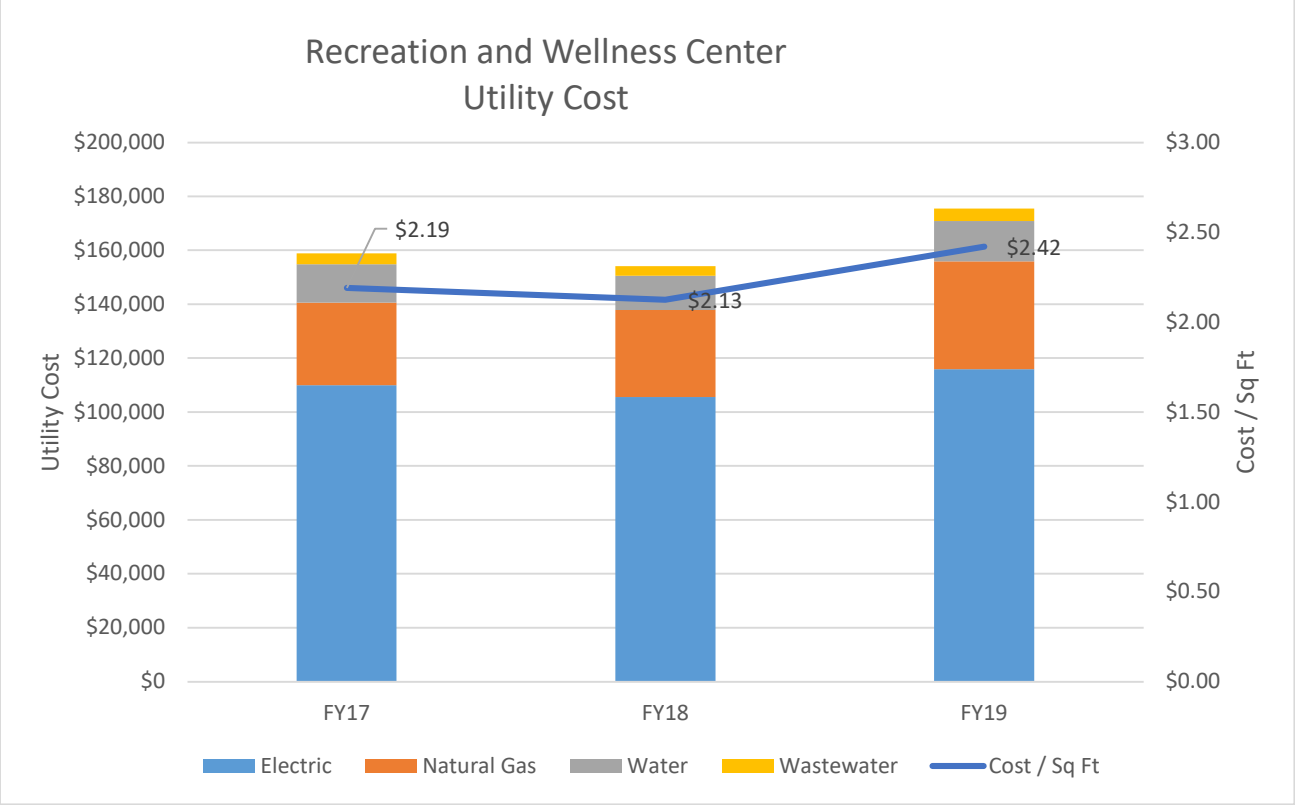

Kraemer Family Library & El Pomar Center Utility Cost Per Year
$350,000
$300,000
$250,000
$200,000
$150,000
$100,000
$50,000
$0
Utility Cost
$2.00
$1.80
$1.60
$1.40
$1.20
$1.00
$0.80
$0.60
$0.40
$0.20
$0.00
Cost / Sq Ft
$1.86
$1.74
$1.67
FY17
FY18
FY19
Electric
Natural Gas
Water
Wastewater
Cost / Sq Ft

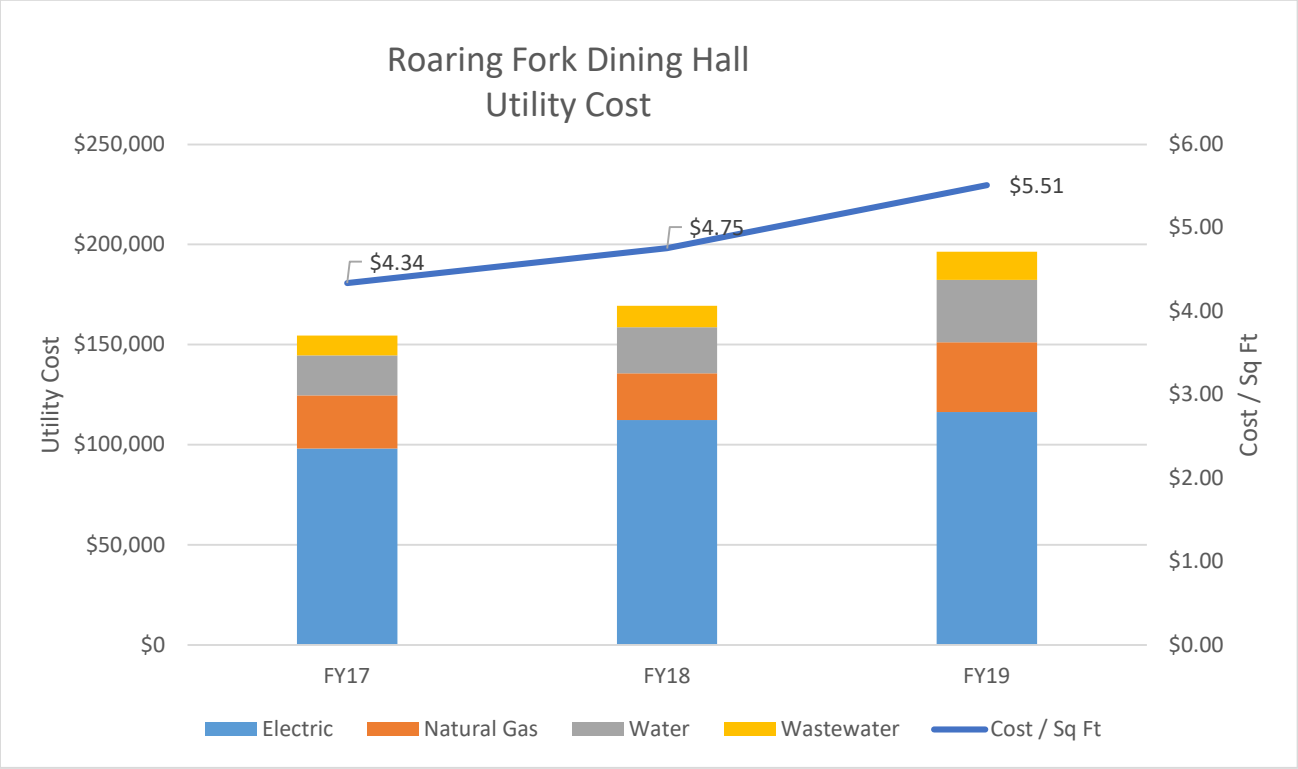

La Plata House Utility Cost
$90,000
$80,000
$70,000
$60,000
$50,000
$40,000
$30,000
$20,000
$10,000
$0
Utility Cost
$1.75
$1.70
$1.65
$1.60
$1.55
$1.50
Cost / Sq Ft
$1.63
$1.58
$1.71
FY17
FY18
FY19
Electric
Natural Gas
Water
Wastewater
Cost / Sq Ft

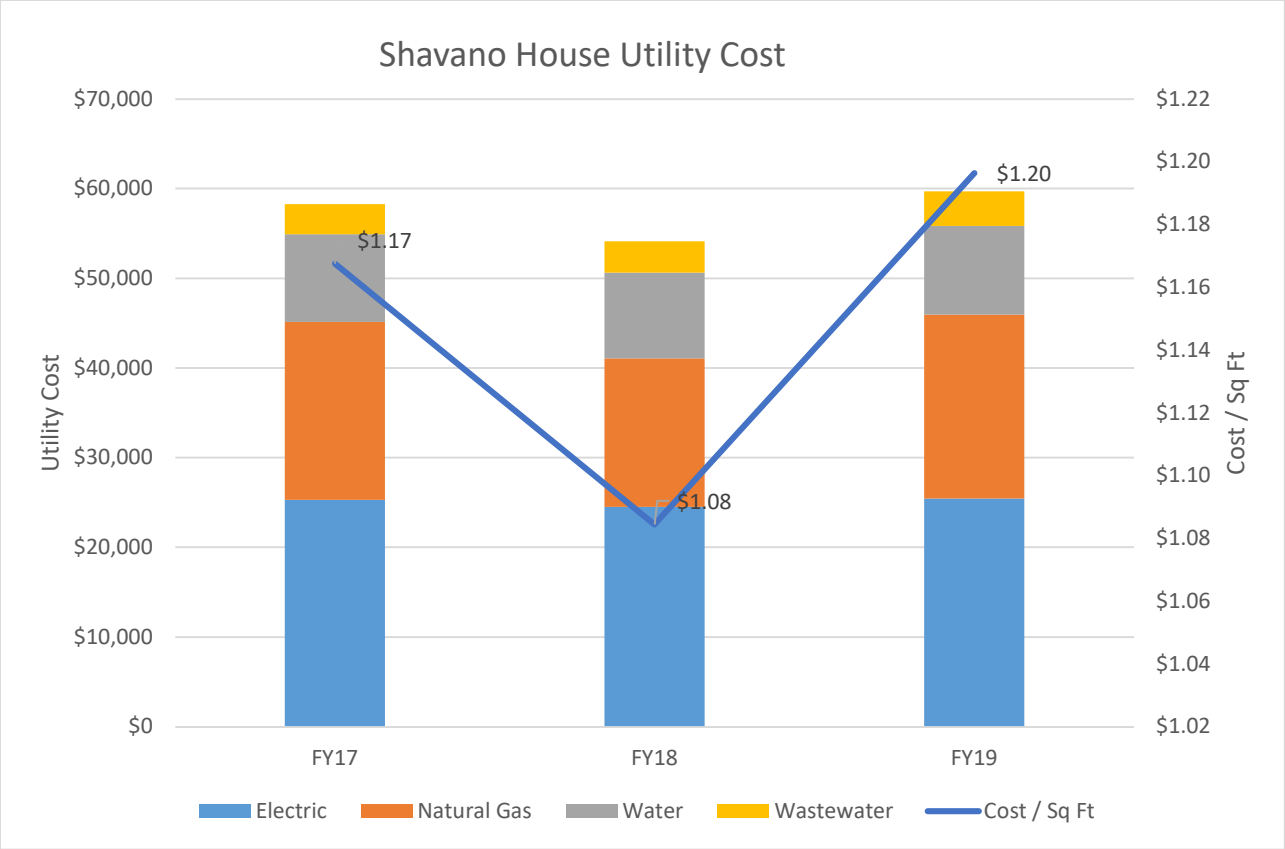

Lane Center Utility Cost
$90,000
$80,000
$70,000
$60,000
$50,000
$40,000
$30,000
$20,000
$10,000
$0
Utility Cost
$1.60
$1.40
$1.20
$1.00
$0.80
$0.60
$0.40
$0.20
$0.00
Cost / Sq Ft
$1.34
$1.25
$1.51
FY17
FY18
FY19
Electric
Natural Gas
Water
Wastewater
Cost / Sq Ft

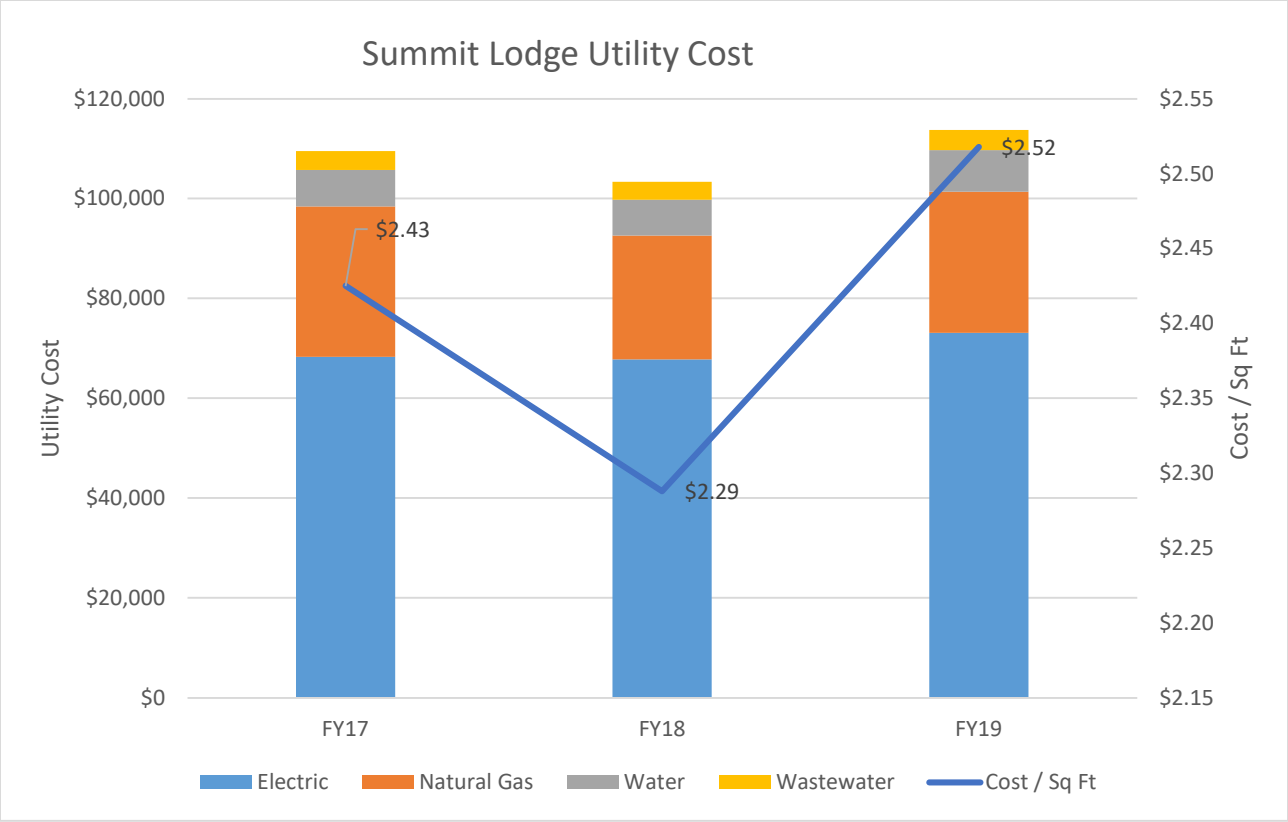

Main Hall Utility Cost Per Year
$140,000
$120,000
$100,000
$80,000
$60,000
$40,000
$20,000
$0
Utility Cost
$3.00
$2.50
$2.00
$1.50
$1.00
$0.50
$0.00
Cost / Sq Ft
$2.40
$2.41
$2.34
FY17
FY18
FY19
Electric
Natural Gas
Water
Wastewater
Cost / Sq Ft

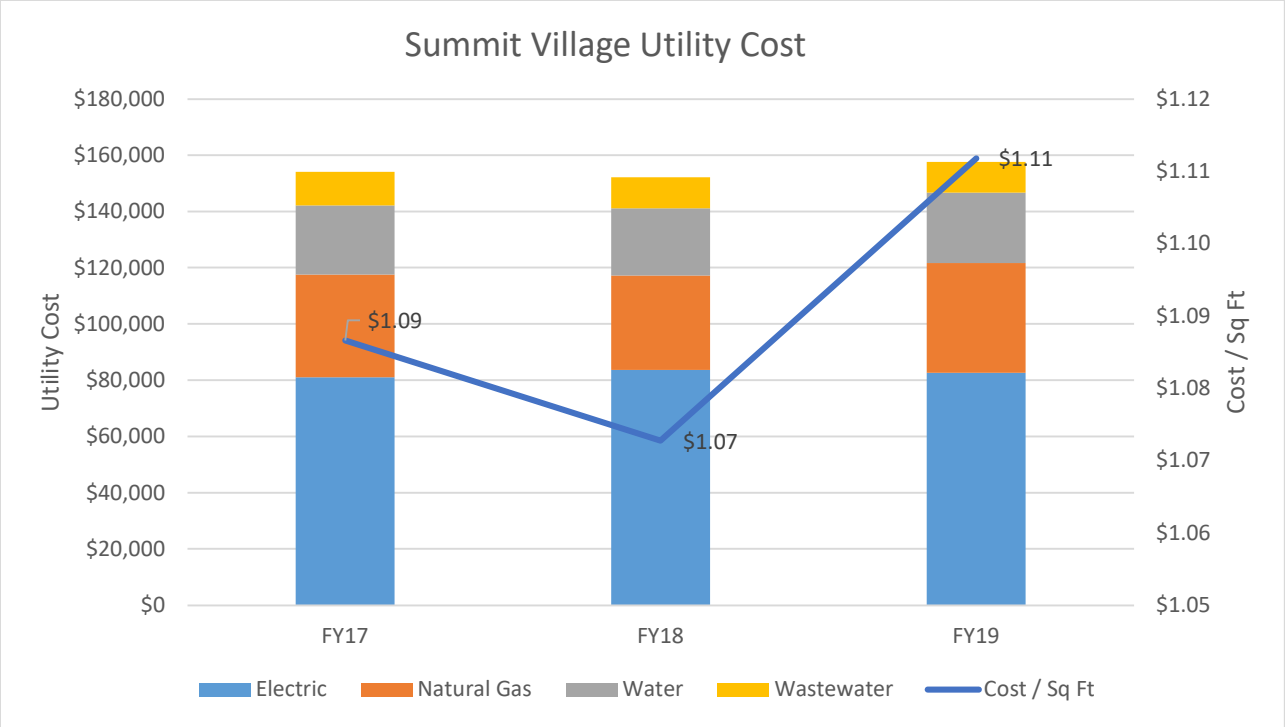

Osborne Center Utility Cost Per Year
$500,000
$450,000
$400,000
$350,000
$300,000
$250,000
$200,000
$150,000
$100,000
$50,000
$0
Utility Cost
$3.00
$2.50
$2.00
$1.50
$1.00
$0.50
$0.00
Cost / Sq Ft
$2.69
$2.73
$2.78
FY17
FY18
FY19
Electric
Natural Gas
Water
Wastewater
Cost / Sq Ft

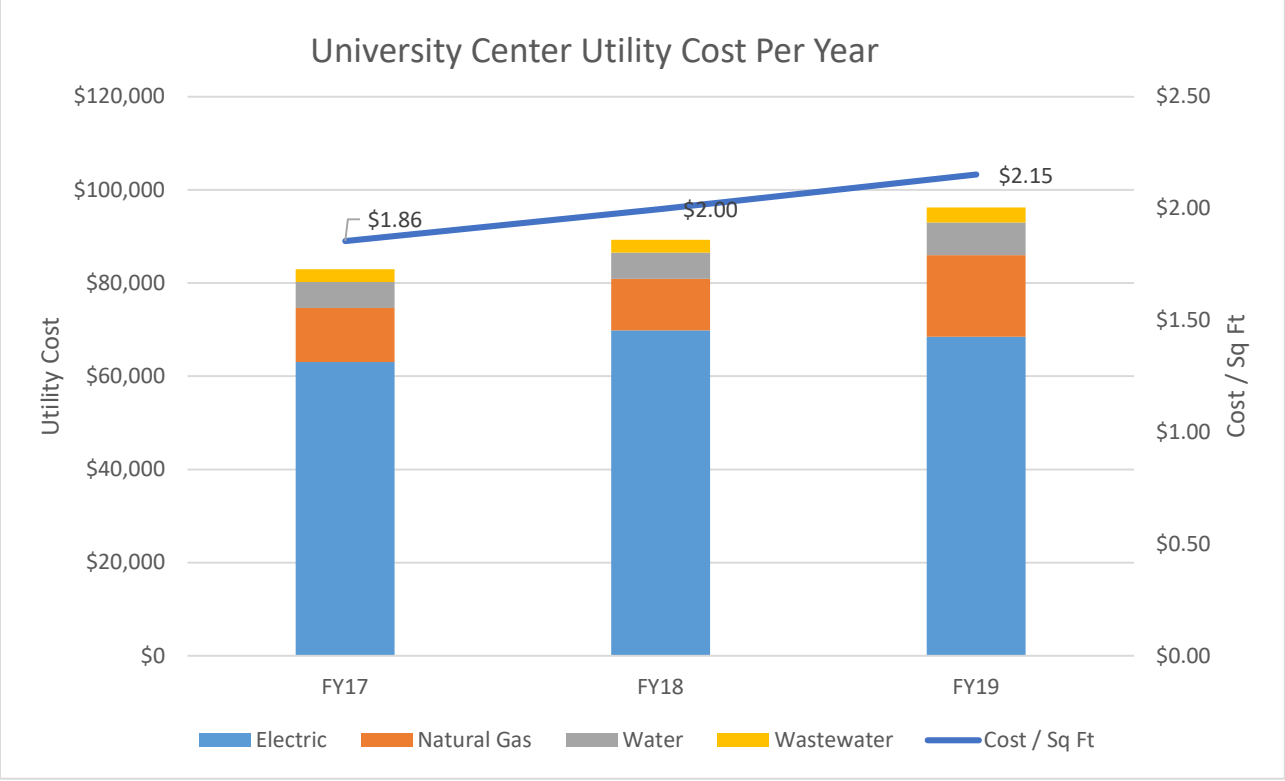

Recreation and Wellness Center
Utility Cost
$200,000
$180,000
$160,000
$140,000
$120,000
$100,000
$80,000
$60,000
$40,000
$20,000
$0
Utility Cost
$3.00
$2.50
$2.00
$1.50
$1.00
$0.50
$0.00
Cost / Sq Ft
$2.19
$2.13
$2.42
FY17
FY18
FY19
Electric
Natural Gas
Water
Wastewater
Cost / Sq Ft

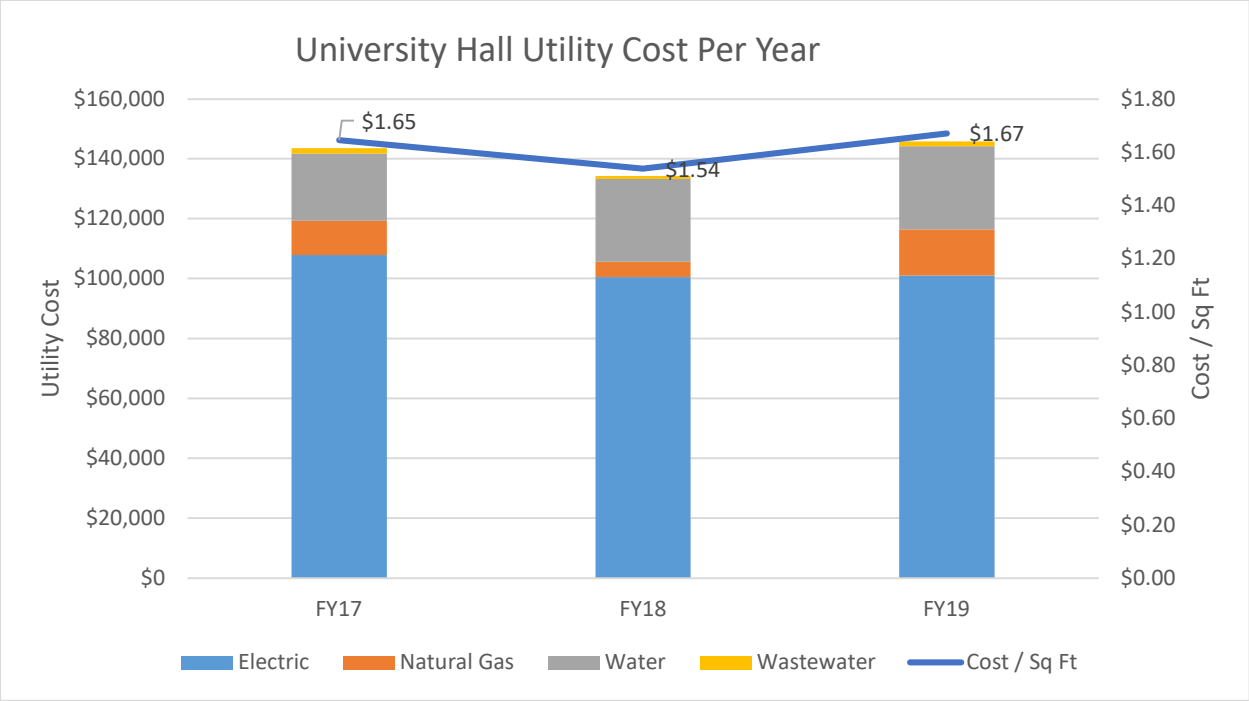

Roaring Fork Dining Hall
Utility Cost
$250,000
$200,000
$150,000
$100,000
$50,000
$0
Utility Cost
$6.00
$5.00
$4.00
$3.00
$2.00
$1.00
$0.00
Cost / Sq Ft
$4.34
$4.75
$5.51
FY17
FY18
FY19
Electric
Natural Gas
Water
Wastewater
Cost / Sq Ft


Shavano House Utility Cost
$70,000
$60,000
$50,000
$40,000
$30,000
$20,000
$10,000
$0
Utility Cost
$1.22
$1.20
$1.18
$1.16
$1.14
$1.12
$1.10
$1.08
$1.06
$1.04
$1.02
Cost / Sq Ft
$1.17
$1.08
$1.20
FY17
FY18
FY19
Electric
Natural Gas
Water
Wastewater
Cost / Sq Ft


Summit Lodge Utility Cost
$120,000
$100,000
$80,000
$60,000
$40,000
$20,000
$0
Utility Cost
$2.55
$2.50
$2.45
$2.40
$2.35
$2.30
$2.25
$2.20
$2.15
Cost / Sq Ft
$2.43
$2.29
$2.52
FY17
FY18
FY19
Electric
Natural Gas
Water
Wastewater
Cost / Sq Ft


Summit Village Utility Cost
$180,000
$160,000
$140,000
$120,000
$100,000
$80,000
$60,000
$40,000
$20,000
$0
Utility Cost
$1.12
$1.11
$1.10
$1.09
$1.08
$1.07
$1.06
$1.05
Cost / Sq Ft
$1.09
$1.07
$1.11
FY17
FY18
FY19
Electric
Natural Gas
Water
Wastewater
Cost / Sq Ft


University Center Utility Cost Per Year
$120,000
$100,000
$80,000
$60,000
$40,000
$20,000
$0
Utility Cost
$2.50
$2.00
$1.50
$1.00
$0.50
$0.00
Cost / Sq Ft
$1.86
$2.00
$2.15
FY17
FY18
FY19
Electric
Natural Gas
Water
Wastewater
Cost / Sq Ft


University Hall Utility Cost Per Year
$160,000
$140,000
$120,000
$100,000
$80,000
$60,000
$40,000
$20,000
$0
Utility Cost
$1.80
$1.60
$1.40
$1.20
$1.00
$0.80
$0.60
$0.40
$0.20
$0.00
Cost / Sq Ft
$1.65
$1.54
$1.67
FY17
FY18
FY19
Electric
Natural Gas
Water
Wastewater
Cost / Sq Ft