



Fiscal Year 2023 – 2024

Campus Annual Energy Use Report

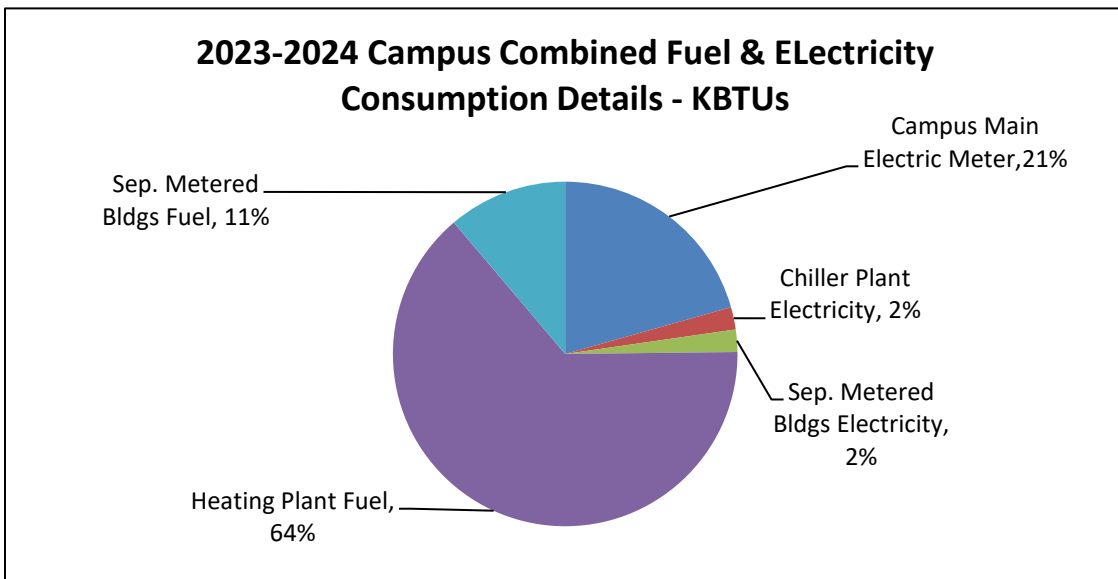
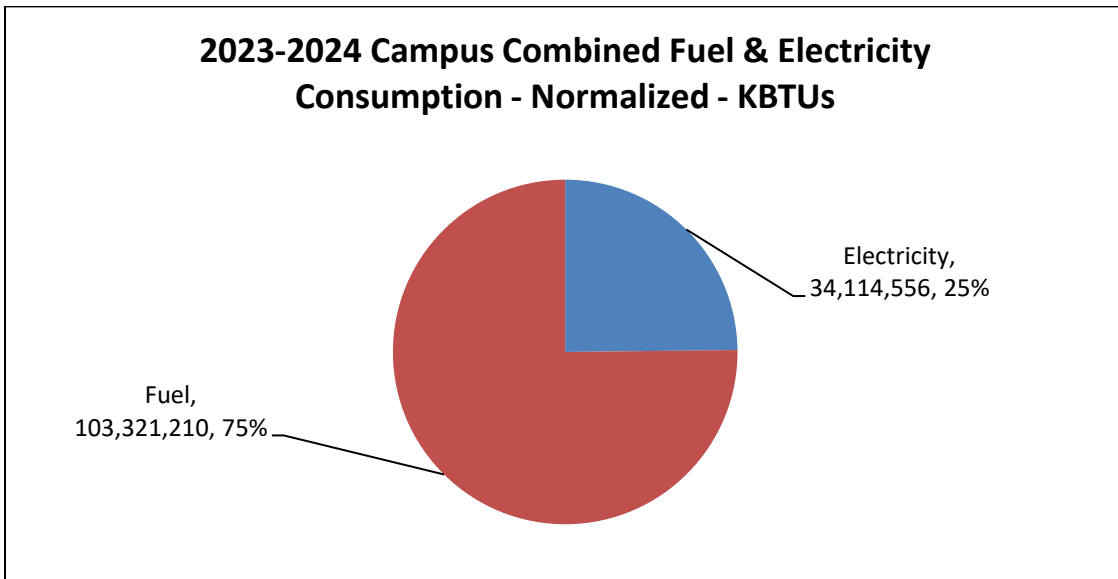
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## Fuel, Electricity, & Water Consumption

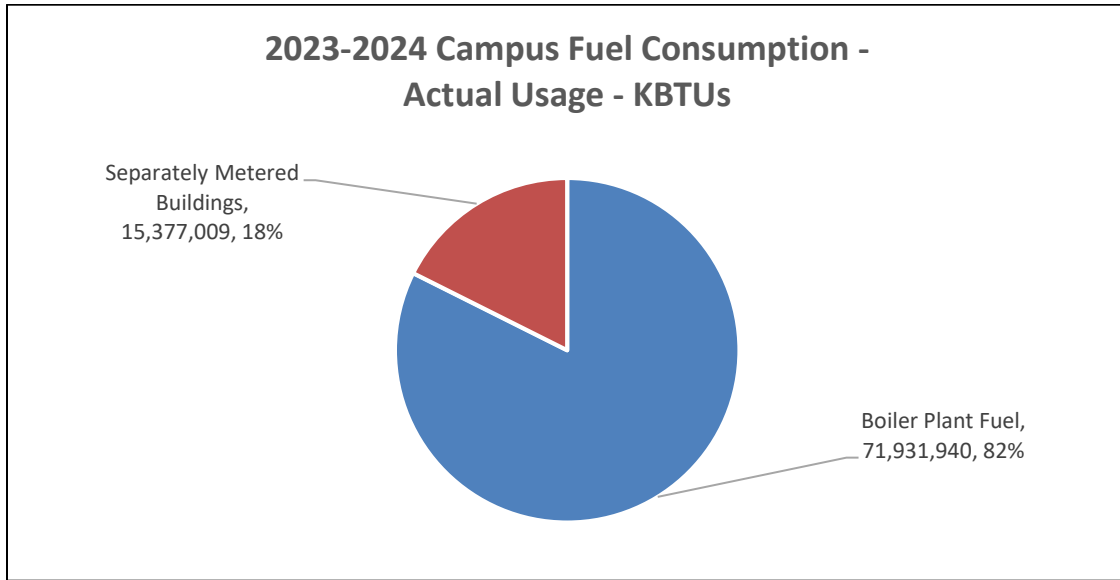
### FY 2023-2024 Total Site Energy Consumption

In fiscal year 2022-23, Macalester College consumed 137,435,766 kBtus of energy on its campus. 75% of the energy was comprised of fuel (natural gas & #2 fuel oil) and the balance of the consumption was electricity usage. The largest single consumer of energy on campus was the heating plant – its fuel consumption accounted for 64% of the campus' total energy usage.

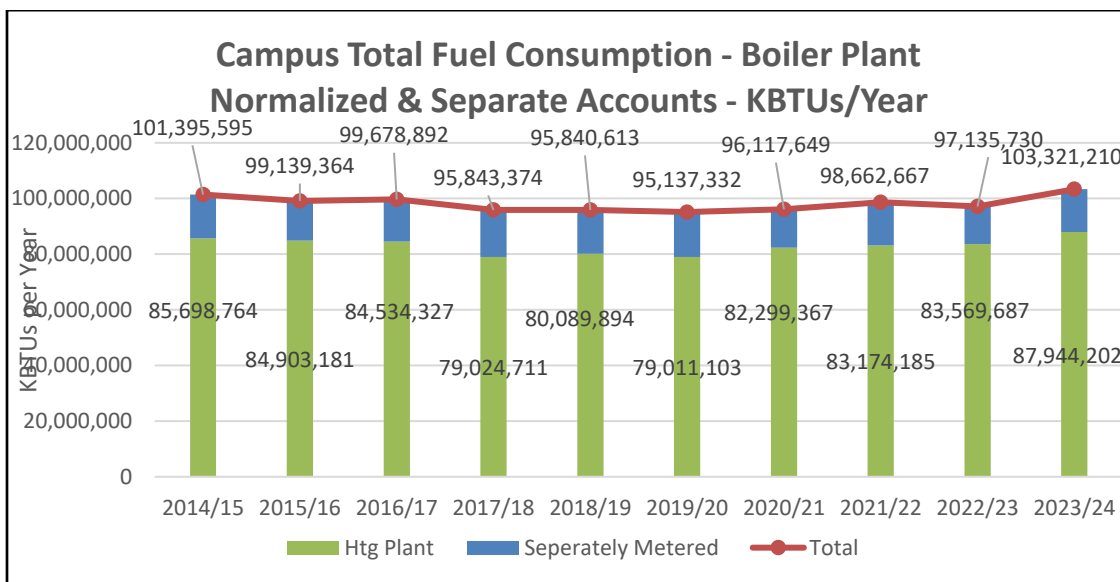


### Fuel Energy Consumption

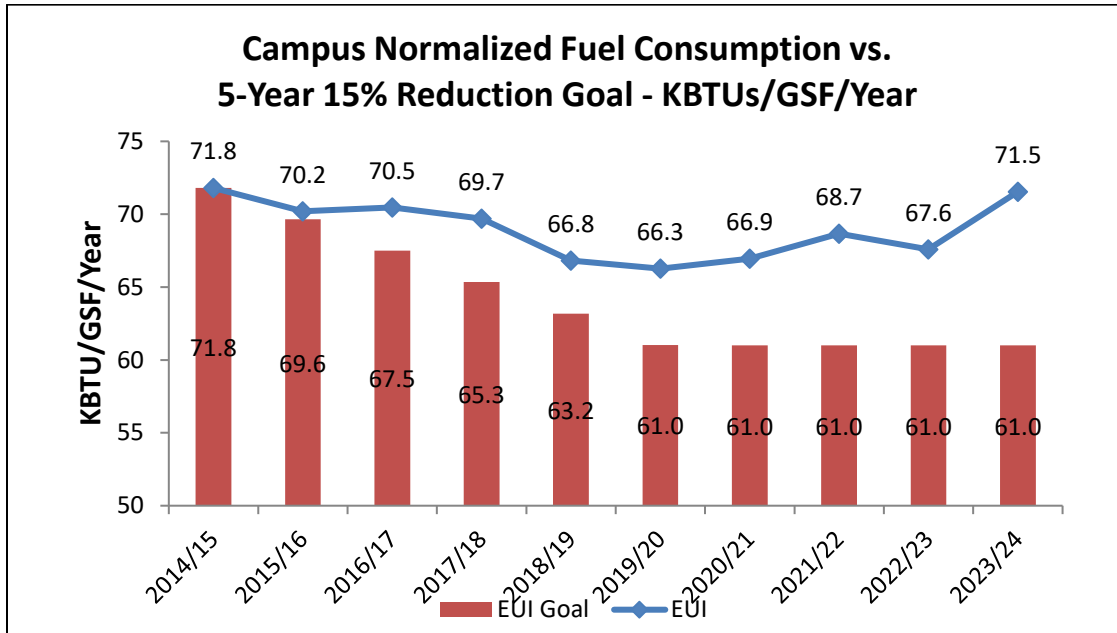
Macalester consumed 87,308,949 kBTUs of fuel during FY 2023-24. 82% of the fuel energy was consumed by the central heating plant and the balance was used in other buildings and houses on campus for space heating, domestic water heating, and cooking. The Art building’s kilns and forges also consume a significant amount of natural gas.



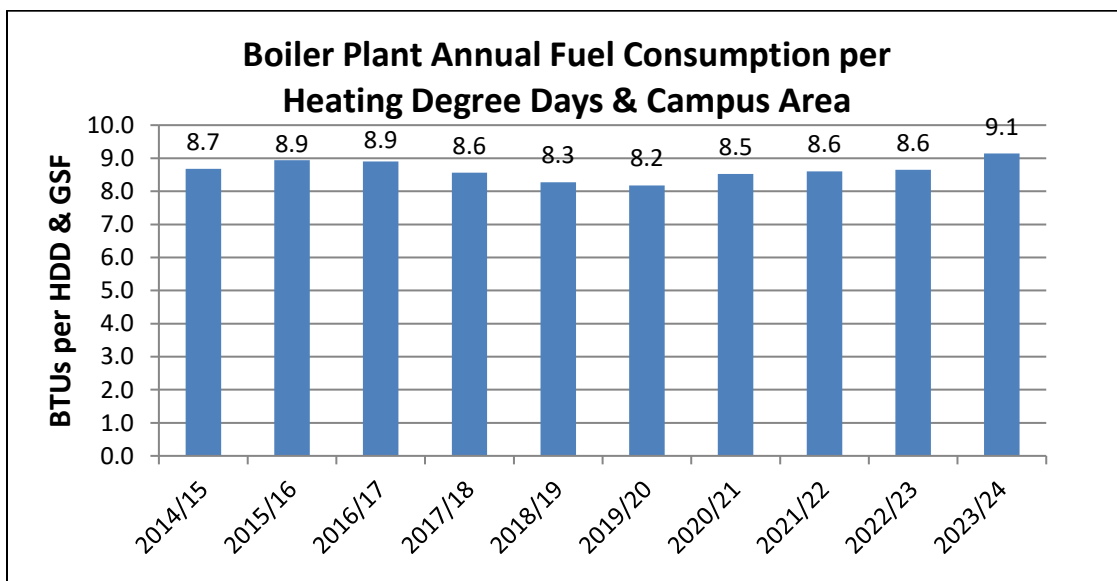
After weather normalization, the total fuel consumption for the campus was 103,321,210 kBTUs, which was a significant increase over the average consumption. The largest increase was due to the Art kilns which used 892,285 more kBTUs vs FY 2022-23 as well as a few of the language houses. Natural gas usage for domestic hot water and kitchen use does not vary with the weather which can skew the numbers. Another factor that affects this is the efficiency of our campus boilers. If the boilers have less of a load on them, the efficiency of burning fuel can drop as much as 8%.



On an EUI basis, the College’s fuel consumption rate of 71 kBTU/GSF/Year FY 2023-24 was a sharp increase from the previous year and we are not in range of the 5-year reduction goal of 61 kBTU/GSF/Year that was to be met in FY 2019-20. Again, this shows our high usage of fuel and begins to point towards the need to move towards systems such as geothermal heating and cooling.

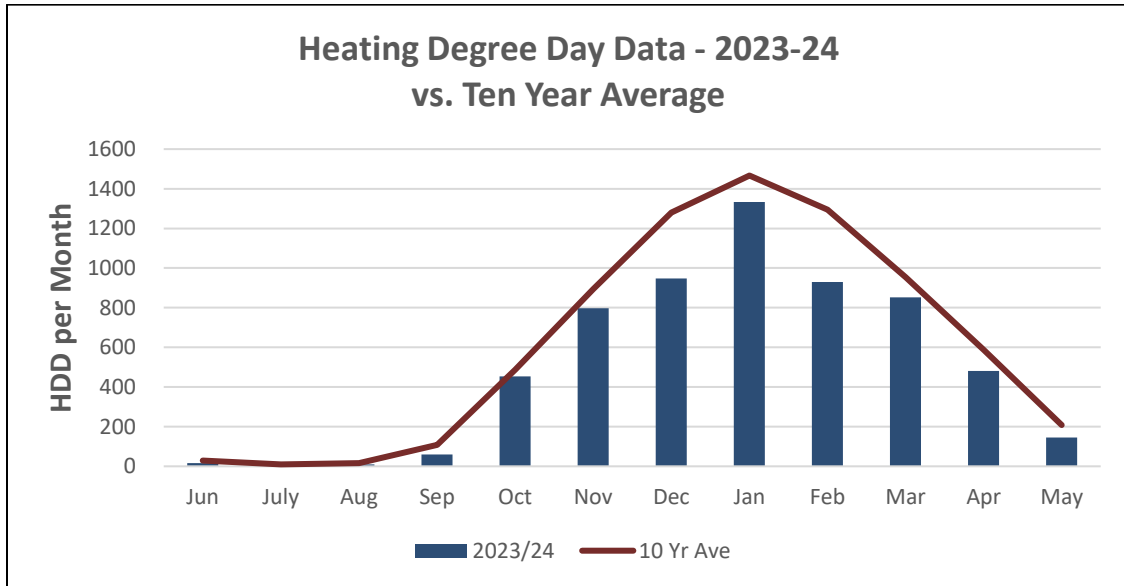


After normalizing for both weather and changes in the square footage of campus area that it serves, the rate at which the heating plant used fuel in FY 2023-24 was higher than the rate at which used fuel over the last nine years.



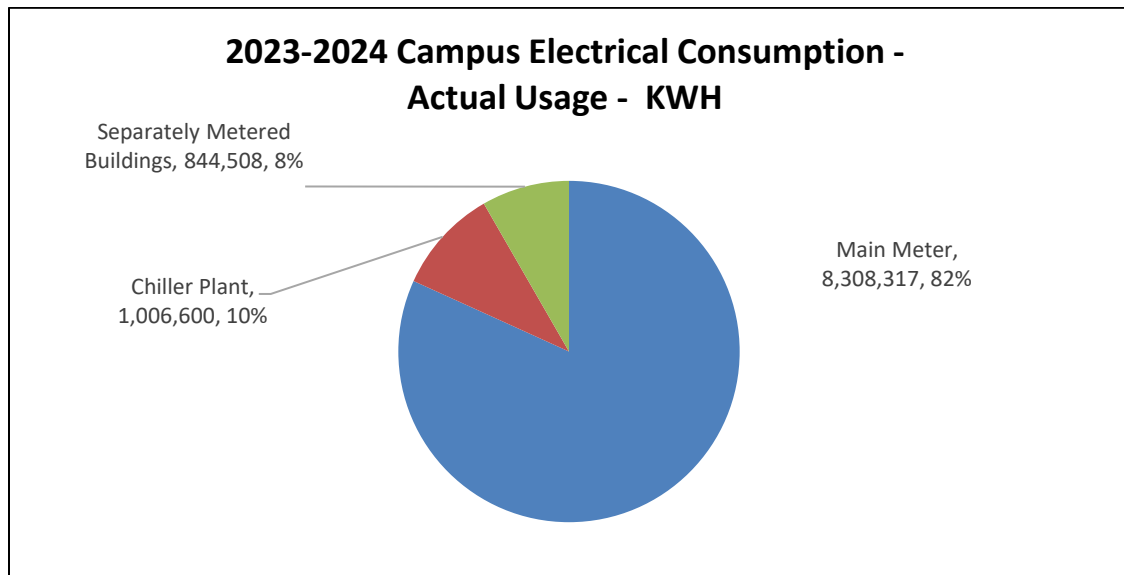
Macalester College 2023-2024 Energy Report

The actual amount of fuel consumed in any given year can be adjusted via weather normalization calculations to provide an “apples to apples” comparison with the fuel consumption in any selected base year. The winter of FY 2023-24 was considerably milder than average, with a total of 6,033 heating degree days (HDD) vs. the average of 7,334 HDD for the previous ten years. The weather in January was severe enough, however, to cause Xcel Energy to curtail the use of natural gas in the heating plant and switch to burning #2 fuel oil for part of the month.

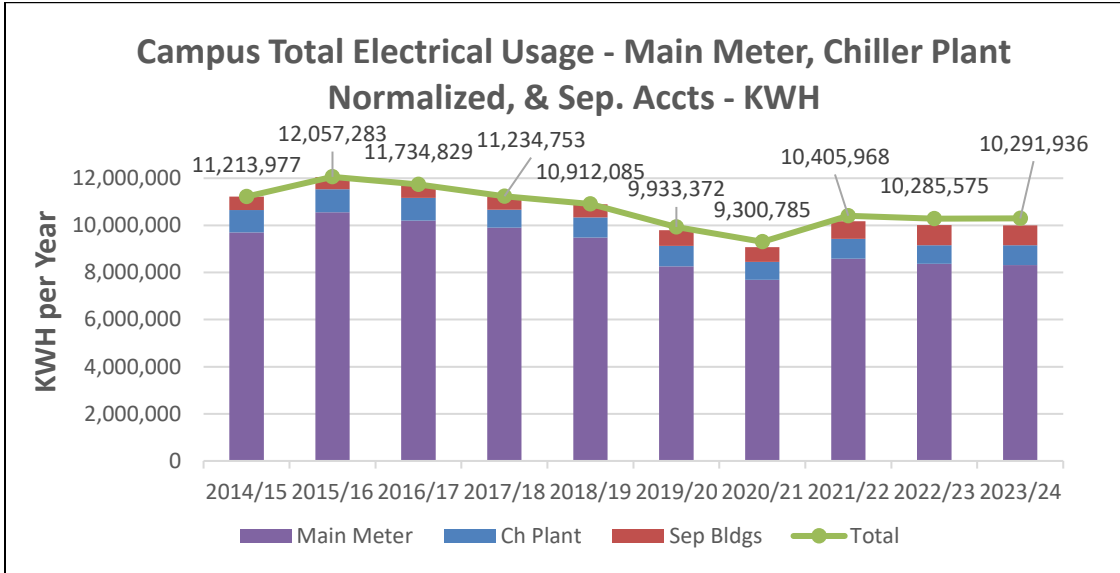


Electrical Energy Consumption

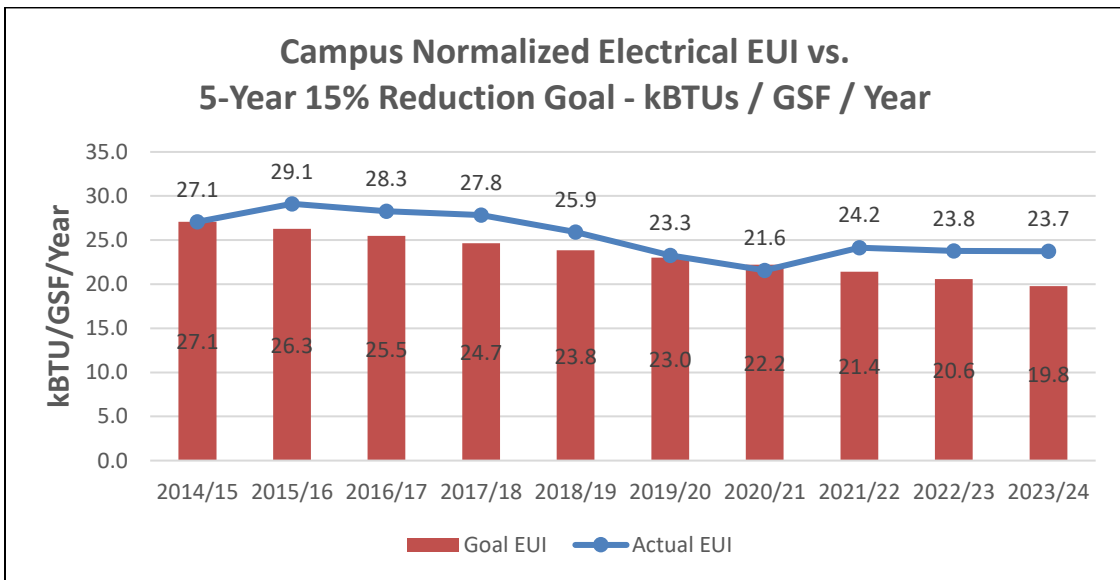
Macalester College’s total actual electrical consumption in FY 2023-24 was 10,159,425 kWh. 82% of the electricity was used for the electrical loads served by the campus main electric service, such as building lighting, HVAC equipment, and plug loads. The College’s chiller plant is served by a separate Xcel meter and used 10% of the campus’ total electric energy. The remaining 8% was used in the various buildings and houses on campus that also have individual electric services and meters.



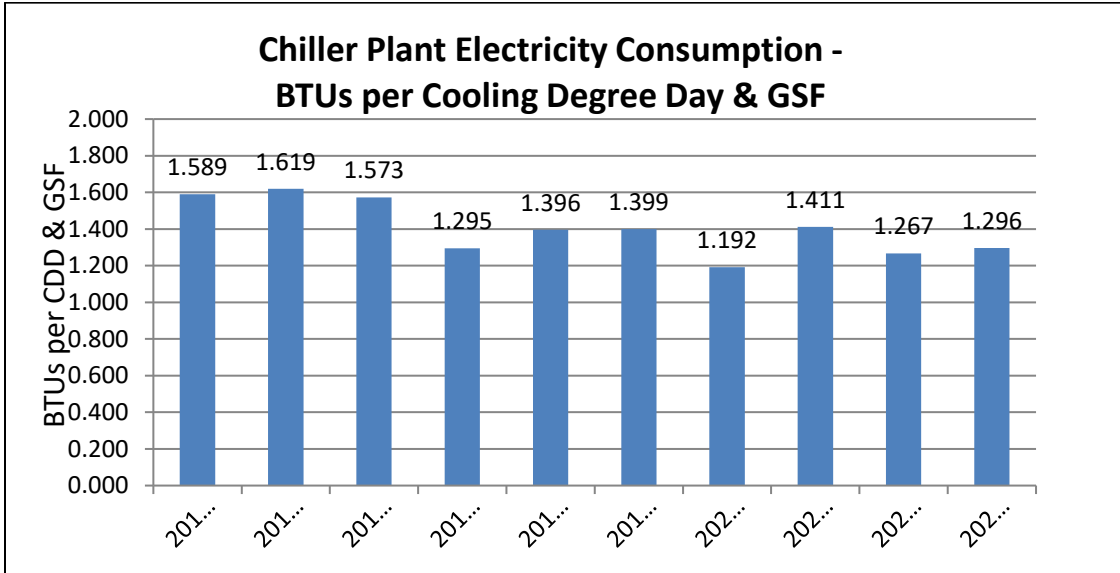
After weather-normalization of the chiller plant’s usage, the total electrical consumption for the campus was 10,291,936 kWh, which was 8% less than the weather-normalized amount of electricity consumed in the 2014-2015 baseline year and in line with FY 2022-23.



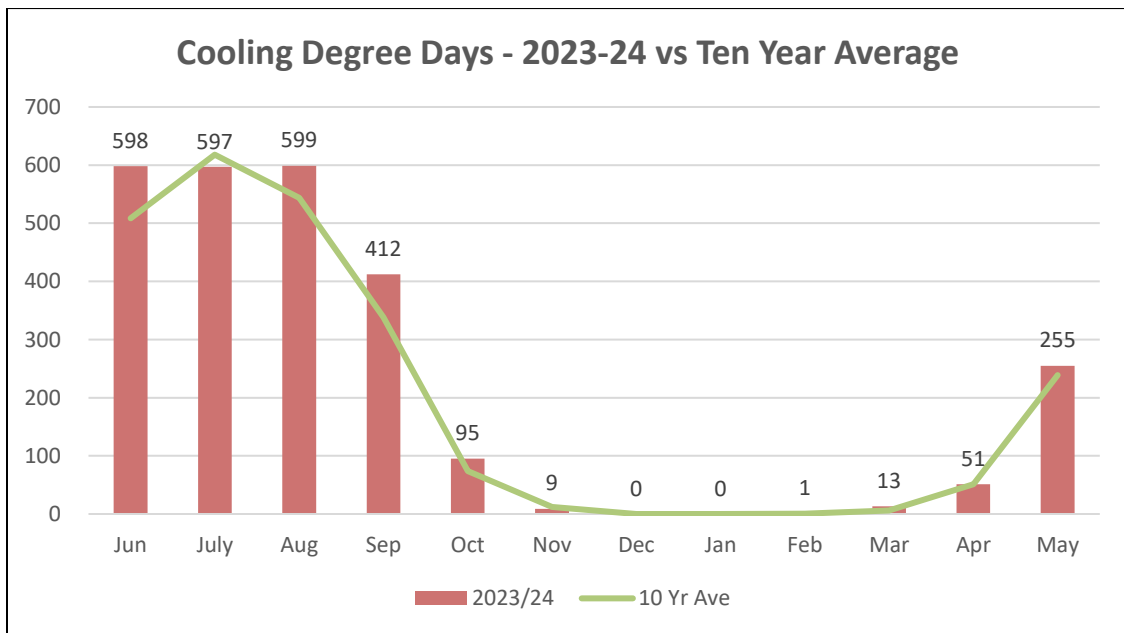
On an EUI basis, the 23.7 EUI rate at which the campus consumed for electricity in FY 2023-24 was slightly higher than the 5-year reduction goal of 23 kBTU/GSF/Year and on par with the last couple years.



Like the boiler plant’s fuel consumption, the amount of electricity used in Macalester College’s central cooling plant is affected by seasonal weather variations and is adjusted via weather normalization calculations to provide a standardized method of measuring year-to-year progress toward the College’s energy reduction goals. After normalizing for both weather and changes in the square footage of campus area that it serves the rate at which the chiller plant used electricity in FY 2023-24 increased slightly from 2022-23.



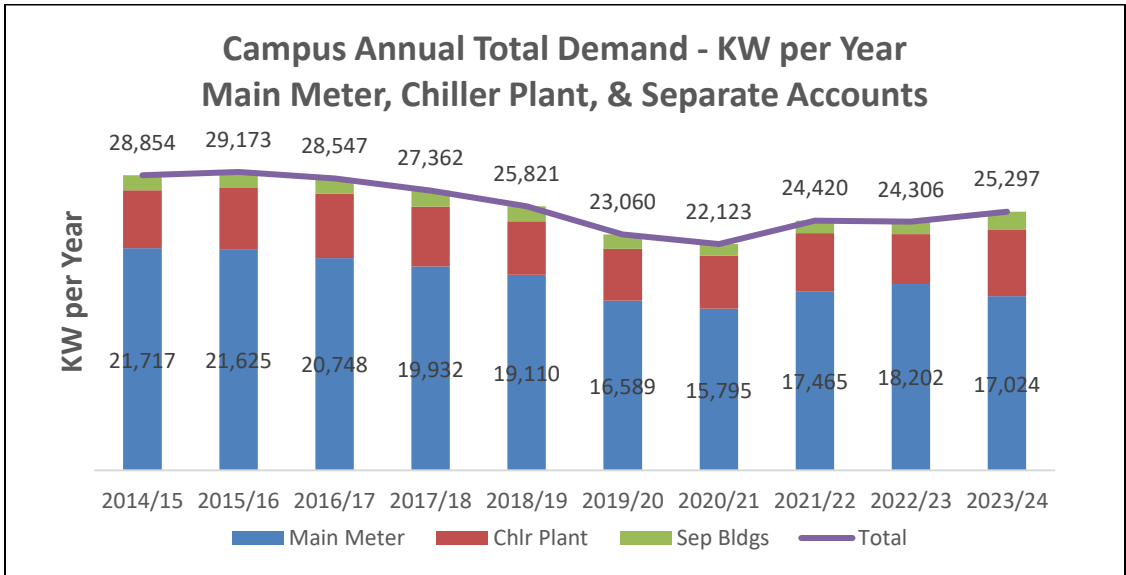
Fiscal year 2023-24’s cooling season was on the warmer side, with a total of 2,630 cooling degree days (CDD) vs the average of 2,391 CDD for the previous ten-year period.



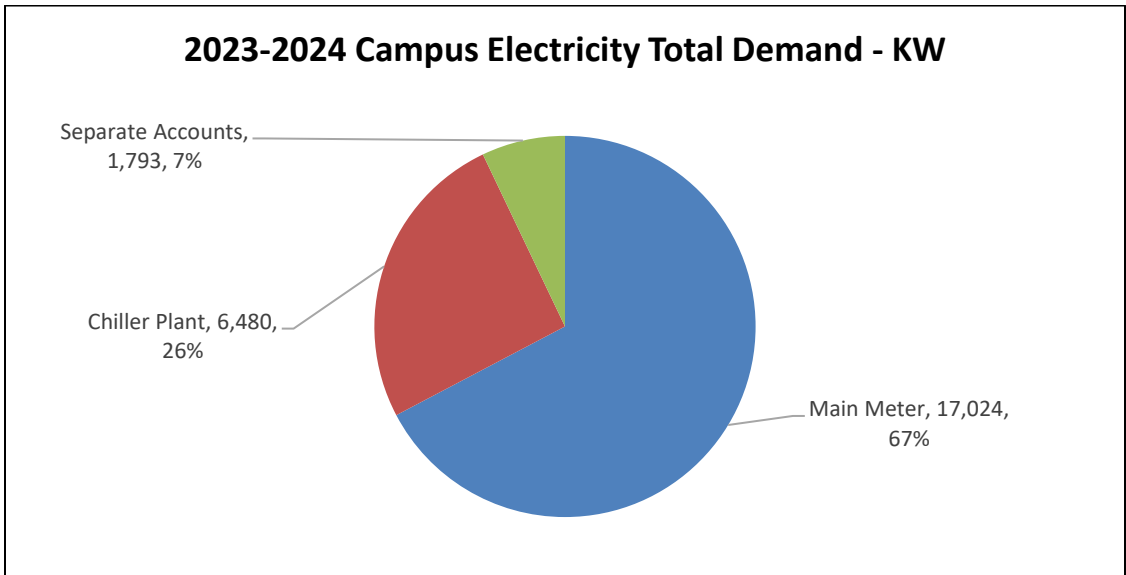


### Electrical Demand

In addition to the amount of electricity consumed on campus (measured in kilowatt-hours or kWh), the College is also charged for the rate at which it uses electricity (demand, which is measured in kilowatts or kW). Macalester used 25,297 kW in FY 2023-24, which was 12% less than the 28,854 kW used in the 2014-2015 base year but 4% more than FY 2022-23, most likely due to the increase in cooling degree days.

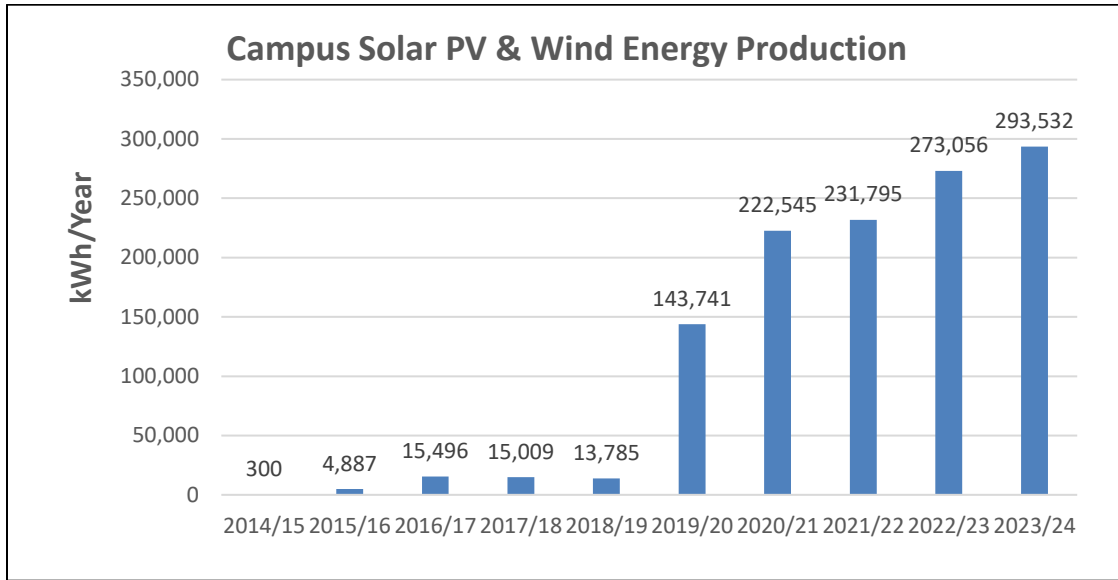


The chiller plant comprises the single largest component of the College’s demand. Although it is operated only from May through October and its electrical consumption is 10% of the campus total, the demand associated with the chiller plant accounts for 26% of the campus total.



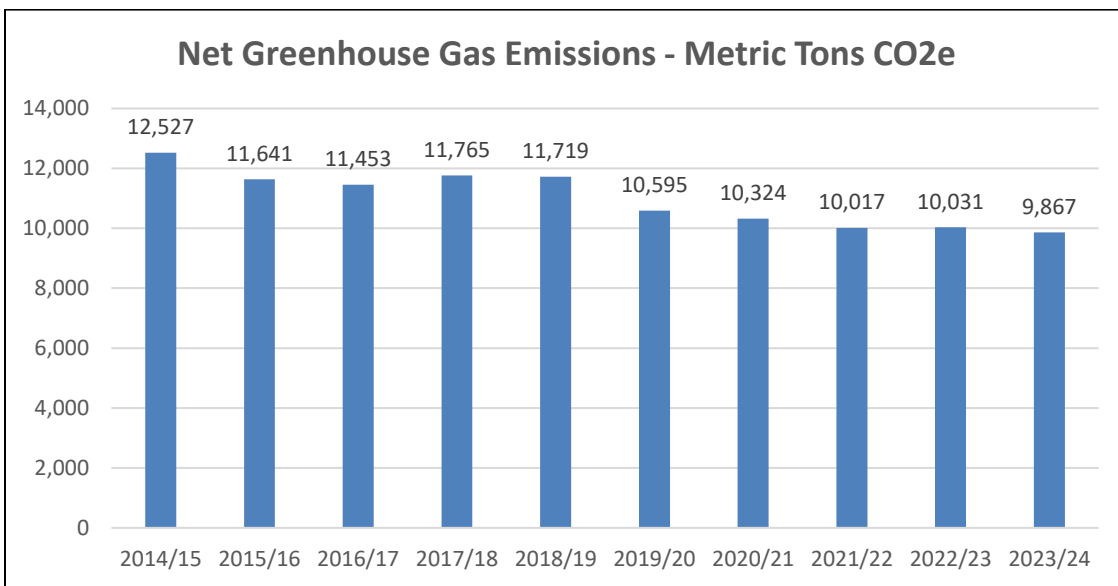
### Campus Solar & Wind Energy Production

In FY 2023-24 the total combined electrical output from the wind turbine installed next to the Olin-Rice Science Building, and the solar arrays installed on the roofs of the International Global Center (IGC), Theater building, Leonard Center, and the Ordway Field Station was 293,532 kWh, which was equivalent to 2.9% of the campus' total electrical consumption.



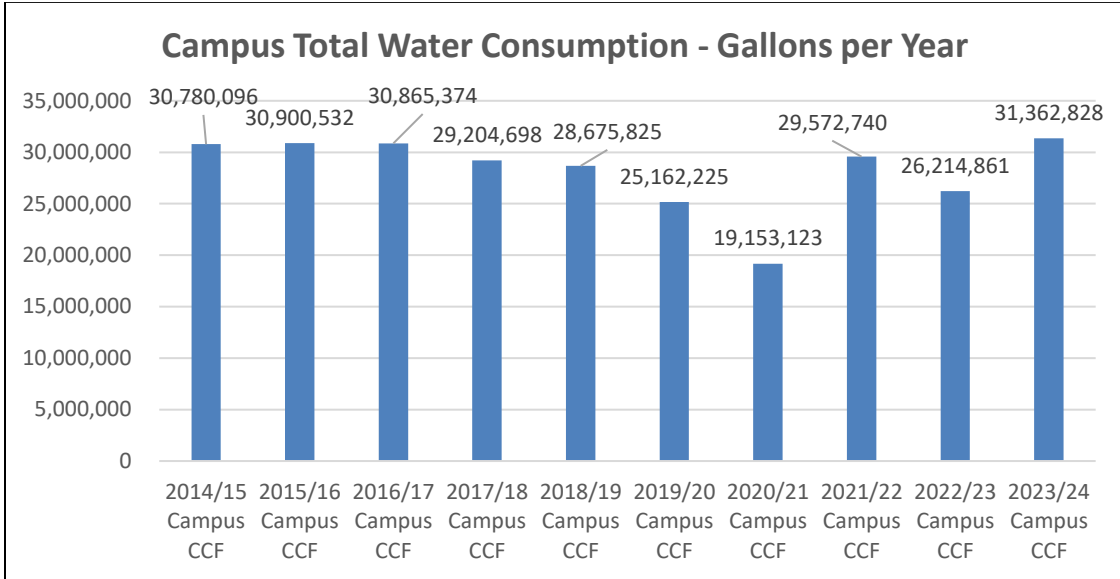
### Carbon Footprint / Greenhouse Gas Emissions

Macalester College records the data related to the amounts of electricity, natural gas, and fuel oil that are consumed in campus buildings in Energy Star Portfolio Manager (ESPM). The Portfolio Manager application uses Xcel Energy's emissions factors to calculate the College's greenhouse gas emissions and carbon footprint. For FY 2023-24, ESPM estimated that Macalester emitted 9,867 metric tons of CO<sub>2</sub>e, which was 21% less than the amount of CO<sub>2</sub>e emitted in FY 2014-15 and 2% less than FY 2022-23.

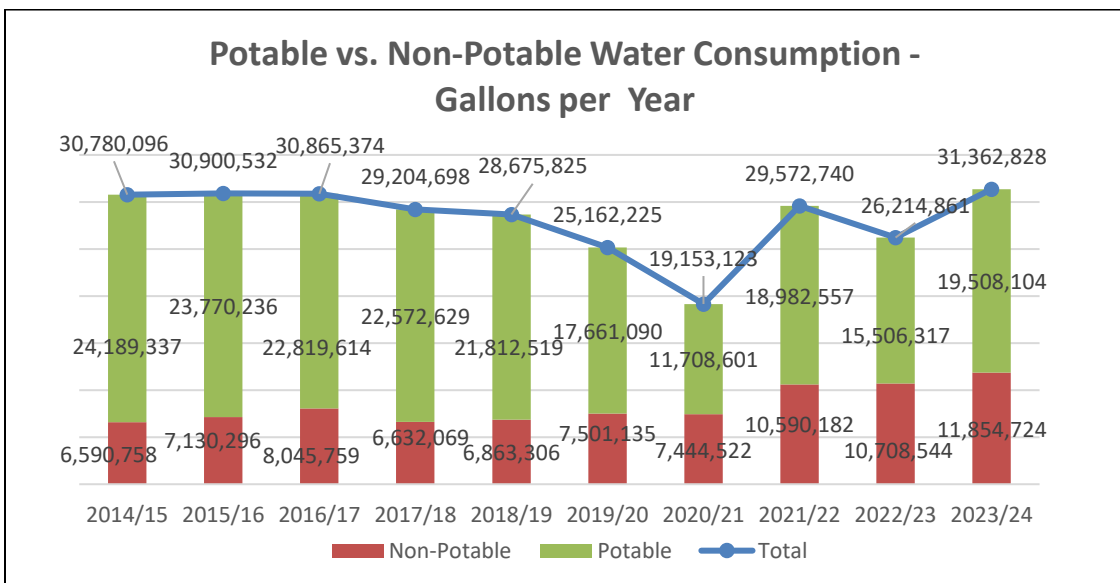


### Water Consumption

Macalester consumed 31,362,828 gallons of water on its campus in FY 2023-24. The amount of potable water consumed on Macalester’s campus in any given year is directly related to the number of full-time students on campus. Usage was the highest it has been in the last nine years.



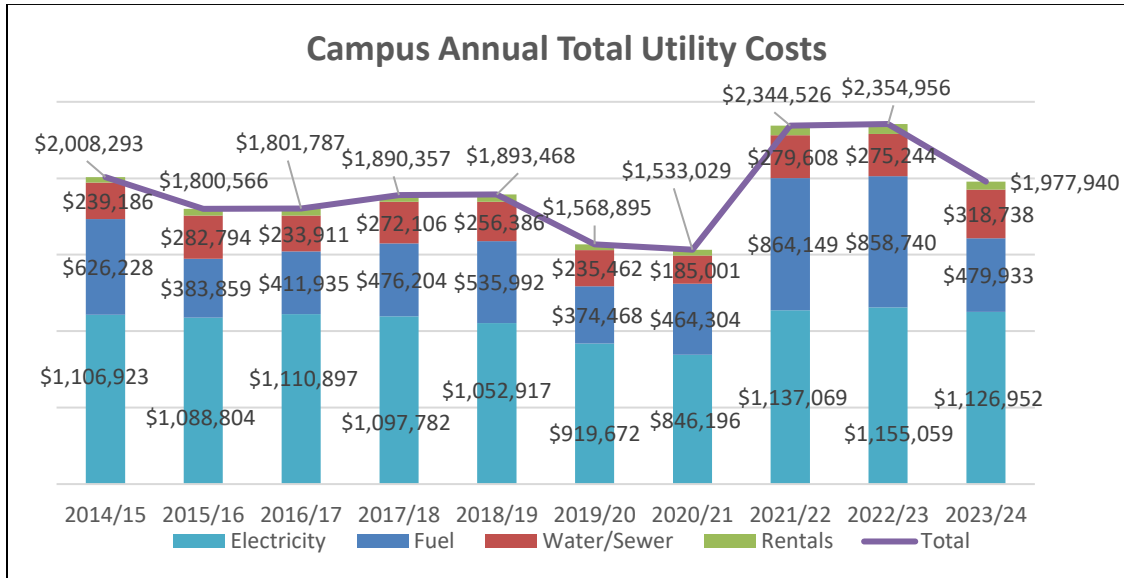
Nearly 38% of the water consumed in FY 2023-24 was used for non-potable purposes, such as the irrigation of campus vegetation and as makeup water in the central heating & cooling plant’s boilers and cooling towers. The non-potable percentage in the last few years has been much higher than the 20-25% typically observed in previous years due to an increase in irrigation needs. Leonard Center, Rice Olin, and George Draper Dayton saw the largest increases in water usage from FY 2022-23.



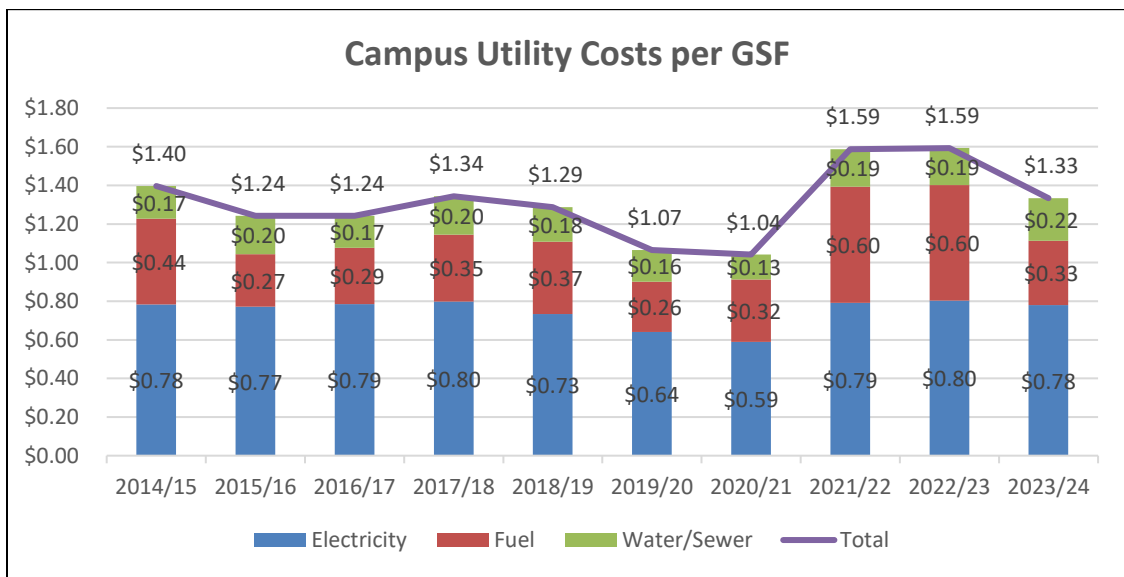
## Total Utility Costs

### Total Annual Utility Costs:

The total amount spent for utilities in FY 2023-24 was \$1,977,940. Macalester’s utility costs dropped significantly from preceding years due to a warmer winter and utility costs dropping back to levels previous to the last couple years.

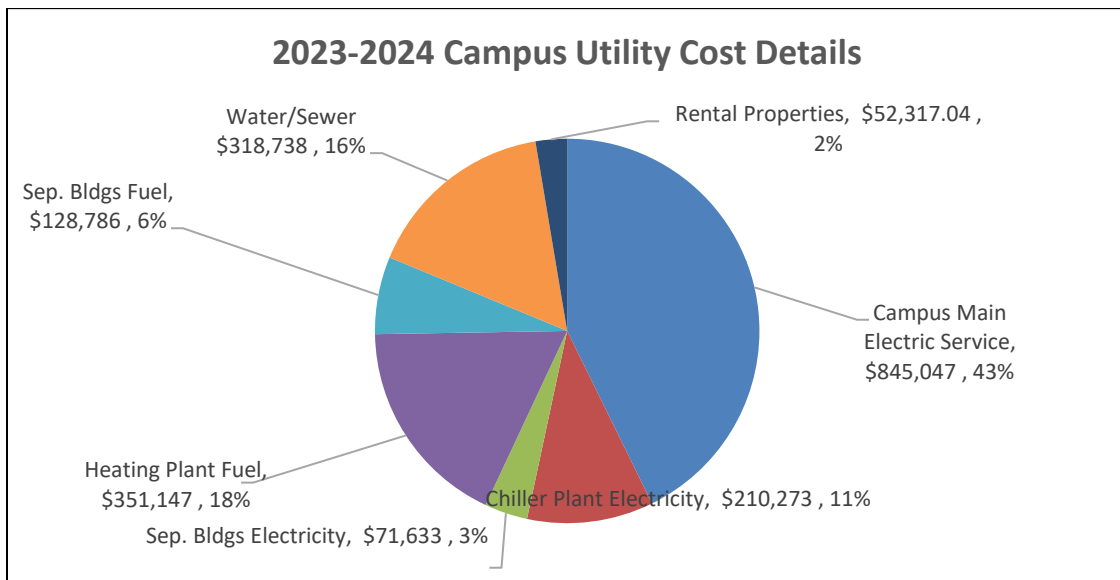
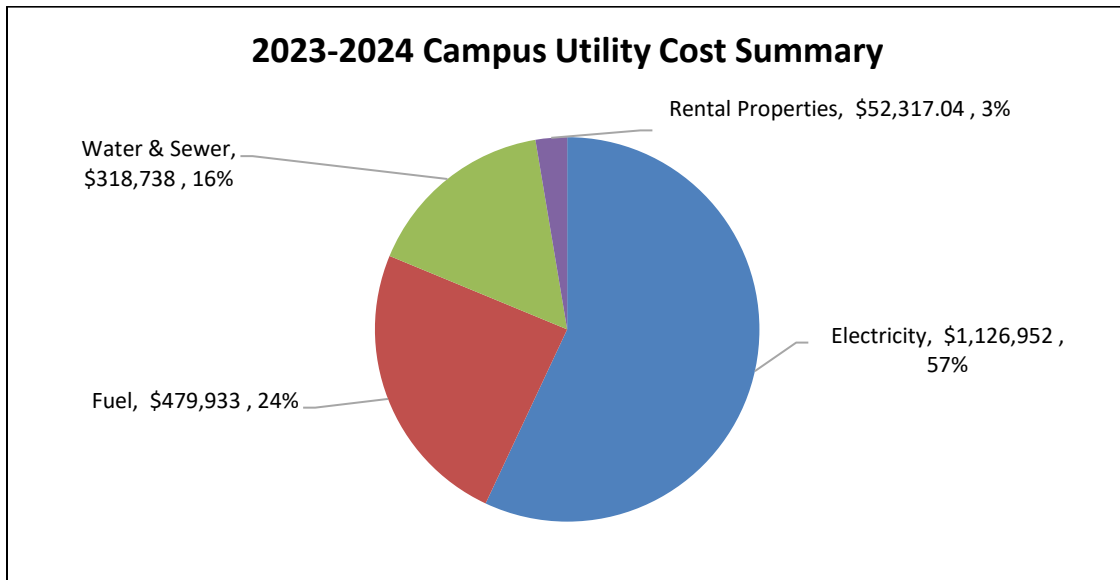


Since FY 2014-15, Macalester’s total utility costs per square foot have varied from a high of \$1.59/GSF, which came in FY 2021-22 and 2022-23, to a low of \$1.04/GSF, which was recorded in FY 2020-21 during Covid-19.



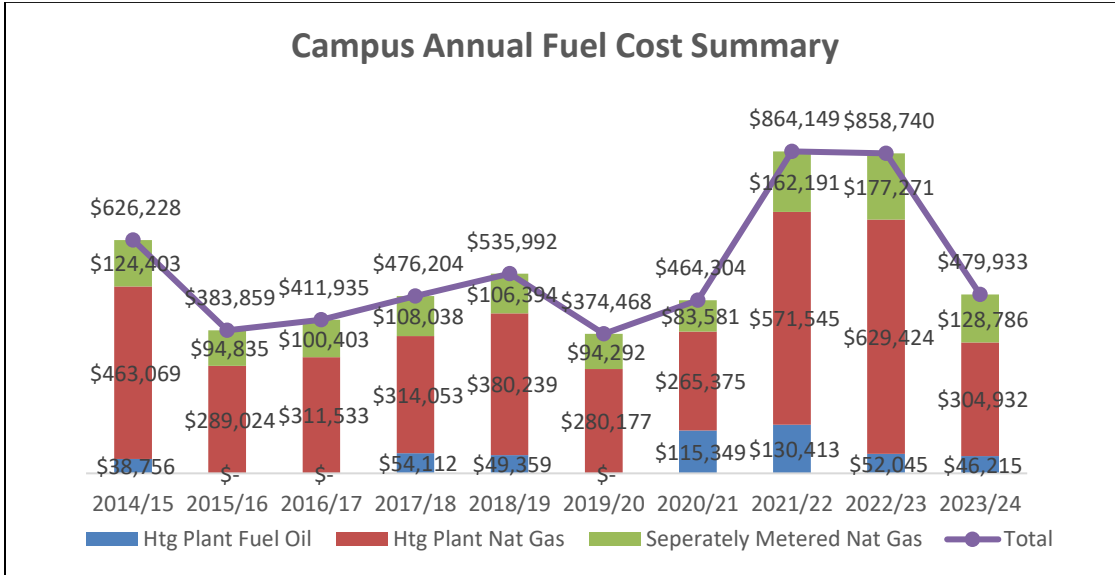
Macalester College 2023-2024 Energy Report

The pie charts displayed below show a summary and detailed breakdown of Macalester College’s utility costs in FY 2023-24. Expenditures for electricity accounted for 57% of the total amount spent and were divided between the main campus electric service, chiller plant, and the buildings on campus that have individually billed electric services. Fuel costs comprised 24% of the total utility costs, and were divided between the central heating plant and the buildings on campus that have separately billed natural gas services. Water & Sewer charges comprised 16% of Macalester’s total utility costs for the year. The combined total cost for the electricity, natural gas, and water/sewer costs for the rental properties owned by the college accounted for 3% of the total utility budget.

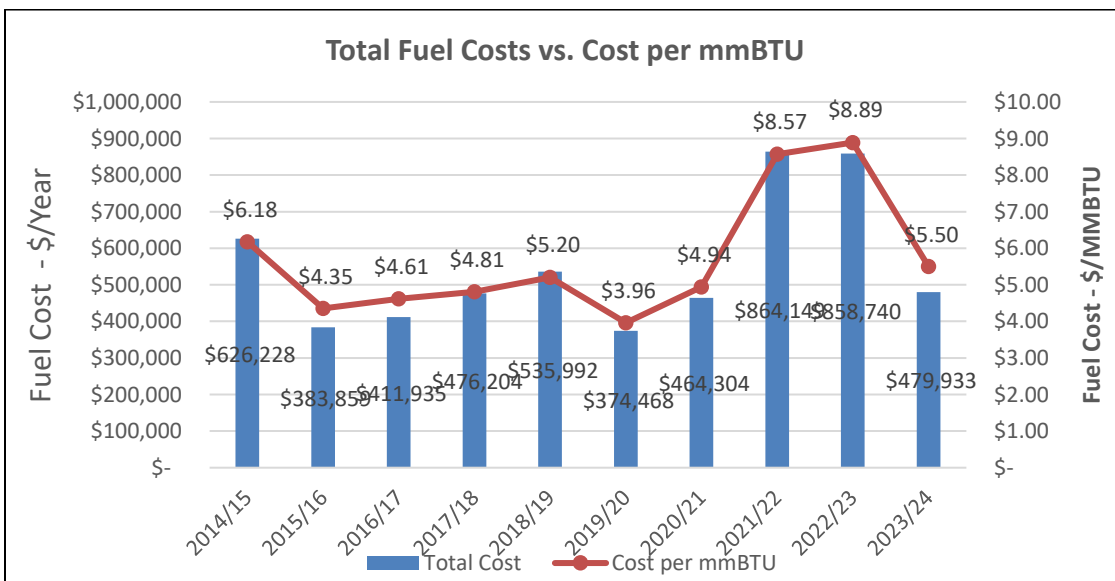


### Fuel Costs

The total cost for the natural gas and #2 fuel oil consumed on Macalester College’s campus in FY 2023-24 was \$479,933. As noted above, Xcel Energy curtailed the College’s use of natural gas during a cold snap in January.

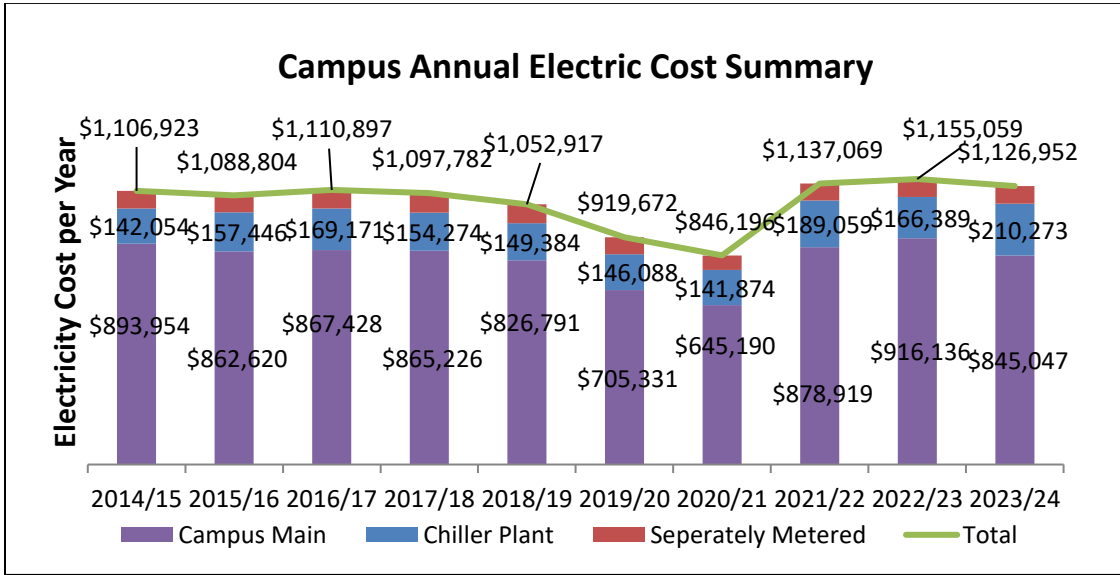


The total amount spent for fuel in any given year is affected by both the severity of the heating season and the cost paid per million BTUs (mmBTU). Since FY 2014-15, the cost paid per mmBTU of fuel has risen to a high of \$8.89/mmBTU in FY 2022-23 from a low of \$3.96/mmBTU in FY 2019-20. In FY 2020-21 Xcel charged \$.403 per Therm compared to \$.866 per Therm in FY 2022-23. That is an increase of 115%. In FY 2023-24 prices have come down to \$.520 per Therm.

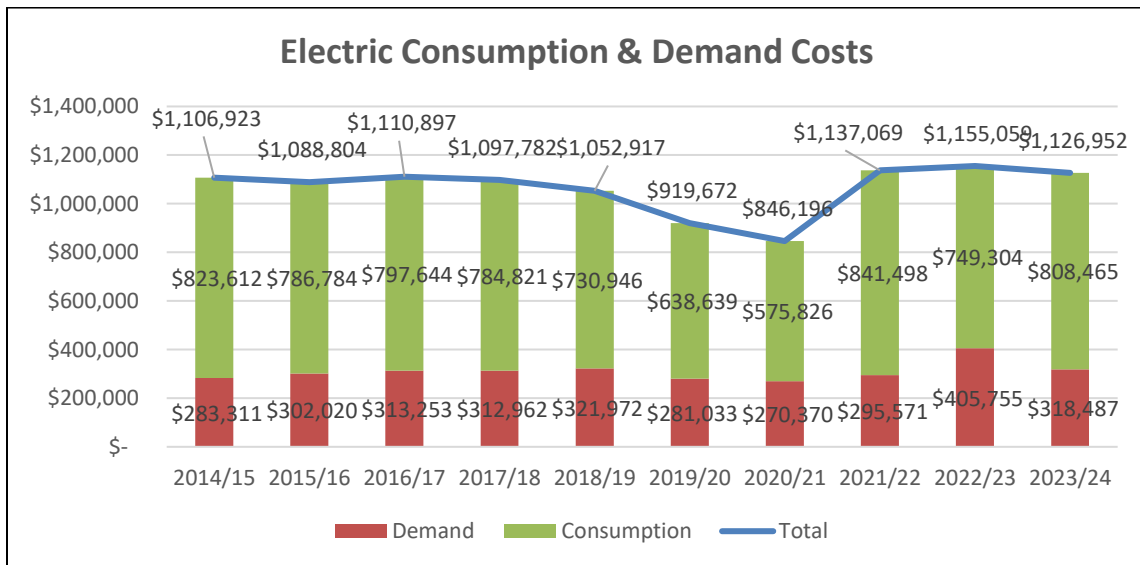


### Electrical Costs

Macalester College spent \$1,126,952 on electricity in FY 2023-24. As stated above, usage is slightly up compared to last year, but the cost of electricity has stabilized and come back down slightly.

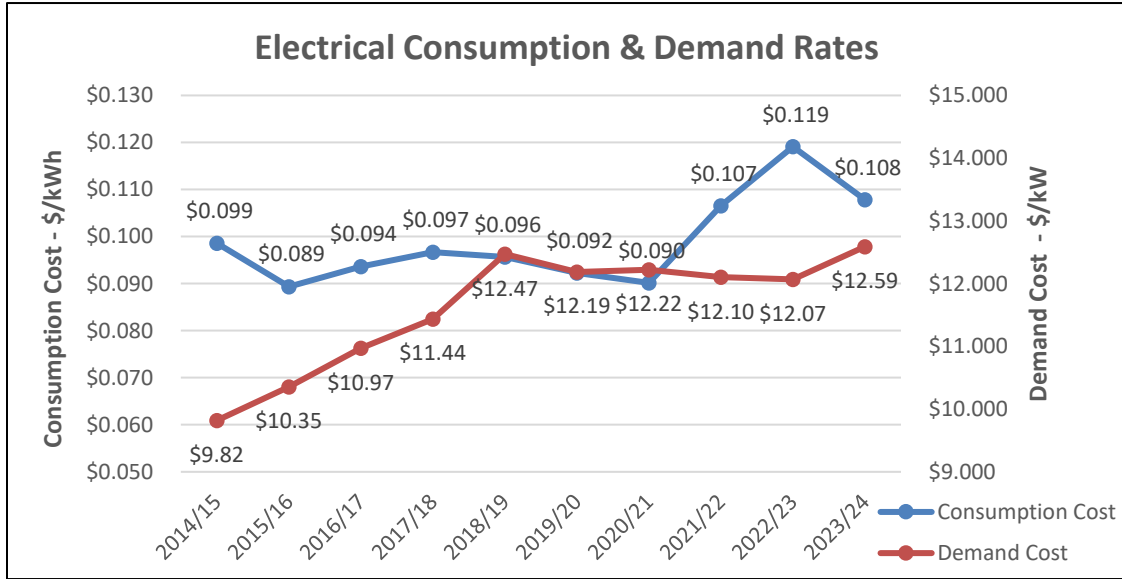


Macalester’s expenditures for electricity include the costs for consumption, measured in kilowatt-hours (kWh), plus the costs for demand, measured in kilowatts (kW). The College pays electrical demand charges for the campus main electric service, chiller plant, and several other buildings on campus that are billed individually. In FY 2023-24 demand charges comprised 28% of the total amount spent on electricity.



Macalester College 2023-2024 Energy Report

The largest factor for increased electric costs is what we are being charged for consumption vs demand. The cost of consumption has risen from \$.090 per kWh in FY 2020-21 to \$.119 in FY 2022-23, nearly a 32% jump in cost but has come back down slightly. The rate charged by Xcel per kW of electrical demand has been on a constant increase to \$12.59/kW in FY 2023-24.



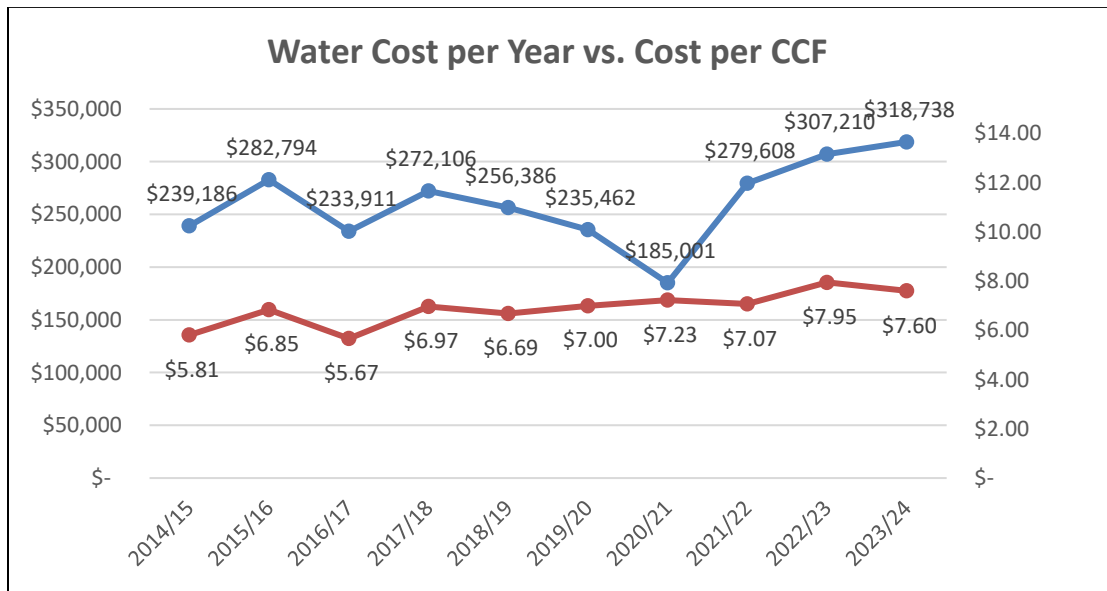
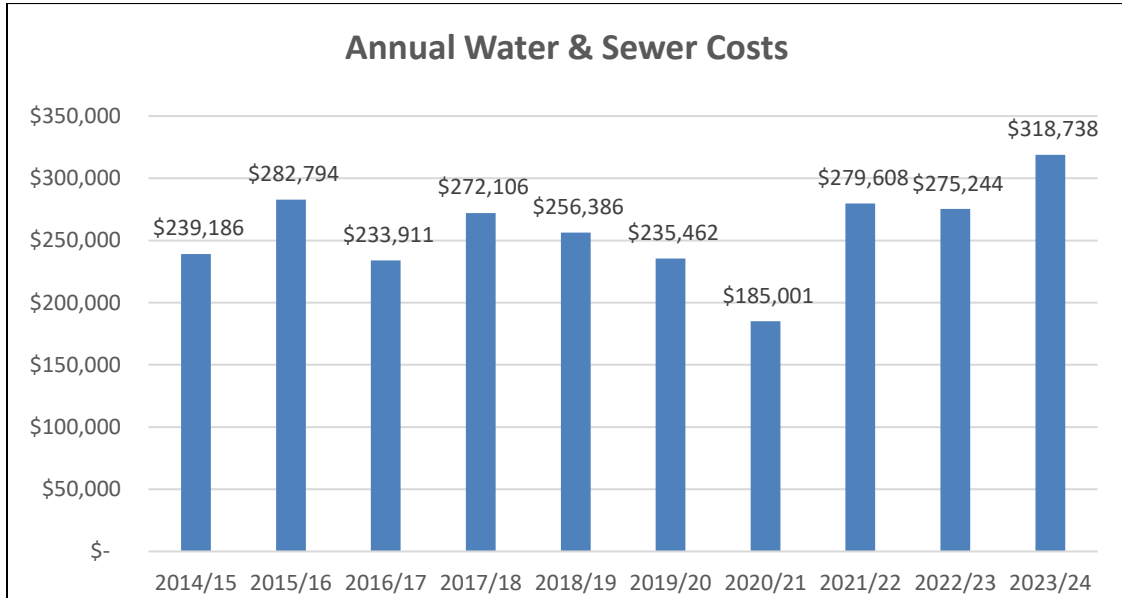
Solar Garden Energy Purchases

In FY 2018-19 Macalester College entered an agreement to purchase a portion of the electricity produced by two regional solar gardens and resell it to Xcel Energy as a partial hedge against future increases in electric utility rates. Under this agreement, Macalester’s cost for the electricity produced by the solar gardens is locked in for the term of the contract, while the amount that the College is paid by Xcel Energy will vary with market rates and are expected to rise over time. The first garden started production in August 2018 and the second solar garden came online in July, 2019. In FY 2023-24, the amount of electricity purchased by the gardens was equal to about 34% of Macalester’s electrical consumption for the year and provided a financial benefit to the College of approximately \$117,000 compared to a benefit of \$66,000 in FY 2022-23 and \$51,000 in FY 2021-22.



### Water & Sewer Costs

Macalester College’s total water & sewer charges in FY 2023-24 were approximately \$319,000. Water & sewer utility rates did increase by 6% and usage was up.




### FY 2022-23 Energy Conservation Projects & Initiatives:

#### GRITS Project Summary

In 2015 Macalester started recording the costs and estimated energy savings associated with the energy conservation projects implemented on campus with the Green Revolving Investment Tracking System (GRITS). From 2015 to date the College has invested over \$1.5M in a total of (95) energy & water conservation projects, with an estimated financial savings to date of over \$2.5M.

Macalester College	
TOTAL PROJECTS FUNDED (COMPLETED / IN-PROGRESS)	95 / 1
TOTAL INVESTED TO DATE *	\$ 1,523,889
TOTAL FINANCIAL SAVINGS TO DATE	\$ 2,530,391
TOTAL ENERGY SAVINGS TO DATE	135,850 MMBtu
TOTAL EMISSIONS ABATED TO DATE	23,397 MTCO <sub>2</sub> e
TOTAL WATER SAVINGS TO DATE	3,009,478 gal

Efficiency data powered by  GRITS

\* Includes investments to in-progress projects without savings to date  
Last updated 11/06/2024

### Energy Conservation Projects:

In FY 2023-24 Macalester College has completed multiple energy conservation projects:

- Building Automation System Upgrades:
  - Obsolete HVAC equipment controls in the buildings listed below were upgraded to newer direct digital control equipment. The new controls provide the ability to implement energy conservation strategies that were not possible with the original equipment.
    - Carnegie Hall VAV Controls Replacement
    - Multiple Language House Smart Thermostat Install
    - Rice/Olin Radiator Controls Upgrade
- Electrical & Mechanical Upgrades:
  - Rice/Olin Lab Controls Upgrade
    - Completed the last phase of lab fume hood controls upgrades allowing for advanced energy conservation controls throughout the building HVAC systems.
  - LED Lighting Retrofit Projects
    - Constant LED upgrades of light fixtures that were missed in building wide retrofits with Xcel rebates covering \$710 of those costs.

### O&M Projects:

- Variable Frequency Drives (VFDs)
  - The VFDs serving HVAC equipment in Leonard Center were replaced by Macalester's Facilities Services staff. Xcel Energy provided rebates of 60% towards the total cost of this work which totaled \$4,100.
- Steam Trap Audits, Repairs, & Replacements:
  - The steam traps in all of the buildings on Macalester's campus that are served by the campus boiler plant as well as in the 1550 Summit Avenue rental property were audited and repaired or replaced as needed.

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