



Fiscal Year 2022 – 2023

Campus Annual Energy Use Report

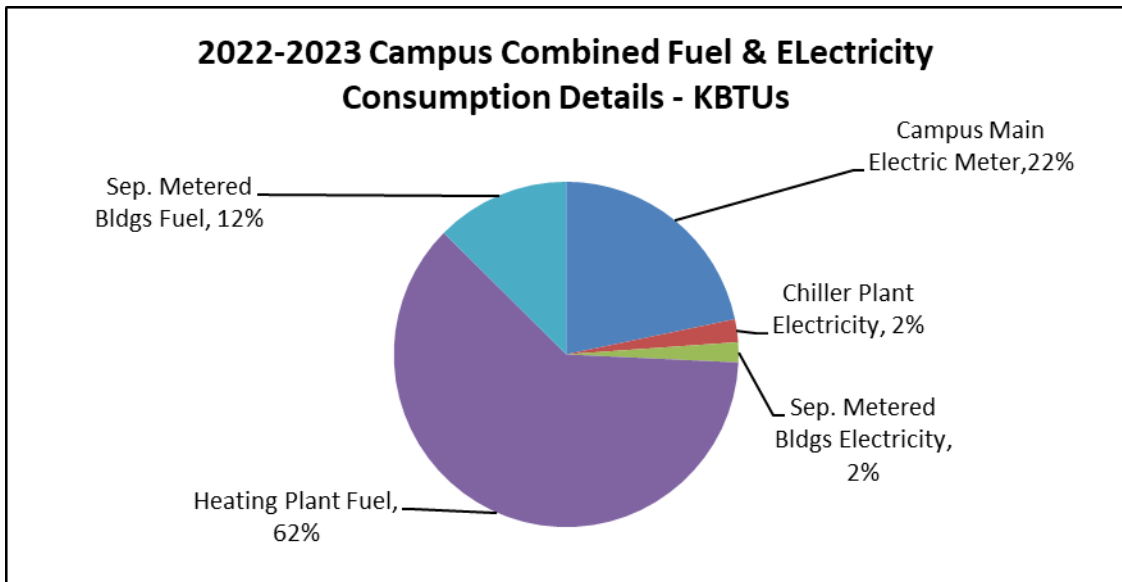
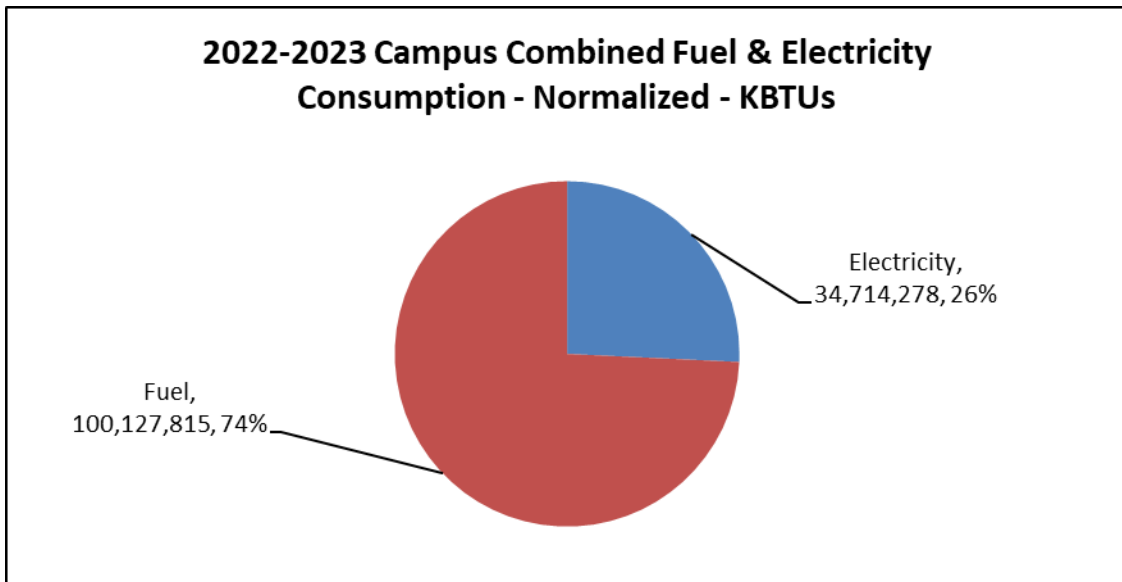
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## Fuel, Electricity, & Water Consumption

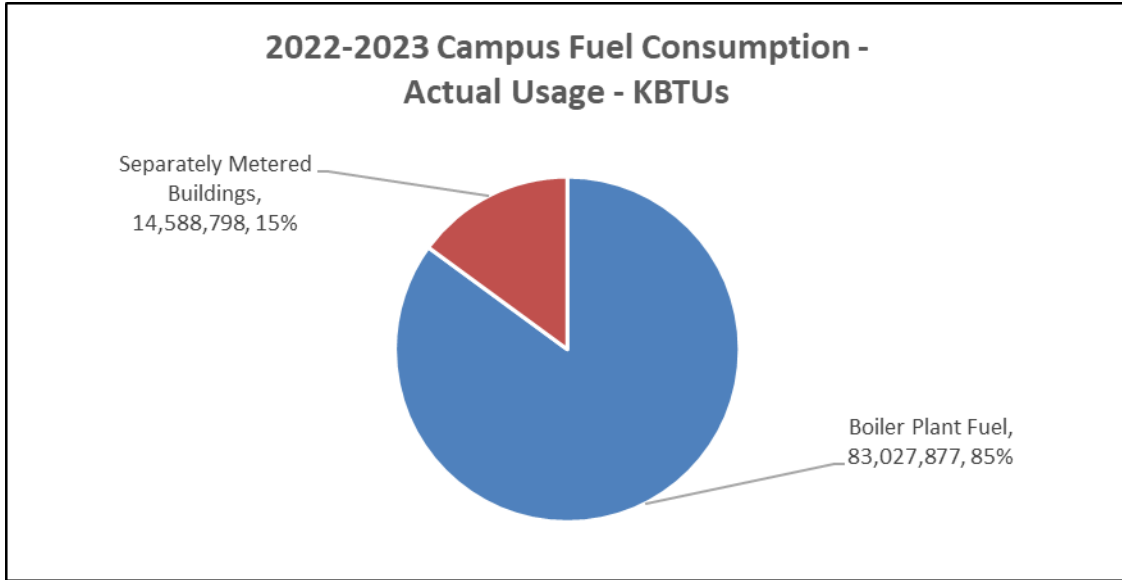
### FY 2022-2023 Total Site Energy Consumption

In fiscal year 2022-23, Macalester College consumed 134,842,093 kBtUs of energy on its campus. 74% 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 62% of the campus' total energy usage.

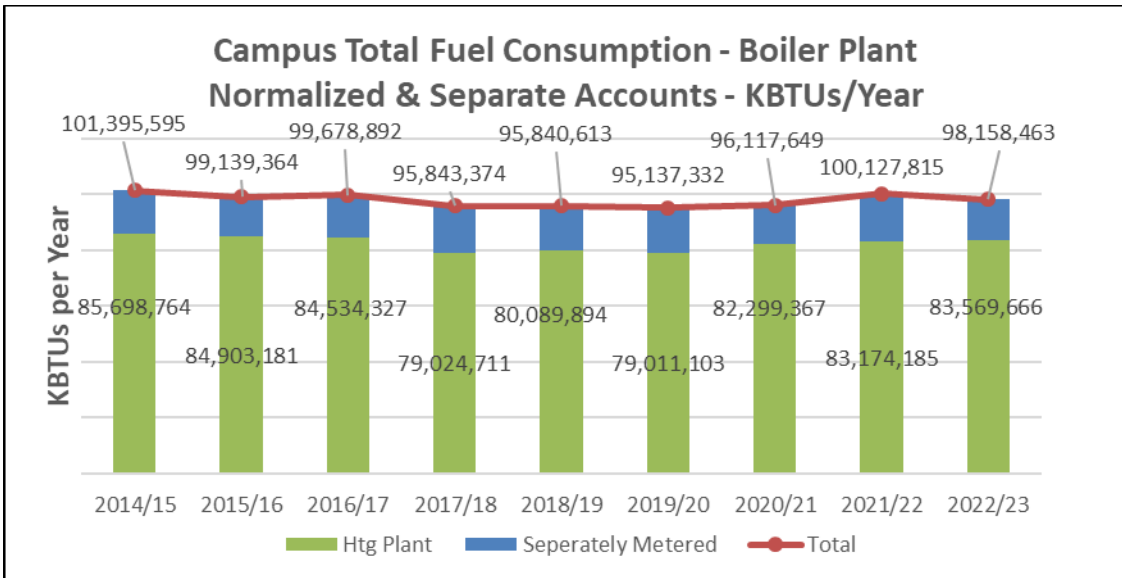


### Fuel Energy Consumption

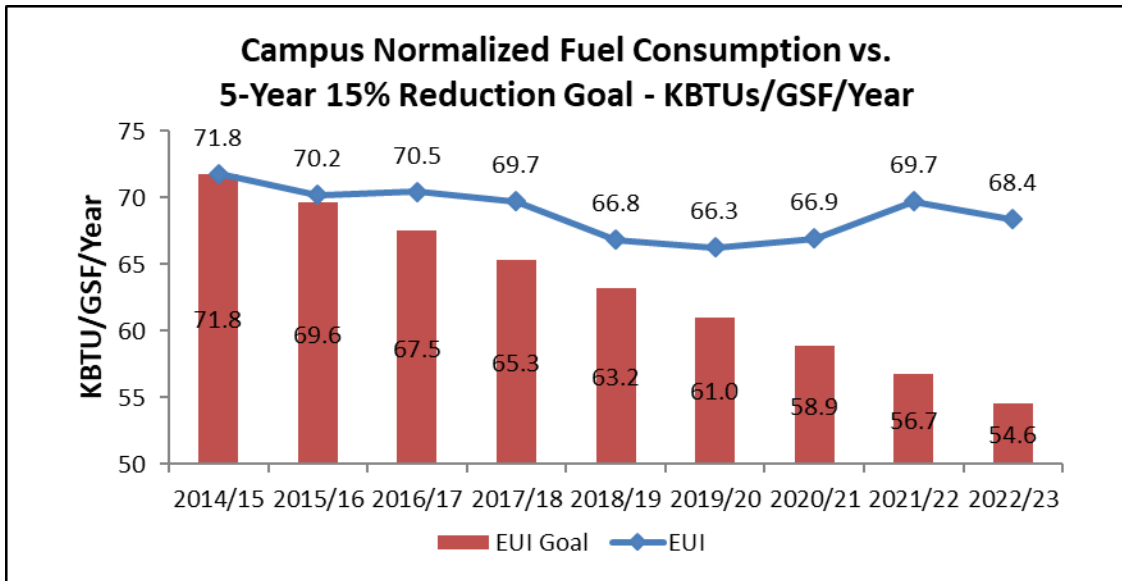
Macalester consumed 97,616,675 kBTUs of fuel during FY 2022-23. 85% of the fuel energy was consumed by the central heating plant and the balance was used in other buildings and houses on campus for space heating, domestic water heating, and cooking. The Art building’s kilns and forges also consume a significant amount of natural gas.



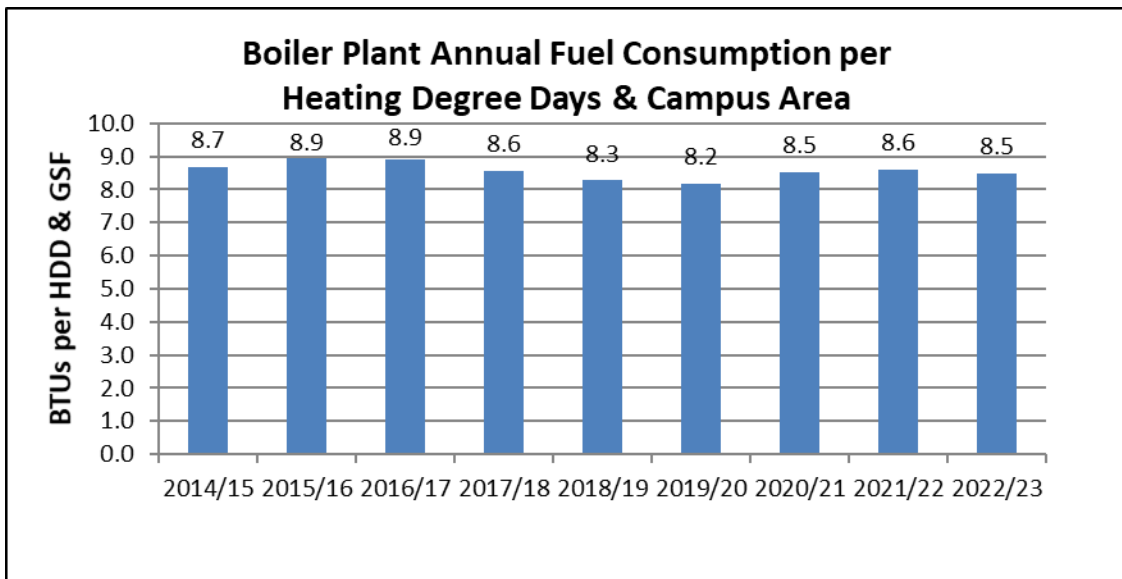
After weather normalization, the total fuel consumption for the campus was 98,158,463 kBTUs, which was a drop from FY 2021-22 but more than the average consumption.



On an EUI basis, the College’s fuel consumption rate of 68 kBTU/GSF/Year FY 2022-23 was a drop from the previous year but 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.

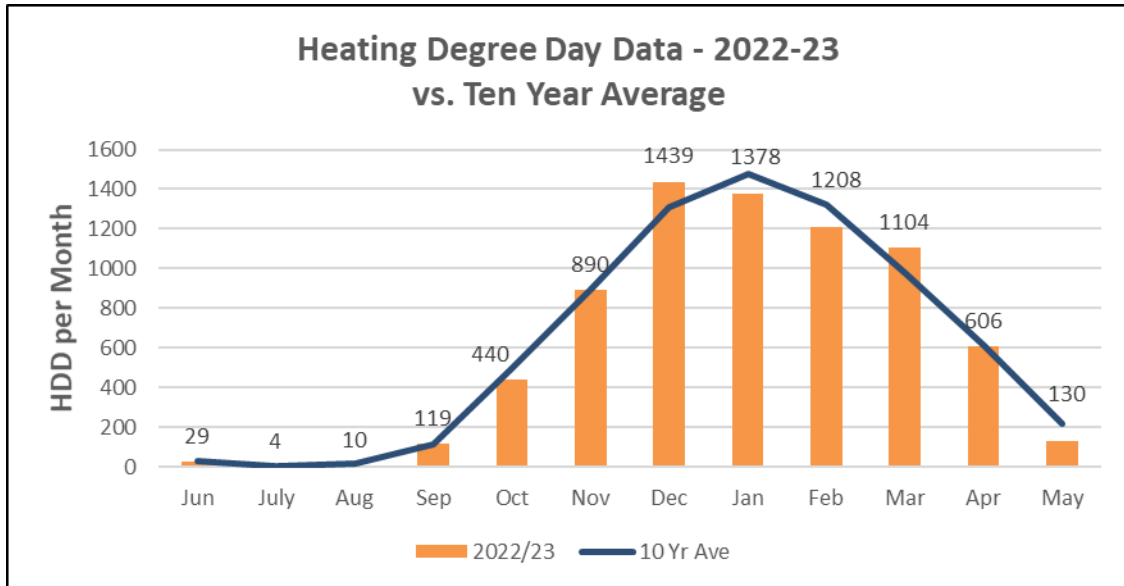


After normalizing for both weather and changes in the square footage of campus area that it serves, the rate at which the heating plant used fuel in FY 2022-23 was very similar to the rate at which used fuel in the past two years.



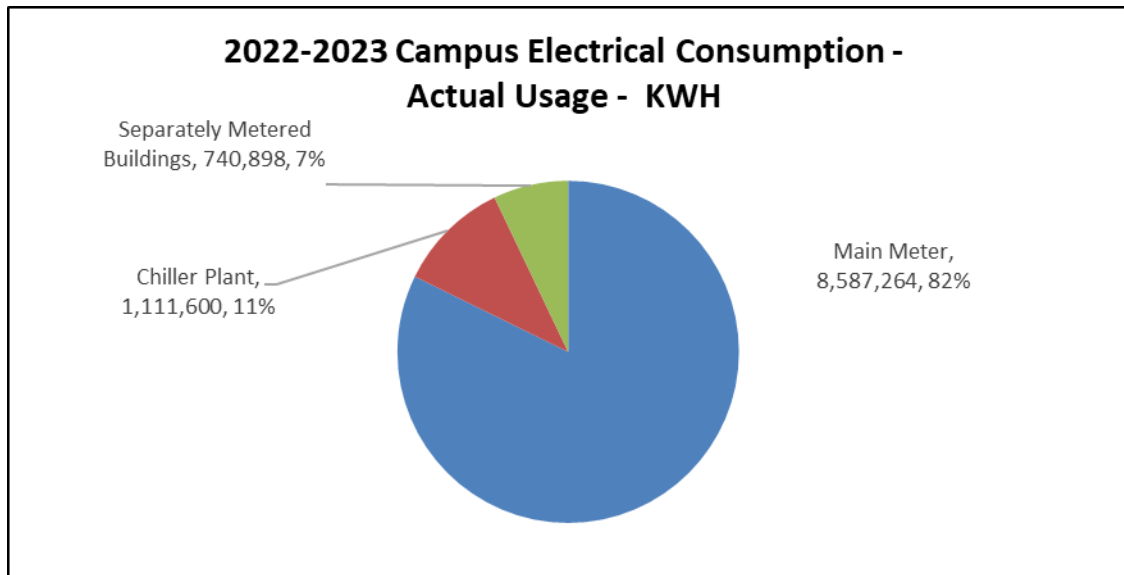
The actual amount of fuel consumed in any given year can be adjusted via weather normalization calculations to provide an “apples to apples” comparison with the fuel consumption in any selected base year. With the exception of the month of December, the winter of FY 2022-23 was slightly milder than average, with a total of 7,358 heating degree days (HDD) vs. the average of 7,494 HDD for the previous

ten years. The weather in December 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.



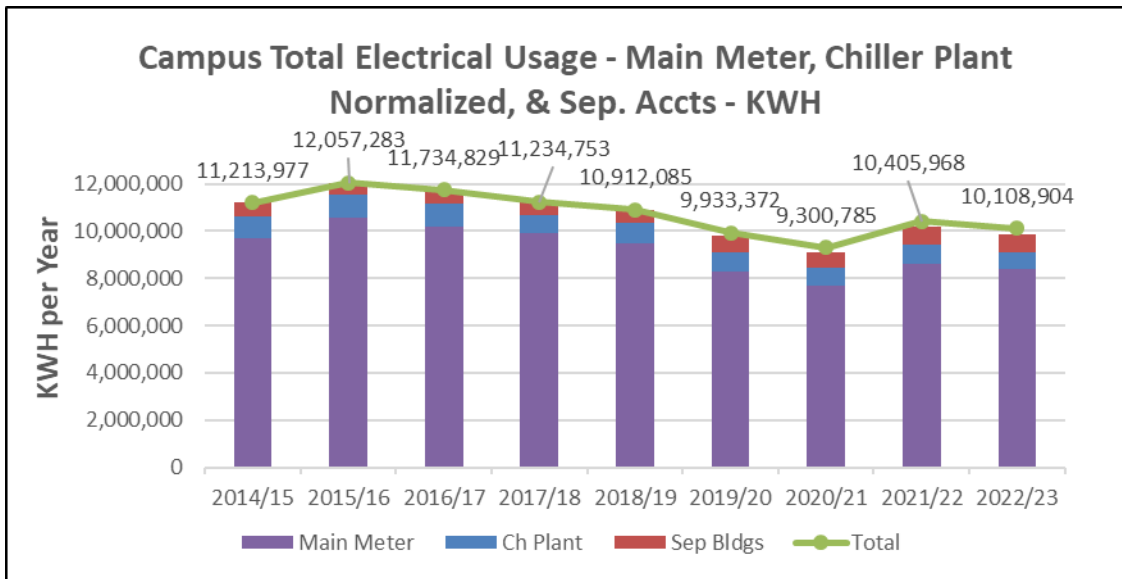
### Electrical Energy Consumption

Macalester College’s total actual electrical consumption in FY 2022-23 was 10,441,762 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 11% of the campus’ total electric energy. The remaining 7% was used in the various buildings and houses on campus that also have individual electric services and meters.

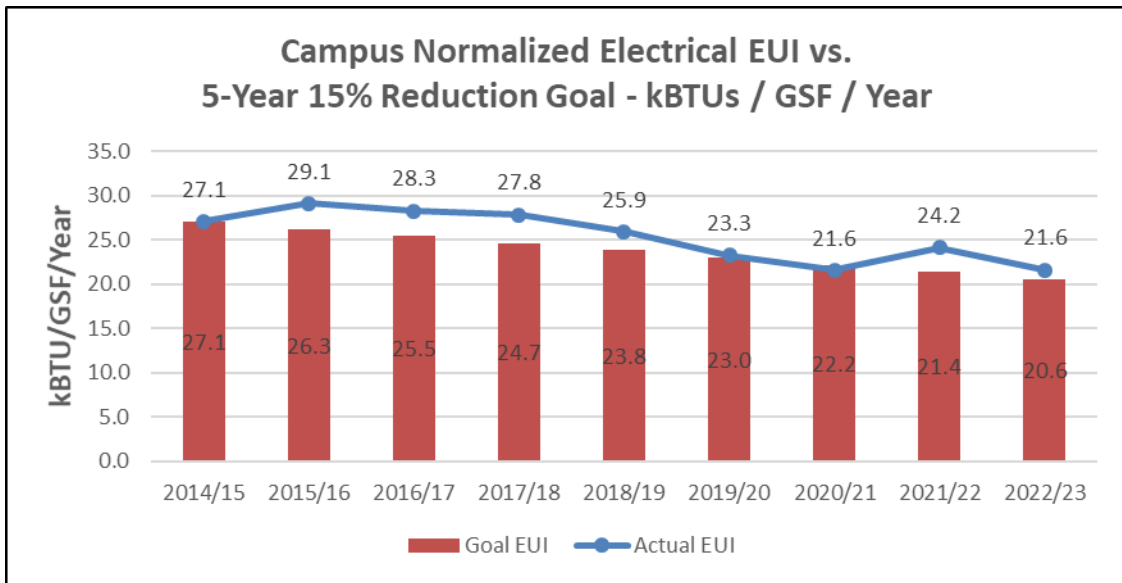


Macalester College 2022-2023 Energy Report

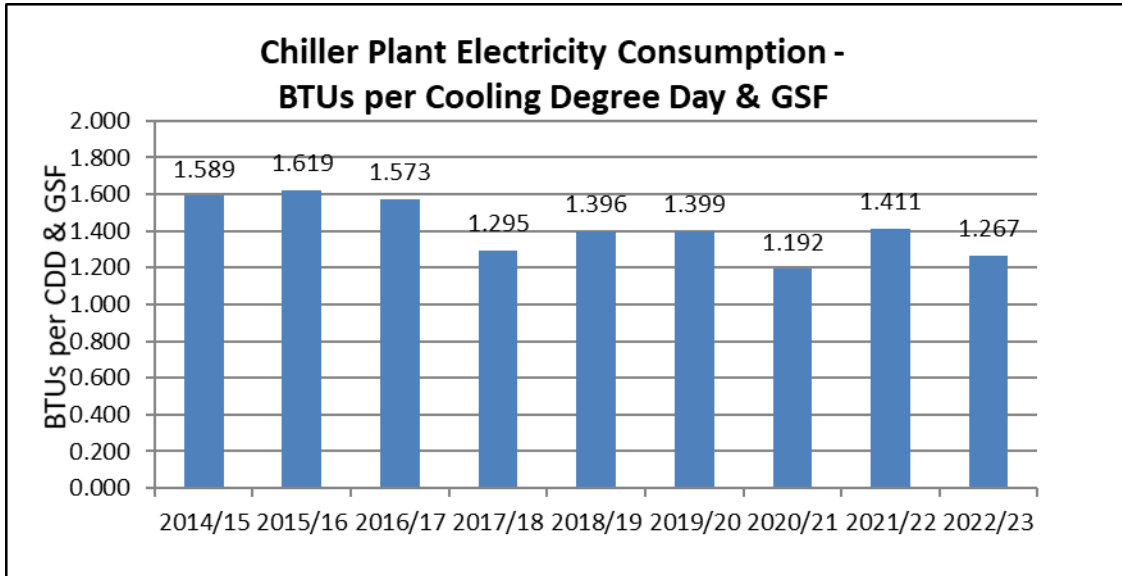
After weather-normalization of the chiller plant’s usage, the total electrical consumption for the campus was 10,108,904 kWh, which was 10% less than the weather-normalized amount of electricity consumed in the 2014-2015 baseline year and 7% less than FY 2018-19, our last year before COVID-19.



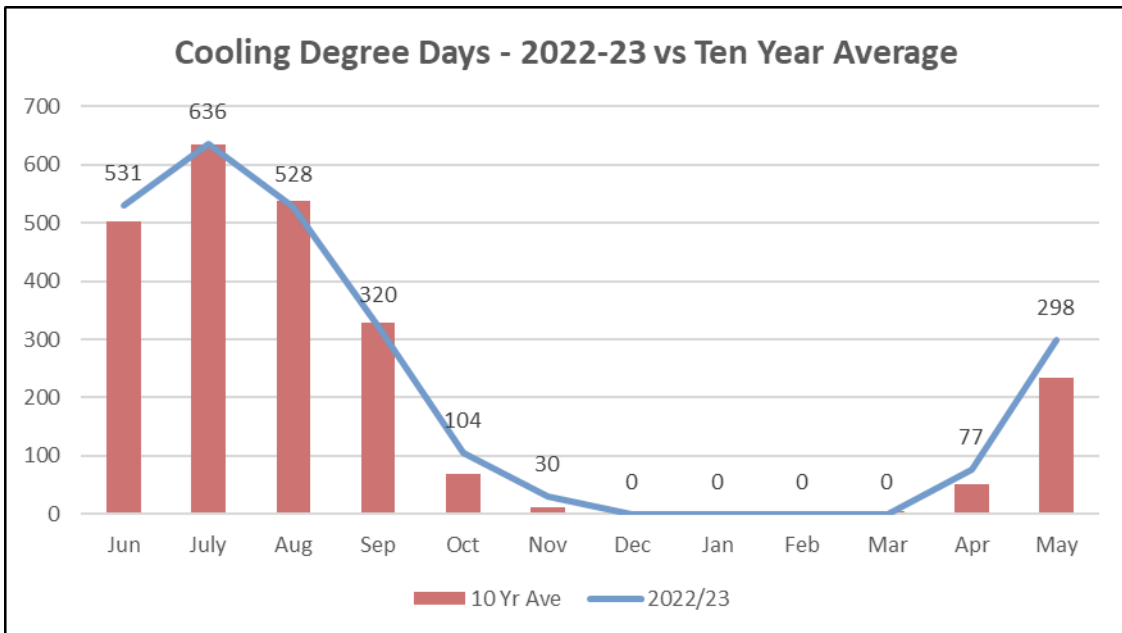
On an EUI basis, the 21.6 EUI rate at which the campus consumed for electricity in FY 2022-23 was slightly higher than the 5-year reduction goal of 20.6 kBTU/GSF/Year, but an improvement over the previous FY 2021-22 and a significant reduction over FY 2018-19.



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 2022-23 improved compared previous years other than FY2020-21 when we were in the middle of COVID-19.



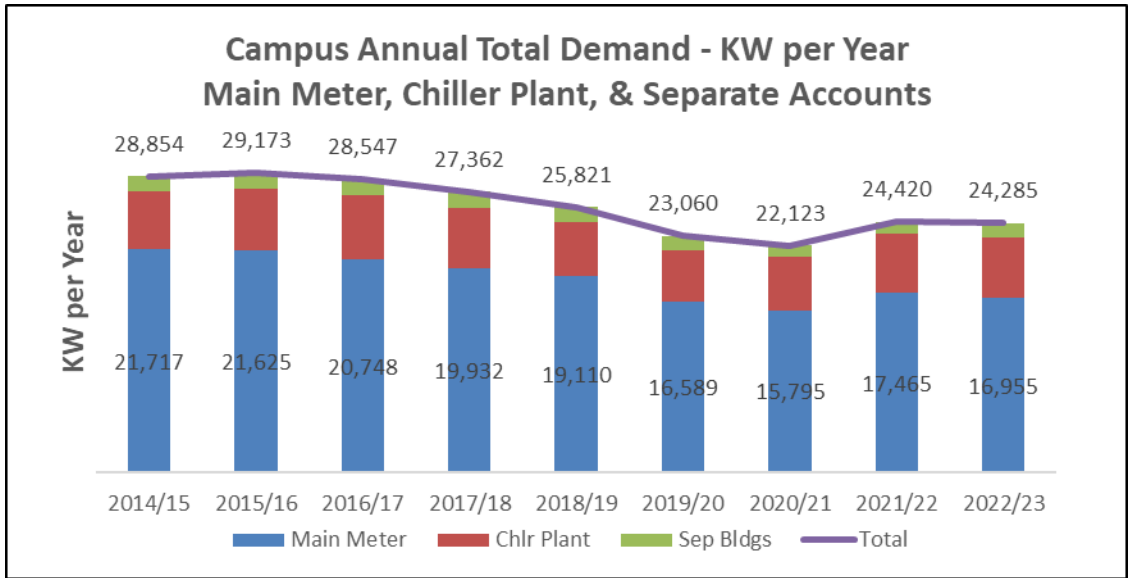
Fiscal year 2022-23’s cooling season was slightly on the warmer side, with a total of 2,525 cooling degree days (CDD) vs the average of 2,375 CDD for the previous ten-year period.



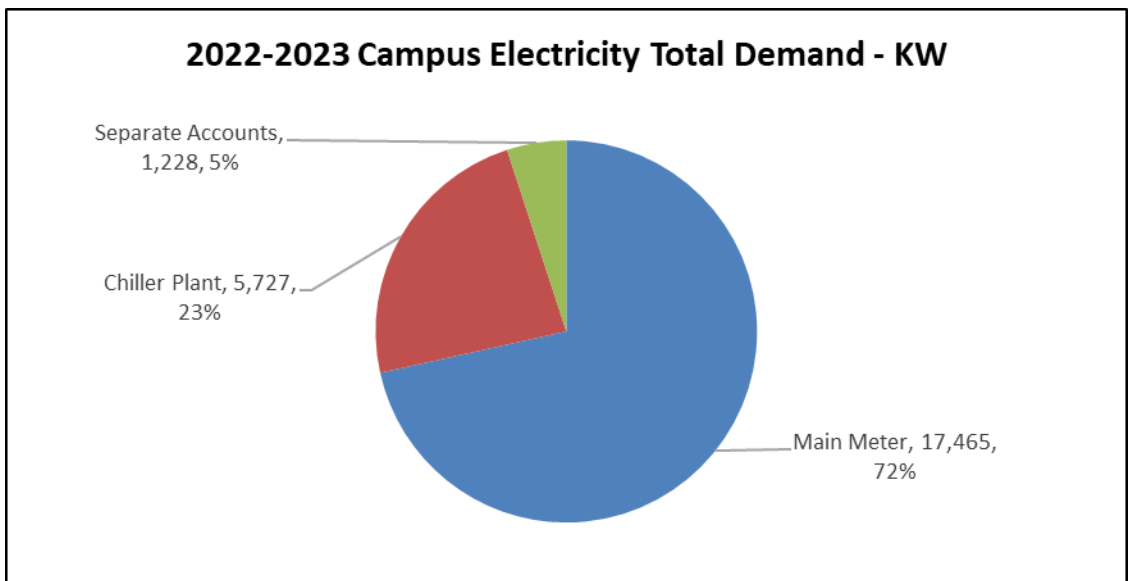


### Electrical Demand

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 24,285 kW in FY 2022-23, which was 16% less than the 28,854 kW used in the 2014-2015 base year and 6% less than FY 2018-19.

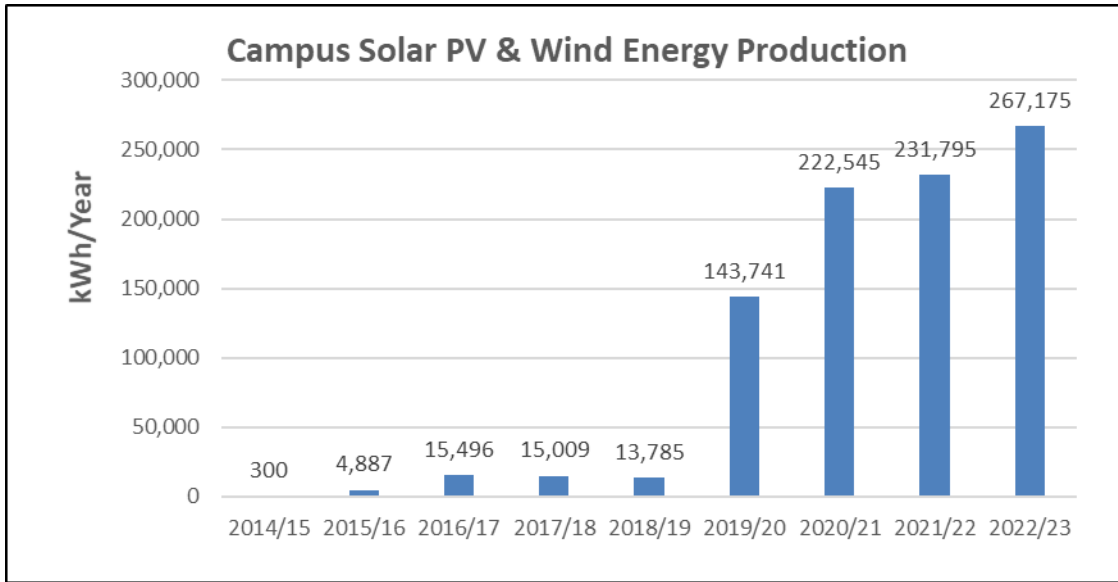


The chiller plant comprises the single largest component of the College’s demand. Although it is operated only from May through October and its electrical consumption is 11% of the campus total, the demand associated with the chiller plant accounts for 23% of the campus total.



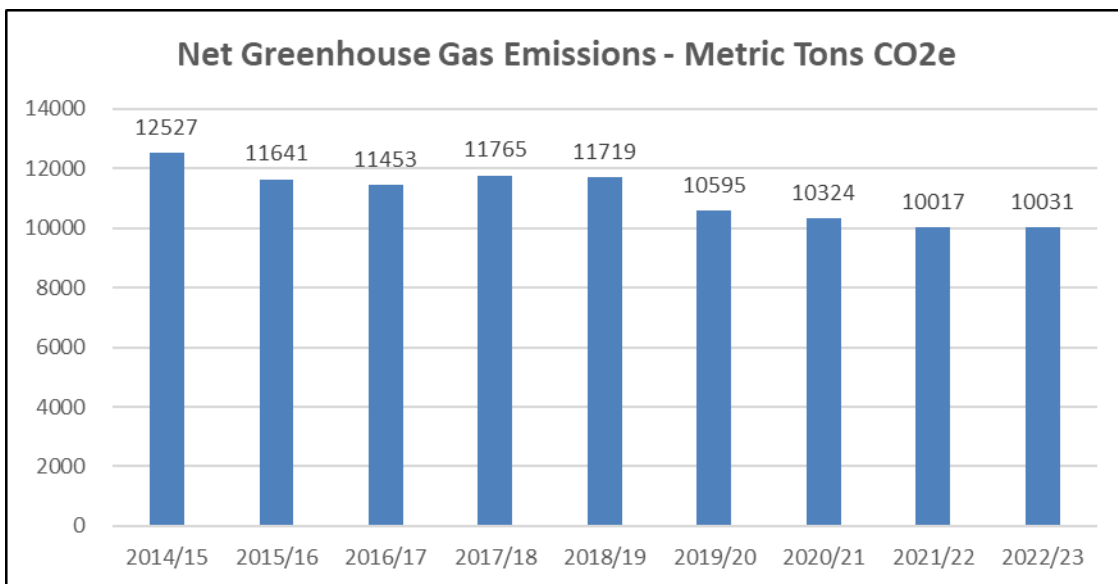
### Campus Solar & Wind Energy Production

In FY 2022-23 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 267,175 kWh, which was equivalent to 2.6% of the campus' total electrical consumption.



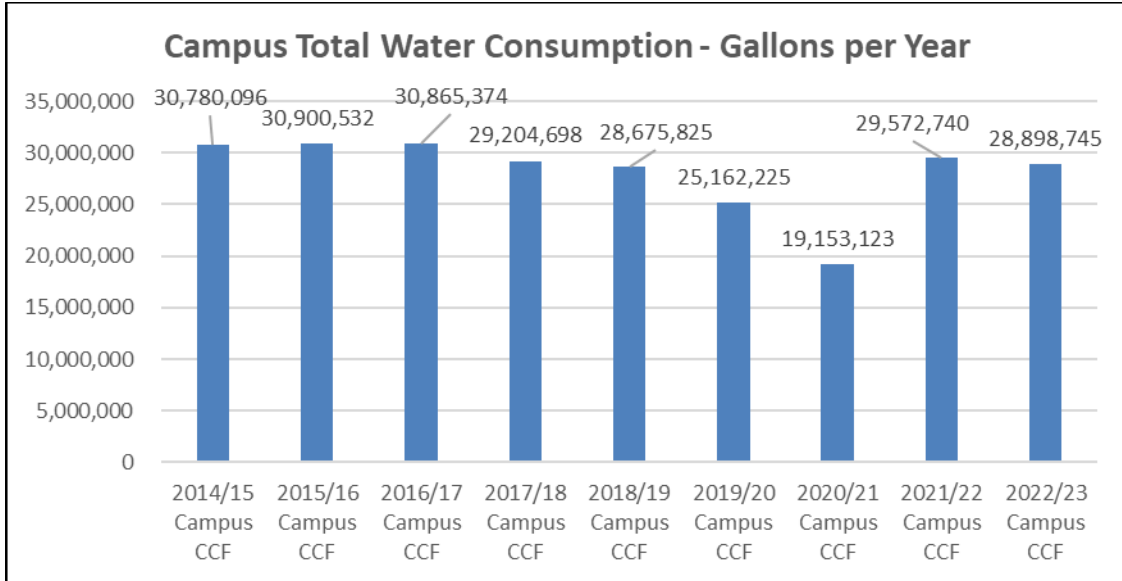
### Carbon Footprint / Greenhouse Gas Emissions

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 2022-23, ESPM estimated that Macalester emitted 10,031 metric tons of CO<sub>2</sub>e, which was 20% less than the amount of CO<sub>2</sub>e emitted in FY 2014-15 and 14% less than FY 2018-19.

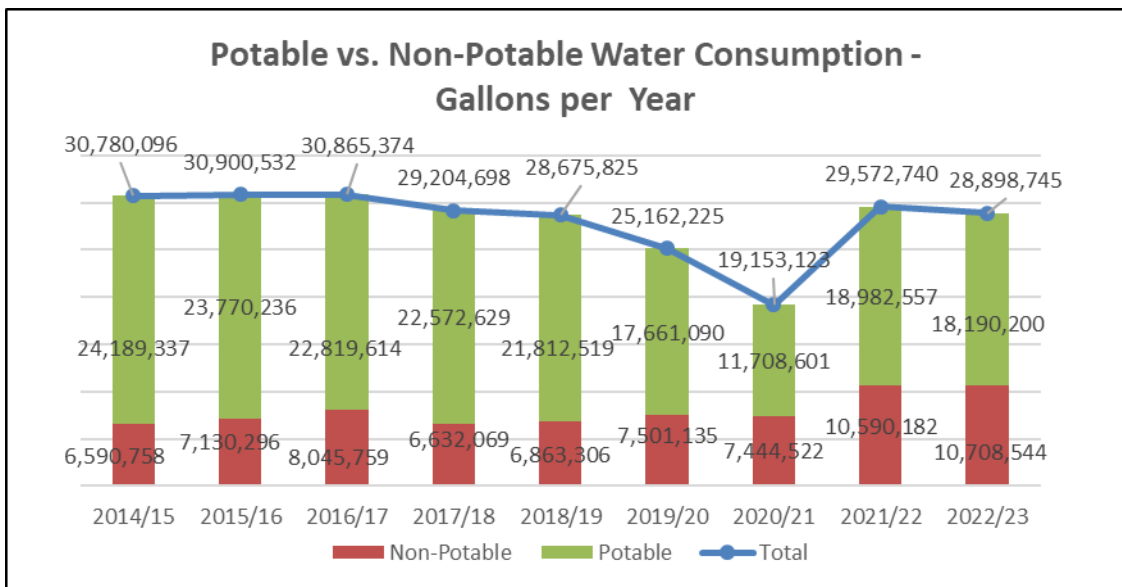


### Water Consumption

Macalester consumed 28,898,745 gallons of water on its campus in FY 2022-23. 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 is consistent with levels before COVID-19.



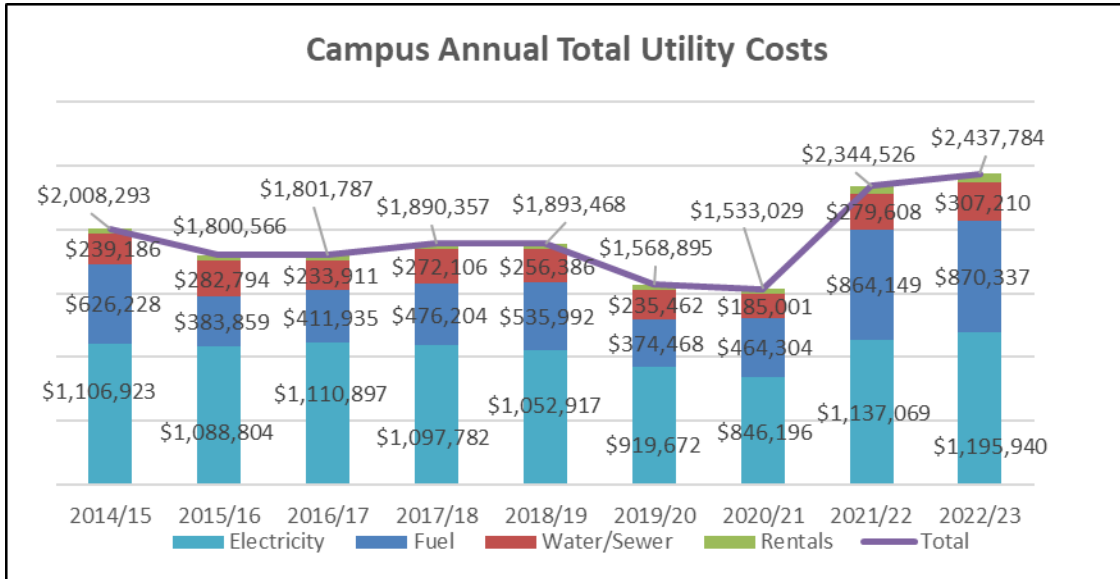
Nearly 40% of the water consumed in FY 2022-23 was used for non-potable purposes, such as the irrigation of campus vegetation and as makeup water in the central heating & cooling plant’s boilers and cooling towers. The non-potable percentage in FY 2021-22 and 2022-23 has been much higher than the 20-25% typically observed in previous years due to an increase in irrigation needs.



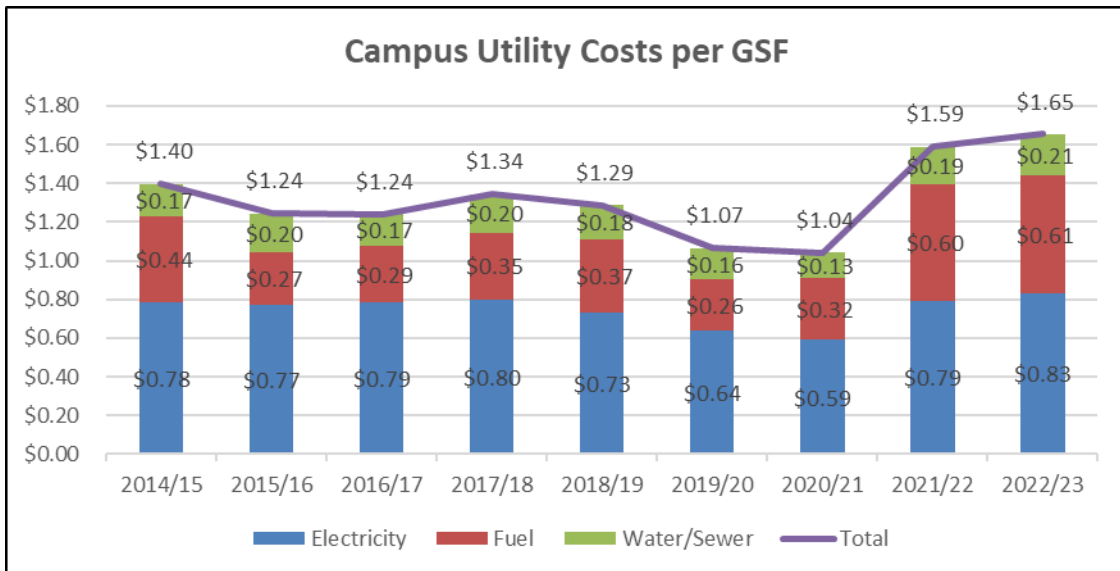
## Total Utility Costs

### Total Annual Utility Costs:

The total amount spent for utilities in FY 2022-23 was \$2,437,784. Macalester’s utility costs were significantly higher than preceding years due to the increased fluctuations in utility costs.

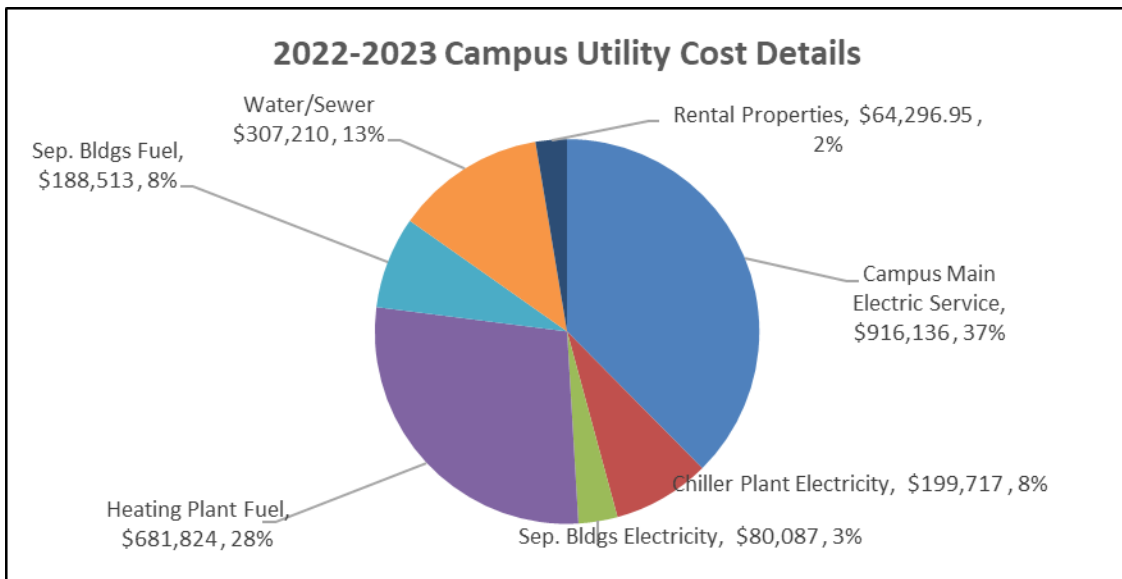
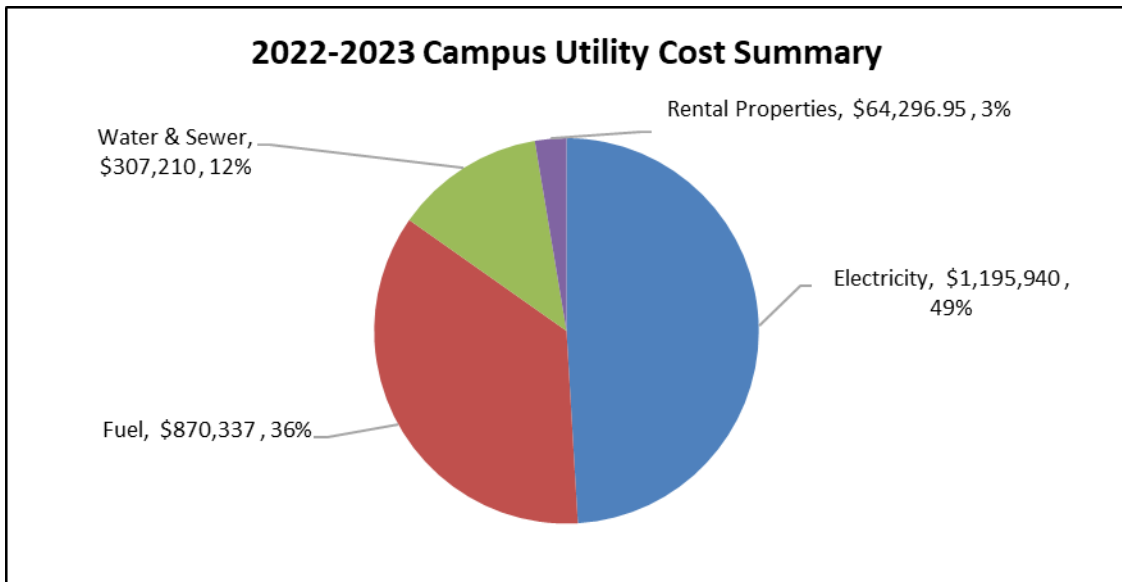


Since FY 2014-15, Macalester’s total utility costs per square foot have varied from a high of \$1.65/GSF, which came in FY 2022-23, to a low of \$1.04/GSF, which was recorded in FY 2020-21.



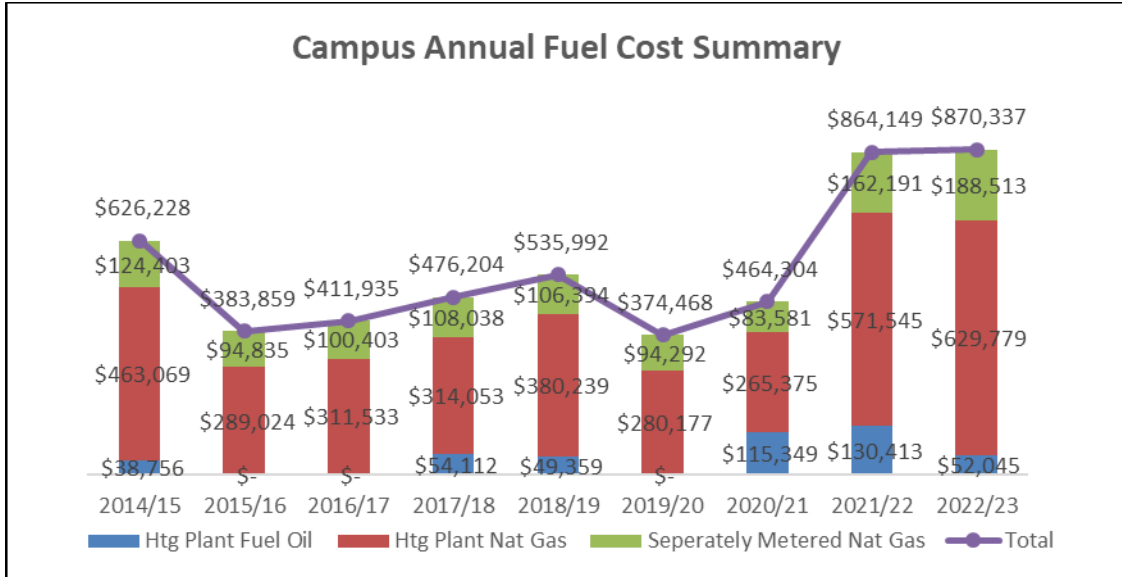
Macalester College 2022-2023 Energy Report

The pie charts displayed below show a summary and detailed breakdown of Macalester College’s utility costs in FY 2022-23. Expenditures for electricity accounted for 49% 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 36% 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 12% 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.

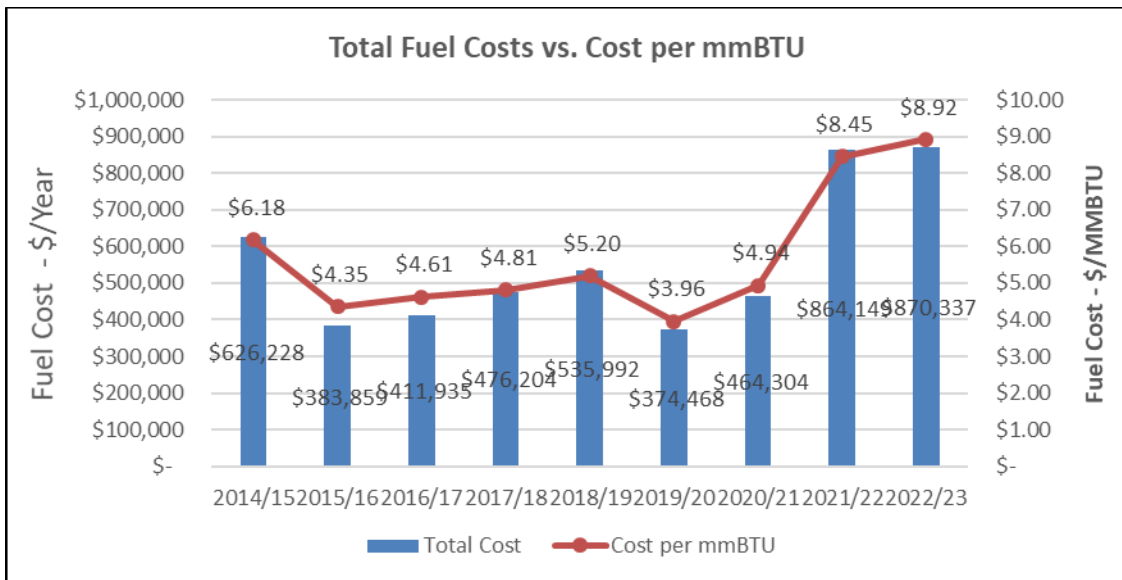


### Fuel Costs

The total cost for the natural gas and #2 fuel oil consumed on Macalester College’s campus in FY 2022-23 was \$870,337. As noted above, Xcel Energy curtailed the College’s use of natural gas during a prolonged cold snap in December.

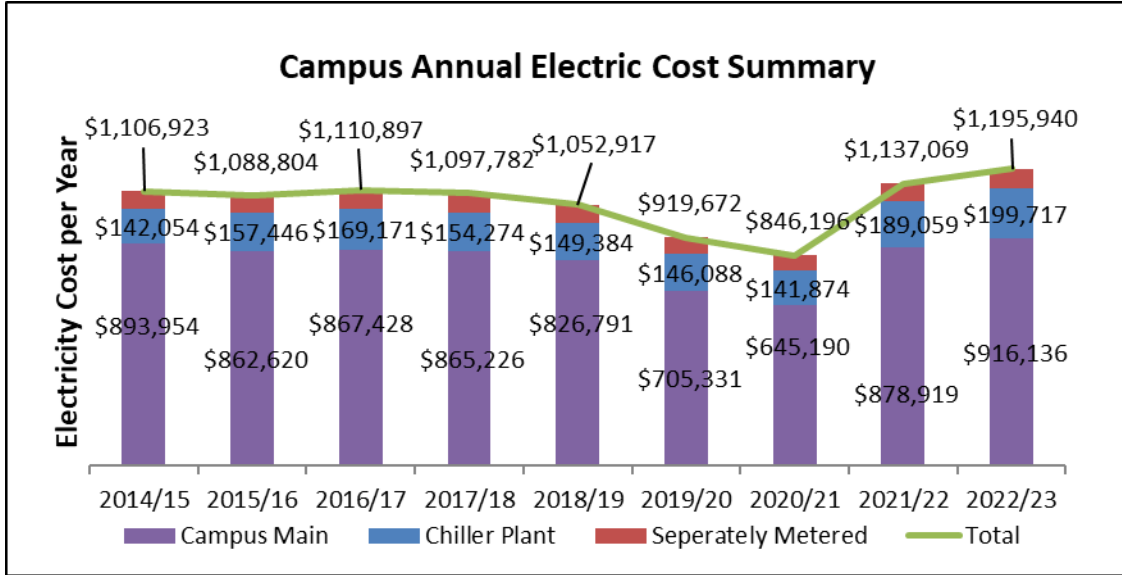


The total amount spent for fuel in any given year is affected by both the severity of the heating season and the cost paid per million BTUs (mmBTU). Since FY 2014-15, the cost paid per mmBTU of fuel has risen to a high of \$8.92/mmBTU in FY 2022-23 from a low of \$3.96/mmBTU in FY 2019-20. In FY 2020-21 Xcel charged \$.403 per Therm compared to \$.866 per Therm in FY 2022-23. That is an increase of 115%.

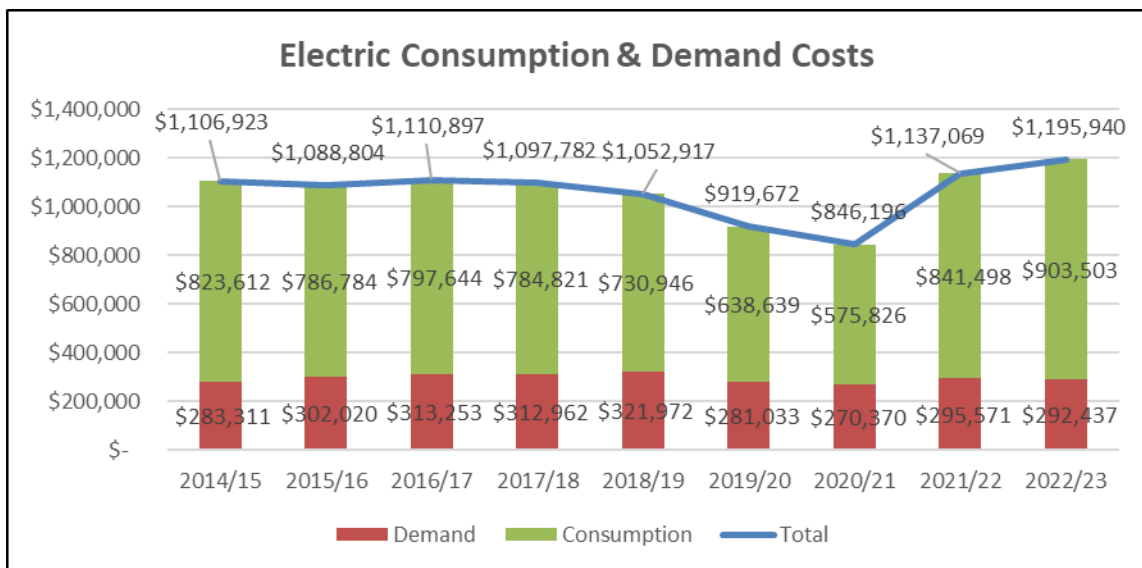


### Electrical Costs

Macalester College spent \$1,195,940 on electricity in FY 2022-23. As stated above, usage is down compared to years before COVID-19, but unfortunately the cost of electricity has been on a climb of late.

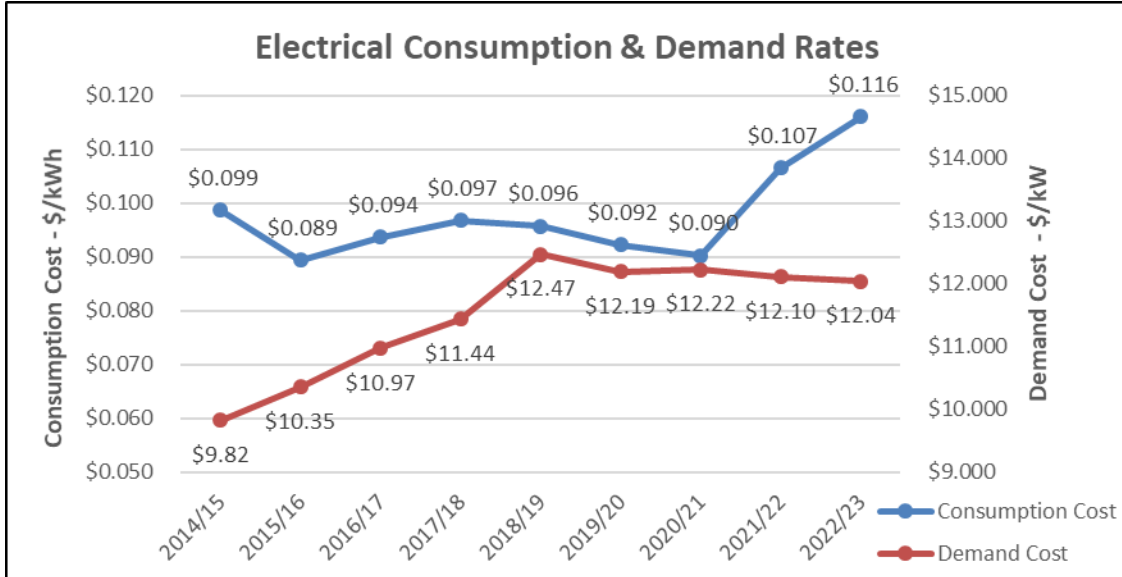


Macalester’s expenditures for electricity include the costs for consumption, measured in kilowatt-hours (kWh), plus the costs for demand, measured in kilowatts (kW). The College pays electrical demand charges for the campus main electric service, chiller plant, and several other buildings on campus that are billed individually. In FY 2022-23 demand charges comprised 24% of the total amount spent on electricity.



Macalester College 2022-2023 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 \$.116 in FY 2022-23, nearly a 29% jump in cost. The rate charged by Xcel per kW of electrical demand has increased from FY 2014-15 but has been slowly coming down to \$12.04/kW in FY 2022-23.



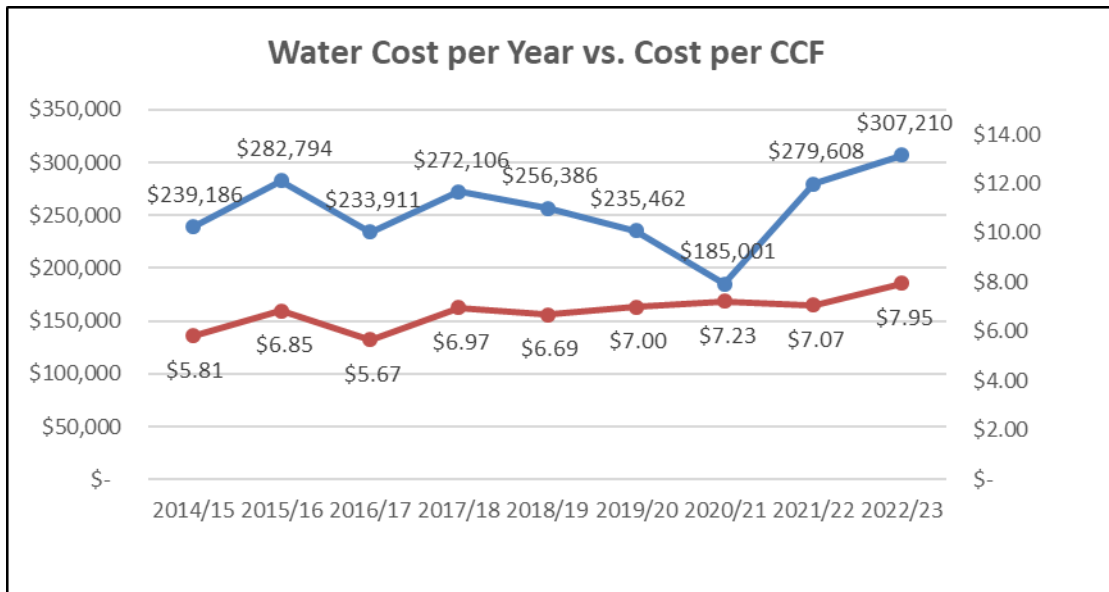
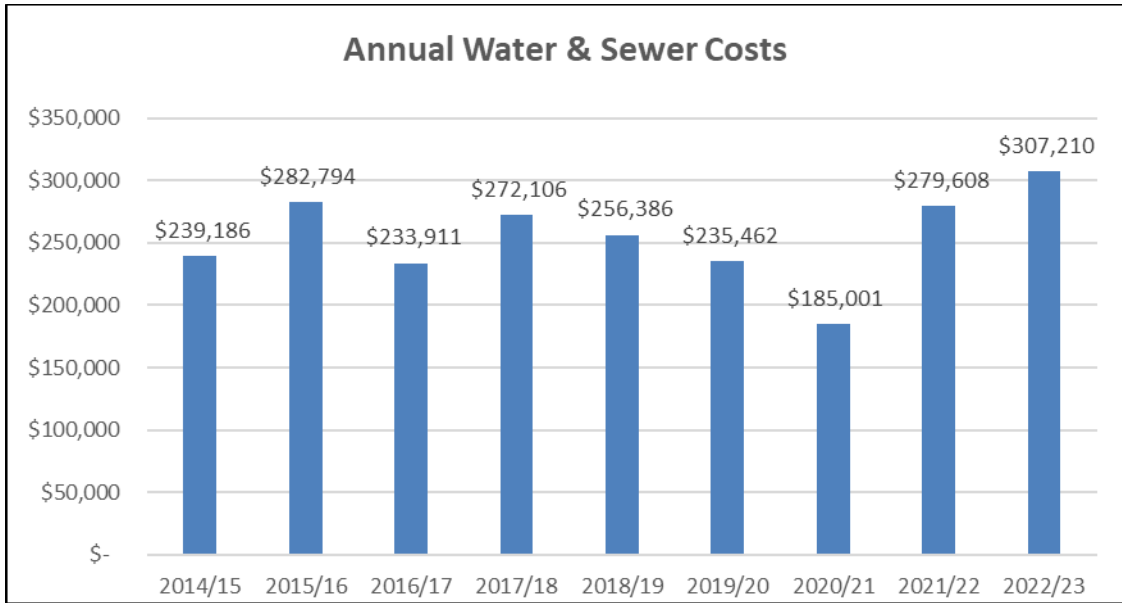
Solar Garden Energy Purchases

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 2022-23, the amount of electricity purchased by the gardens was equal to about 36% of Macalester’s electrical consumption for the year and provided a financial benefit to the College of approximately \$65,000 compared to a benefit of \$51,000 in FY 2021-22 and \$39,000 in FY 2020-21.



### Water & Sewer Costs

Macalester College’s total water & sewer charges in FY 2022-23 were approximately \$307,000. As noted above, usage was in line with previous years before COVID-19. Water & sewer utility rates have been on a steady rise every fiscal year and jumped over 12% since FY 2021-22.




### 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 \$1.4M in a total of (88) energy & water conservation projects, with an estimated financial savings to date of over \$2M.

Macalester College	
TOTAL PROJECTS FUNDED (COMPLETED / IN-PROGRESS)	88 / 0
TOTAL INVESTED TO DATE *	\$ 1,405,740
TOTAL FINANCIAL SAVINGS TO DATE	\$ 2,048,495
TOTAL ENERGY SAVINGS TO DATE	110,545 mmbtu
TOTAL EMISSIONS ABATED TO DATE	19,033 MTCO <sub>2</sub> e
TOTAL WATER SAVINGS TO DATE	3,007,521 gal

Efficiency data powered by  GRITS

\* Includes investments to in-progress projects without savings to date  
Last updated 10/05/2023

### Energy Conservation Projects:

In FY 2022-23 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
    - Old Main
- Electrical & Mechanical Upgrades:
  - Rice/Olin Lab Exhaust Fan Replacement
    - Large exhaust fans on the roof of Rice/Olin that serve all the lab spaces were replaced with new variable speed fans that can be slowed down while still providing the needed exhaust for proper operation. This included new controls to even further aid with energy savings.
  - 77 Mac Boiler Replacement
    - Replaced 25-year-old boilers with new high efficiency condensing boilers.
  - LED Lighting Retrofit Projects
    - Carnegie hall and 30 Mac LED conversions

### O&M Projects:

- Variable Frequency Drives (VFDs)
  - The VFDs serving HVAC equipment in the buildings listed below that were more than 20 years and past the end of their expected service life were replaced by Macalester's Facilities Services staff. Xcel Energy provided rebates of 60% towards the total cost of this work.
    - Kagin Hall
    - Turck Hall
    - Leonard Center
- 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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