



ANNUAL REPORT 2021

Emory University – Campus Services

In 2021, Emory continued to make progress on its 2025 Sustainability Vision goals to reduce energy use per square foot (EUI) by 50 percent and overall energy consumption by 25 percent by 2025. This year brought much change from operating with minimal occupancy because of COVID to a full return of students, faculty, and staff to campus in the fall. From a 2015 baseline, in 2021, Emory achieved an EUI reduction of **15.3%** and a total energy use reduction of **14.1%**. Emory also targets to reduce potable water consumption 50% by 2025 and has made great progress through the seven years during which the WaterHub at Emory has been operating with a current reduction of **29%**. Emory is committed to self-generating 10% of energy needed on campus. Emory currently has a steam turbine generator and on-site solar arrays that have a combined capacity of over **4.2 MW**. In 2021, Emory self-generated **1.5%** of the total electricity used on campus.

For more information, you can access Emory's Sustainability Vision and Strategic Plan at the following web address:

https://sustainability.emory.edu/wp-content/uploads/2018/01/VisionReport2-3-20-FINAL_with-updated-investment-language.pdf

2025 Energy Reduction Goals from a 2015 Baseline

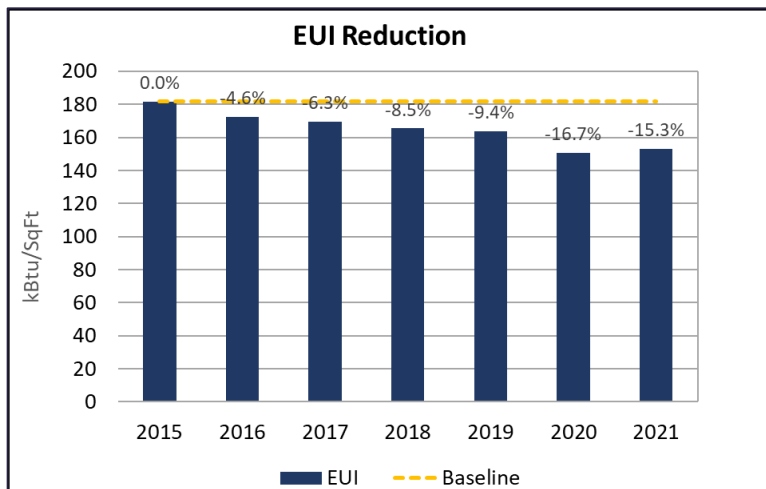
- ❖ 25% reduction in Emory University total energy consumption
- ❖ 50% reduction in Emory University energy use per square foot (EUI)
- ❖ 25% reduction in Emory Healthcare total energy consumption
- ❖ 10% self-generation of energy used on campus to replace fossil fuel sources
- ❖ 50% reduction in Emory Campus total potable water consumption

EFFORTS TO ACHIEVE ENERGY REDUCTION

Energy & Sustainability Initiatives

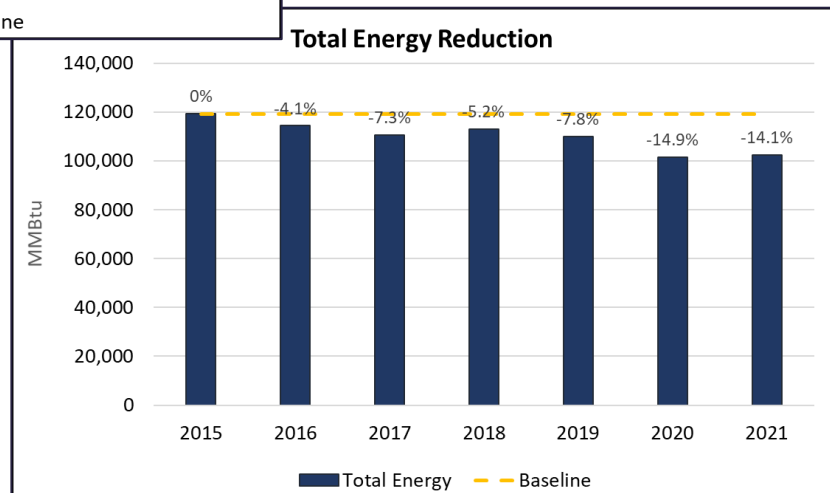
Reaching Emory's ambitious energy reduction goals requires continuous process improvement, innovative energy reduction strategies, and detailed monitoring of building energy performance across campus. There are currently 35 projects identified across campus with a payback of 5 years or less.

Emory is currently making progress to reduce building energy use by 50% and total energy by 25%. The graphs below show our progress to date:



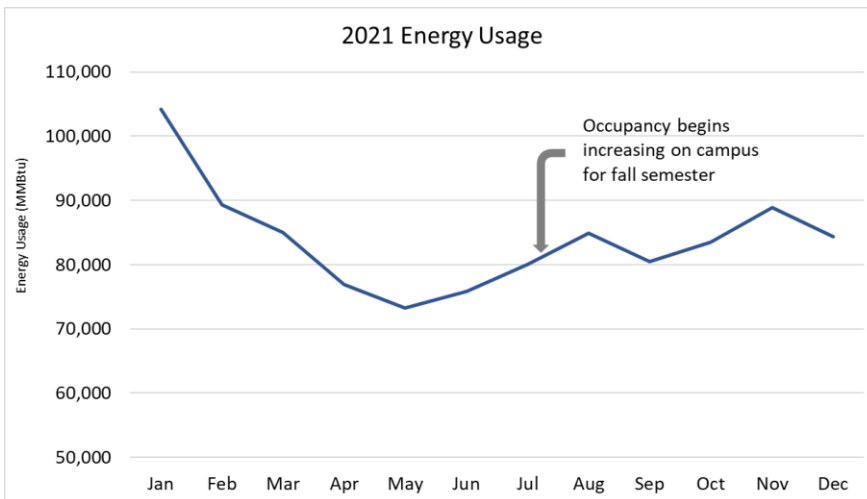
Through 2021, Emory has realized an EUI reduction of 15.3% since 2015

Through 2021, Emory has achieved a total energy reduction of 14.1% since 2015



COVID-19 Impact

The COVID-19 pandemic continued to have substantial and far-reaching impacts to Emory's energy program. Emory's campus returned to near normal occupancy levels with the start of the fall 2021 semester. Emory continued to operate in a minimal campus occupancy cadence until the beginning of the fall semester to help save energy. The Engineering department continued to review setpoints and building management programs to identify issues and



energy savings potential in the buildings. Even as students, faculty, and staff returned to campus, the Engineering team was able to maintain some energy savings due to optimizing systems and resolving issues in building programming while campus was largely empty.

Emory closely followed CDC and

ASHRAE guidelines and recommendations for operation during the pandemic, which included switching to maximum outside air circulation in buildings. This change drove energy usage up in the buildings particularly during the summer months. The mechanical systems now had to respond by increasing the amount of heating and or cooling to achieve desired air temperatures and removing high levels of moisture in the air typical for Georgia's climate.

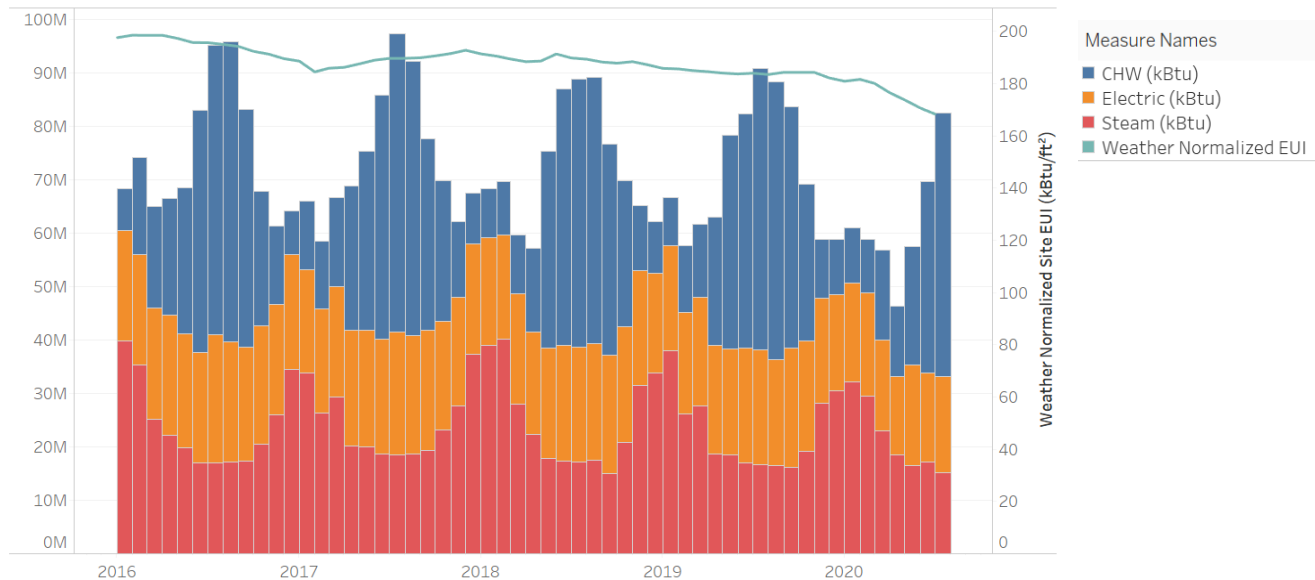
Recommissioning

Emory continues to support in-house commissioning of campus projects, as well as recommissioning of existing buildings. Recommissioning is a strategic process that optimizes existing building systems to return them to their originally commissioned state where possible. Recommissioning is the major driver of the EUI reductions for the University. Emory is using Fault Detection and Diagnostics (FDD) to identify anomalies in equipment and system operation that in most cases can be corrected remotely through the building controls system or in some cases results in required field corrections.

Sustainable Performance Program (SPP)

The SPP is a continuous commissioning program that strives to keep building HVAC systems optimized and prevent performance degradation.

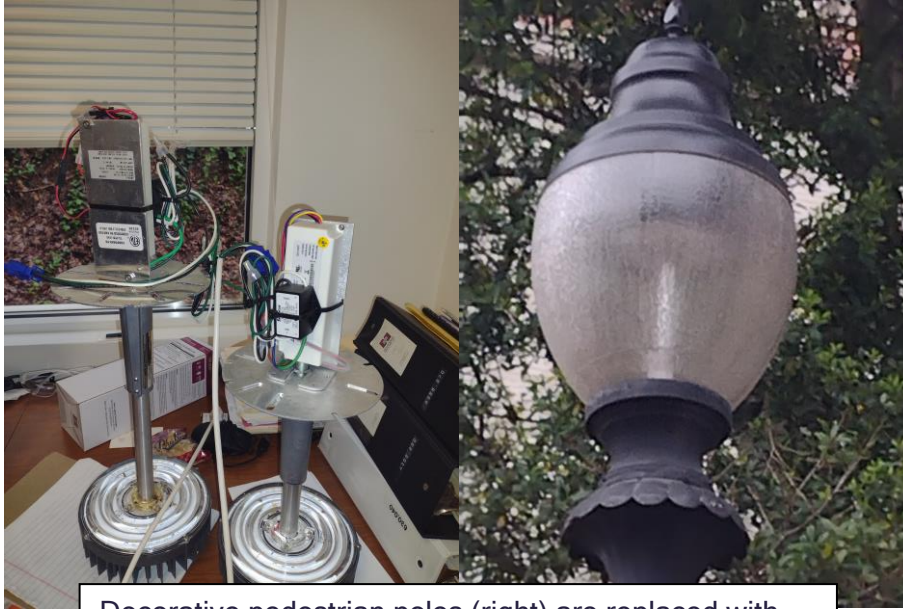
Total Energy vs. Weather Normalized EUI for SPP Buildings



First, buildings are recommissioned to ensure they are operating optimally. At that point they can be added to the SPP program with the goal of maintaining optimal performance over time. FDD software is crucial in identifying issues that arise to maintain that high performance level. In 2021, Callaway South and 1525 Clifton were added to the SPP program, bringing the total to 33 participating buildings. In 2021, because Emory's laboratory buildings are the largest energy consumers, we developed weekly reports on six of the largest labs, which quantify the number of hours. We have been able to reduce these hours by roughly 50%. In total, 2021 saw 336 issues identified and 264 were fixed. These issues can range from programming changes implemented remotely to physical repairs and replacement of mechanical equipment. The chart above is used to monitor the SPP program building's energy usage in Tableau. The Weather Normalized EUI trend line (teal) shows that overall SPP buildings have trended down in energy, exceeding the goal of maintaining a constant energy use profile. The SPP is conserving right at \$2.5M/year in energy costs as compared to a 2011 baseline.

Lighting

Emory continued to install LED lighting throughout the campus as individual projects or part of other renovations. LEDs remain easy low hanging fruit for energy savings which we plan to capitalize on as often as possible.



Decorative pedestrian poles (right) are replaced with LED internal hardware (left)

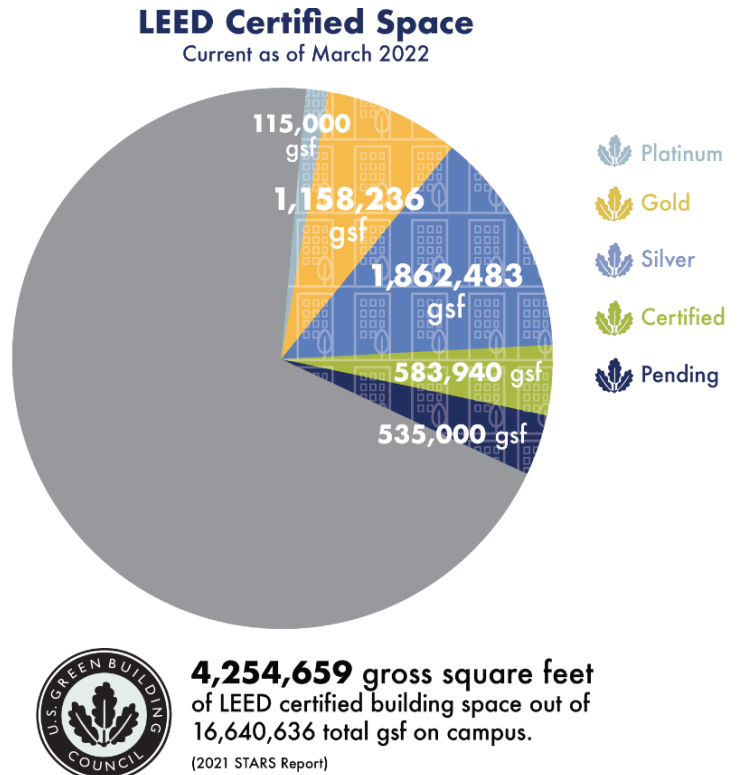
Emory began upgrading exterior pedestrian pole lighting across campus. These LEDs are retrofitted into the existing decorative and high poles which is projected to reduce the energy used by these lights by **77%**. Phase 1 of this project LEDs are installed in nearly every renovation that occurs in building spaces. A

few examples that occurred in

2021 can be found in Center for Rehab Medicine Building, Atwood 5th floor labs, and the exterior of White Hall. Transportation & Parking Services is developing plans to retrofit a few additional parking decks to LED for energy savings. These projects hope to be approved and start construction in late 2022. To date, 8 parking decks have been retrofitted with LED lights over a 7-year period, with savings totaling around **\$890,000** and **12,900,000 kWh**.

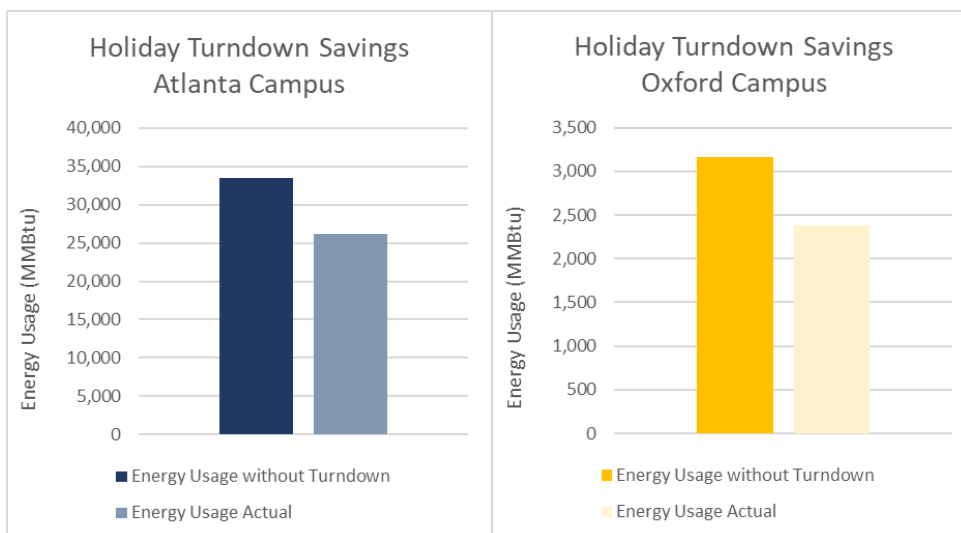
LEED Construction

To meet Emory's long-term energy reduction goals, special attention must be paid to the removal, addition, and renovation of buildings on campus. The minimum design and construction standard for Emory is LEED Silver; however, for most new buildings Emory achieves Gold. Emory's large new buildings under construction, the Health Science Research Building II and the Randall R. Rollins Building, are both on track for achieving LEED Gold. In 2019, the Emory Student Center officially opened its doors boasting a LEED Platinum certification that includes several innovative energy saving technologies such as geothermal heating and cooling, solar thermal hot water heating, and chilled beams to reduce forced air energy.



Holiday Turndown

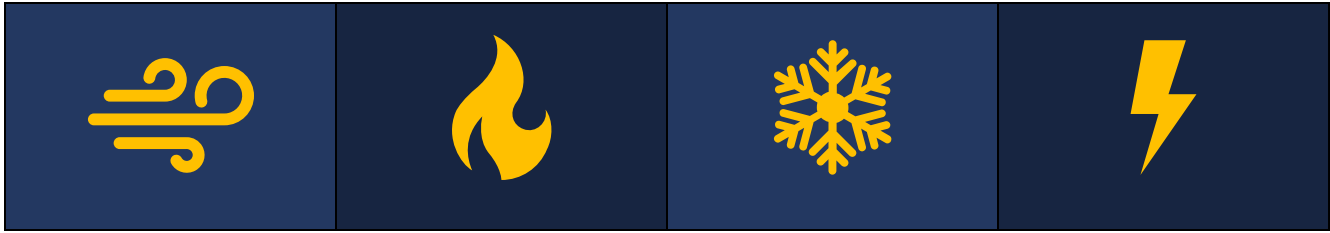
During official University winter holidays, the heating systems in buildings across Emory's campus are programmed to maintain a 55° F minimum set point which helps save energy.



Roughly 45 buildings participated in the holiday turndown to help save energy. Emory's Atlanta campus saw a **22%** reduction and Oxford campus saw a **25%** reduction from adjusting setpoints down. The holiday turndown

managed to save **\$77,000** in utility costs over a 3 week period.

UTILITY OVERVIEW – ATLANTA CAMPUS



Steam

Emory operates five 100,000 lb/hr. steam boilers that consume natural gas and fuel oil when the natural gas supply is interrupted. The boiler plant annually consumes about 786 million cubic feet of natural gas to produce about 693 million lbs. of steam. One of the newly installed boilers operates at 250psi and then drops the pressure through a 1MW steam turbine generator to distribution pressure of 115psi. The steam is distributed underground to 59 buildings on the central campus for space heating, water heating, humidification, and process loads. Steam consumption is metered at every building. Looking ahead, additional alarms and sensors will be added to more quickly detect and address operational issues.



Natural Gas

Southern Company Gas annually delivers approximately 830 million cubic feet of natural gas, purchased through marketers, to the central steam plant as well as directly to some facilities. Emory purchases mostly interruptible gas for the steam plant but has a base load volume of firm gas to provide reliability during high volume days.

Chilled Water

Three main chilled water plants provide cold water for space cooling to numerous buildings through underground distribution systems. There are additional plants in building mechanical spaces that supply chilled water directly to a specific building.



The plants provide annually about 50,000,000 ton-hours of cooling by supplying 42° F water used to cool and dehumidify air entering and circulating in the buildings. Chilled water consumption is metered at each building on the distribution system. In 2021, Emory finalized plans and began the early phase of construction to upgrade chillers in the Michael Street chiller plant that will significantly boost reliability and efficiency for meeting the campus cooling load.

Electricity

In 2021, Georgia Power provided over 250 million kilowatt hours of electricity to the central campus facilities with a peak summer electric demand of about 42 megawatts. Electric power is primarily fed by Georgia Power through two substations and then delivered by the Emory 20kV distribution system. Buildings not connected to Emory's distribution system receive electricity directly from Georgia Power. Electricity consumption is metered by either Georgia Power, directly, or Emory meters at every building.

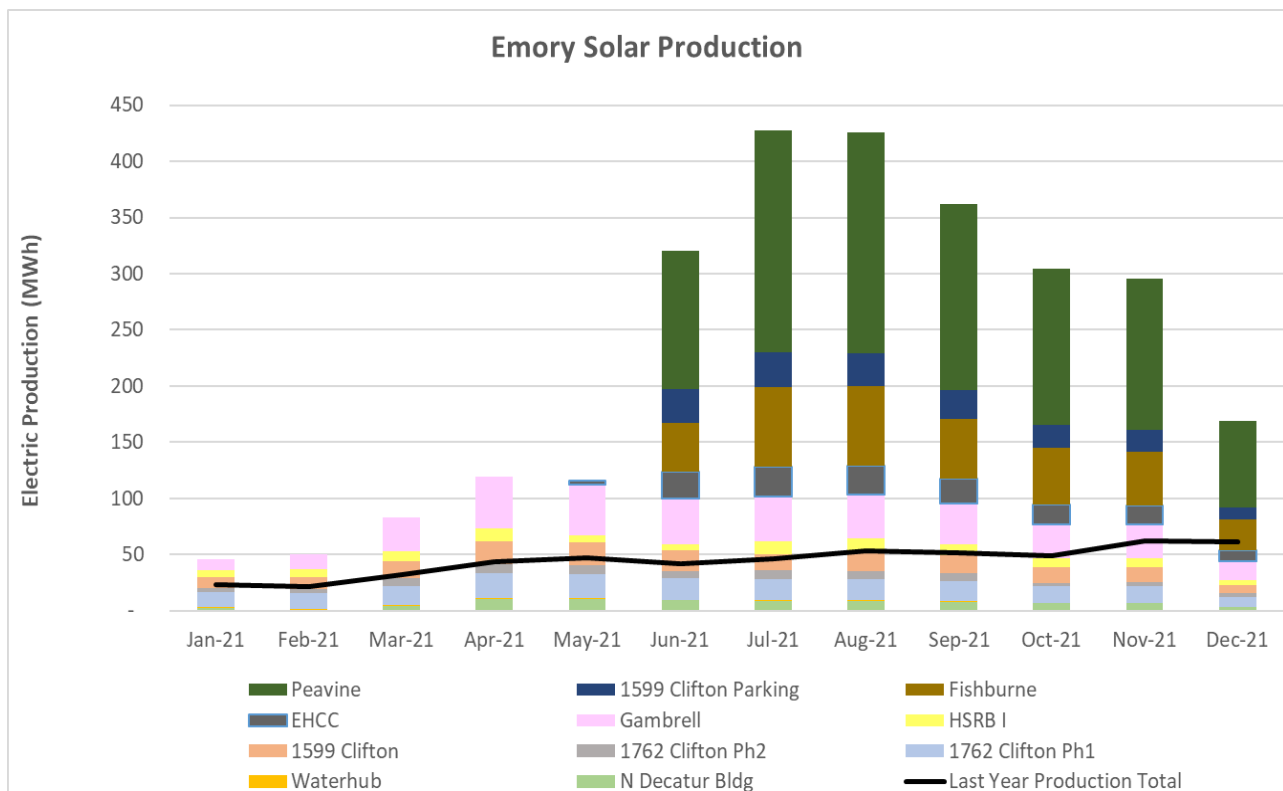


Emory Atlanta campus Oxford Rd Electric Substation

EFFORTS TO ACHIEVE SELF-GENERATION

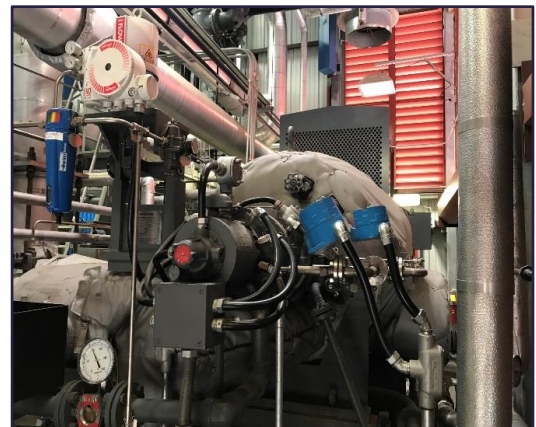
Solar Produced Electricity

To date, Emory has installed eleven solar projects with a combined capacity of **3.2 MW**. 2021 brought a massive increase in on campus solar as 4 new arrays came online. In 2021, Emory's solar projects produced over **2710 MWh** of electricity, a 410% increase over 2020.



Steam Electric Production

In 2016, Emory commissioned a steam turbine generator that was added to the steam plant for electricity generation. This 1 MW steam turbine uses higher pressure steam to rotate a generator that produces electricity. In 2021, Emory generated **1,280 MWh** of power from the steam turbine generator (pictured left).



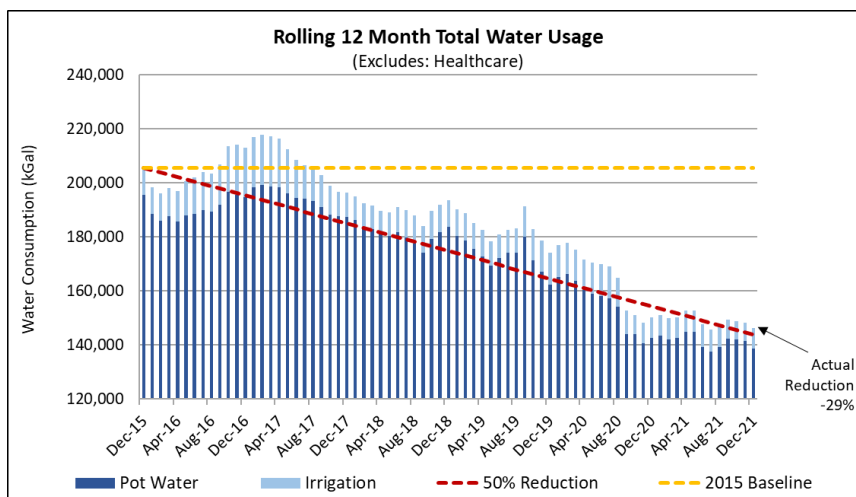
EFFORTS TO ACHIEVE WATER REDUCTION

The WaterHub at Emory

Launched in 2015, Emory's WaterHub is an on-site water reclamation system which utilizes eco-engineering processes to clean wastewater for non-potable use on campus, primarily for utility water make-up and toilet flushing. This water reclamation facility is the first of its kind in the United States. In 2021, Emory's WaterHub displaced over **58 million** gallons of city potable water to Emory's major utility plants, a decrease from the prior year largely due to COVID-19 reductions. The facility provides **75%** of total water sent to cooling towers around campus. Since operations began, the WaterHub has used over 50,700 kWh of solar energy produced from its panels (approximately 6,700 kWh in 2021).



Water Reduction



Emory has a current water reduction of **29%** from our 2015 baseline. The COVID-19 pandemic resulted in having a largely vacant campus which contributed to a drastically lower demand for water used on campus daily. Even with the return to campus, efforts

have been made to keep water usage low. Emory continued the use of smart irrigation technology known as UgMO (Underground monitoring). UgMO uses specialized sensors buried in the soil to detect moisture levels. The system then uses algorithms to determine how much irrigation water is needed to maintain a healthy landscape while minimizing water waste. In addition to smart irrigation, Emory also uses underground cisterns to capture and store rainwater.

**For questions or additional information
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