2019 Annual
Energy and Utilities Report

EMORY
UNIVERSITY

In 2019, 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. From a 2015 baseline, in 2019 Emory achieved an EUI reduction of **9.4%** and a total energy use reduction of **8.7%**. Emory also targets to reduce potable water consumption 50% by 2025 and has made great progress through the first four and a half years operating its WaterHub. Emory is committed to self-generating 10% of energy needed on campus, and currently has installed over **1.36MW** of solar and co-generation.

The 2025 total energy use reduction goal of 25% challenges Emory to reduce energy consumption while also meeting its current building expansion plans. The design and construction standards for new buildings, with a LEED Silver minimum requirement, have contributed to the EUI goal to date. In addition to energy efficiency in new construction, renovations, recommissioning, LED lighting upgrades, Emory's Sustainability Revolving Loan Fund projects, and participation in the U.S. Department of Energy's Smart Labs Accelerator program have all pushed Emory forward toward our ambitious goals.

2025 Reduction Goals:

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

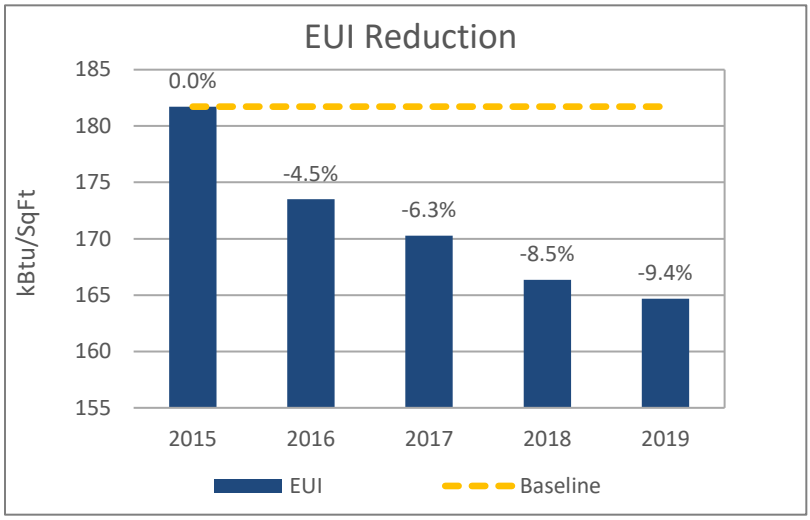
. . . So how do we get there?

Efforts to Achieve Targeted Energy Reduction

Energy & Sustainability Initiatives

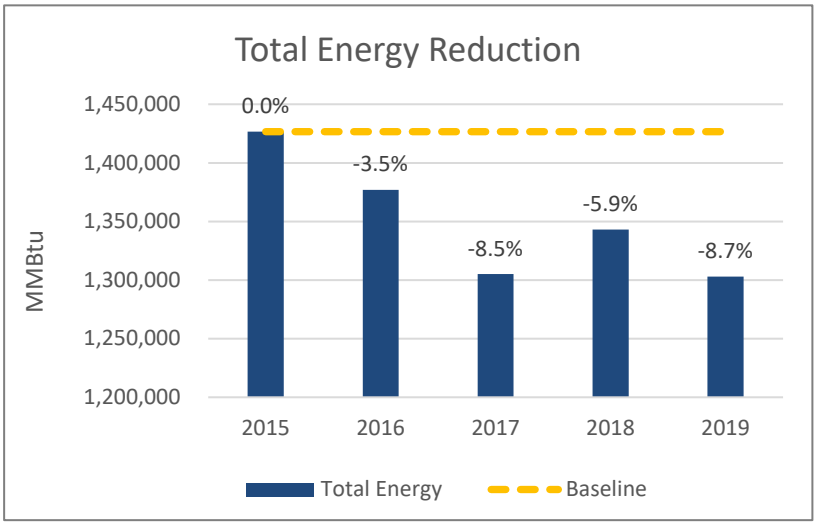
Reaching Emory's ambitious energy reduction goals requires continuous process improvement, innovative energy reduction strategies, and detailed monitoring of building energy performance across campus. A team of Emory University students, faculty and staff continue to identify ways to reduce the energy and water needs of Emory University and engage campus in these conservation efforts. This Energy and Water Task Force keeps a running list of potential energy conservation measures that are continuously evaluated for implementation. There are currently 38 projects identified across campus with a payback of 5 years or less. In 2019, five projects from this list were completed, including the upgrade of fume hoods in the O. Wayne Rollins building to variable air volume and installation of LEDs in the Oxford Road parking deck.

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



Through 2019, Emory has realized an EUI reduction of **9.4%** since 2015

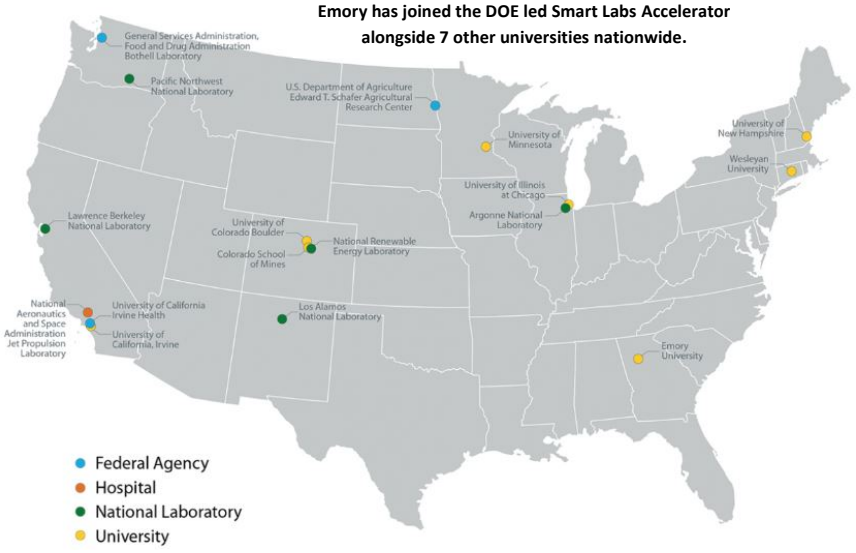
Through 2019, Emory has achieved a total energy reduction of **8.7%** since 2015



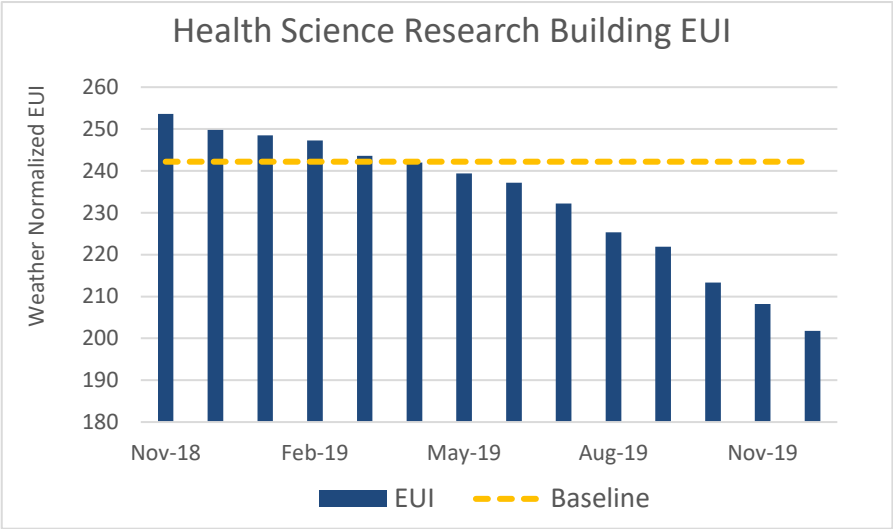
DOE Smart Labs Accelerator

To focus on existing laboratory buildings across campus that have the highest EUIs, Emory joined the Department of Energy's Smart Labs Accelerator program in 2018. Emory works directly with the DOE and other participating institutions nationwide to advance strategies that rapidly improve energy efficiency in laboratory buildings to achieve an overall 20% reduction. As a part of this challenge, Emory and the other participants share strategies and achievements, collectively helping everyone's success in the program. Under this program, Emory has focused on HVAC optimization and utilized occupancy sensors to turn down and turn off select equipment in several lab buildings, including the Health Sciences Research Building. In 2019, Emory won the DOE's Accelerating Smart Labs Award for Program Development and Implementation, presented at the International Institute for Sustainability Laboratories (I^2SL) conference.

Emory has joined the DOE led Smart Labs Accelerator alongside 7 other universities nationwide.

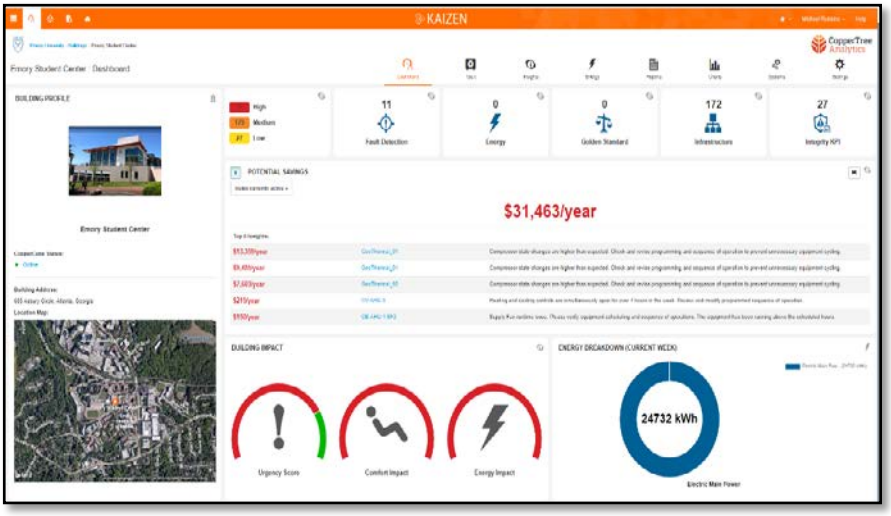


The implemented upgrades in the Health Sciences Research Building included a recommissioning effort that prioritized optimization of air change rates. As a result, this building has reduced its EUI by **16.6%** since the 2017 Smart Labs baseline. Emory is currently working to replicate the savings in the other lab buildings in the program:



- Emory Children's' Center
- Whitehead Memorial Research Building
- Claudia Nance Rollins
- O. Wayne Rollins Research Building
- Emerson
- Atwood

Recommissioning

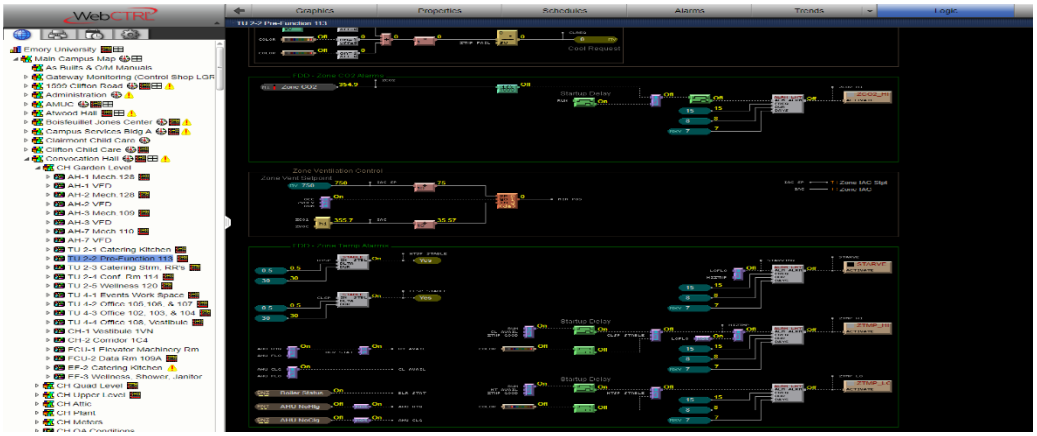


Emory continues to support in-house commissioning of campus projects, as well as recommissioning of existing buildings. Recommissioning is a strategic process that optimizes existing building systems to return them to their originally commissioned state where possible. Recommissioning is the major driver to 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 prevents performance degradation. The program uses the FDD software to aid in maintaining the optimized operation of the recommissioned or newly commissioned buildings. Emory recently began adding all new buildings to the SPP following initial commissioning. Prior to 2019, there were 26 buildings in the program. Three additional buildings were added in 2019.

- Emory Student Center (new building)
- Convocation Hall (recommissioned building)
- AMUC (recommissioned building)



Integrated fault detection and diagnostics at Convocation Hall

Lighting

Transportation & Parking Services continued its LED lighting conversion in 2019 with the Oxford Road parking deck. To date, the total savings for **8** parking deck lighting retrofits is over **$665,000** and **9,100,000 kWh**. The Psychology and Interdisciplinary Studies Building, Math & Sciences Building, and 1462 Clifton Road all received LED retrofits that collectively reduced energy used for lighting in those fixtures by **41%** across the buildings. In 2019, Emory approved plans to upgrade 160 pedestrian light poles and 7 streetlight poles with LED technology, which is projected to reduce the energy used by these lights by **77%**. This project is slated to start mid-2020.

LEED Construction

In order 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 strives to achieve 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.

Renovations

Emory has completed numerous renovation projects with energy reduction and improved occupant satisfaction in mind. Most of the energy savings in these small-scale renovations come from upgrading light fixtures to LEDs. Some of the 2019 renovation projects occurred at Callaway Memorial Building, Eagle Row fraternity houses, O. Wayne Rollins labs, and Clairmont guest apartments.

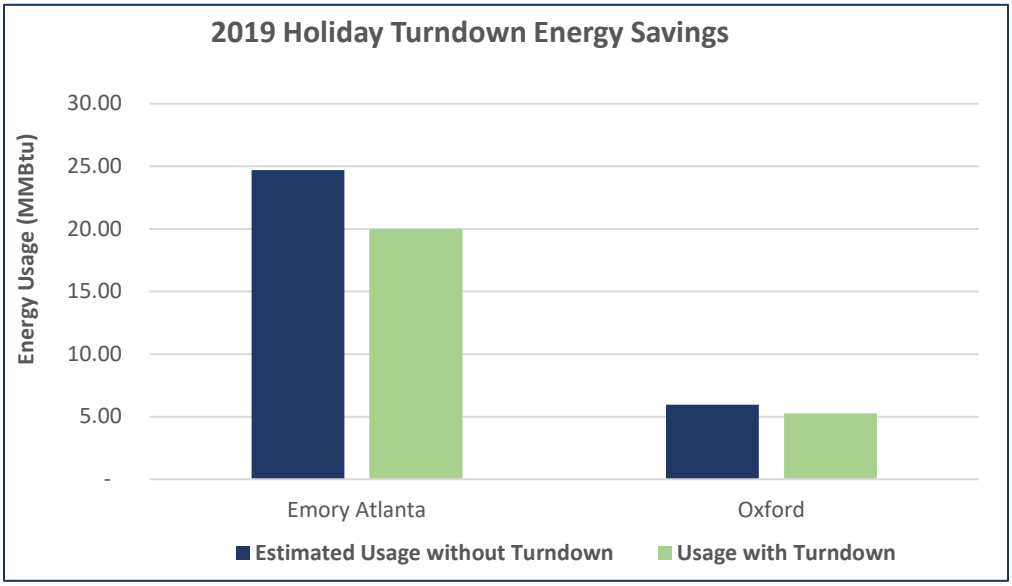
Renovations before (above) and after (right) at Callaway Memorial Building, 5th floor north suite

Sustainability Revolving Fund

Emory's Sustainability Revolving Fund, initially established in 2017 with seed capital from the Kendeda Fund, will continue providing funding for approved projects that reduce energy and water consumption at Emory. Each project is selected with the criteria that it is financially viable, has environmental and or energy benefits, and improves the student experience. In 2019, three projects continued progress and two projects were completed using these funds. Mechanical upgrades were made to the cooling coils in Woodruff Memorial Research building, saving around **$35,000** per year. Fume hoods in O. Wayne Rollins Research building were upgraded to variable air volume on two floors equating to a **$22,116** savings per year.

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 to save energy.



In 2019, HVAC systems in 28 buildings on Emory's Atlanta campus were turned back, which resulted in a **19%** reduction in energy use during the month of December. At Emory's Oxford campus, 38 buildings also received HVAC setbacks which resulted in **12%** reduction in energy usage. In total, Emory saved over **$60,000** in utility costs primarily in just 10 days!

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.

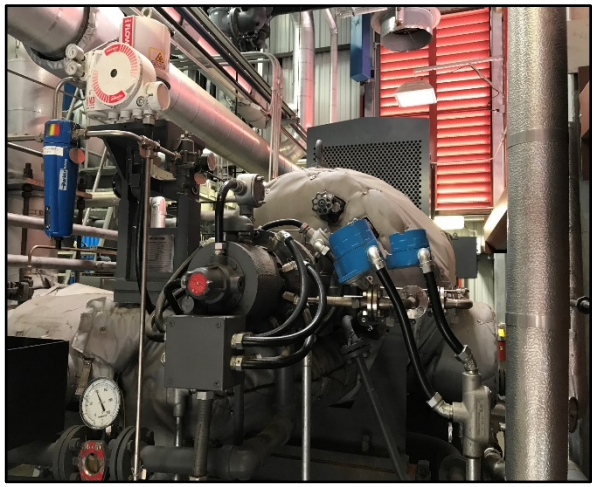
Steam turbine generator

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 chilled water plants provide cold water for space cooling to numerous buildings through underground distribution systems. 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 2019, Emory invested in upgrading equipment at the Quad chiller plant and Michael Street cooling tower and replaced an inefficient chiller at the Clairmont SAAC.



Electricity

Georgia Power provides over 270 million kilowatt hours of electricity annually to the central campus facilities with a peak summer electric demand of about 45 megawatts. Electric power is primarily fed by Georgia Power through two substations and then delivered by the Emory 20kV distribution system. Electricity consumption is metered either by Georgia Power directly or by Emory meters at every building.

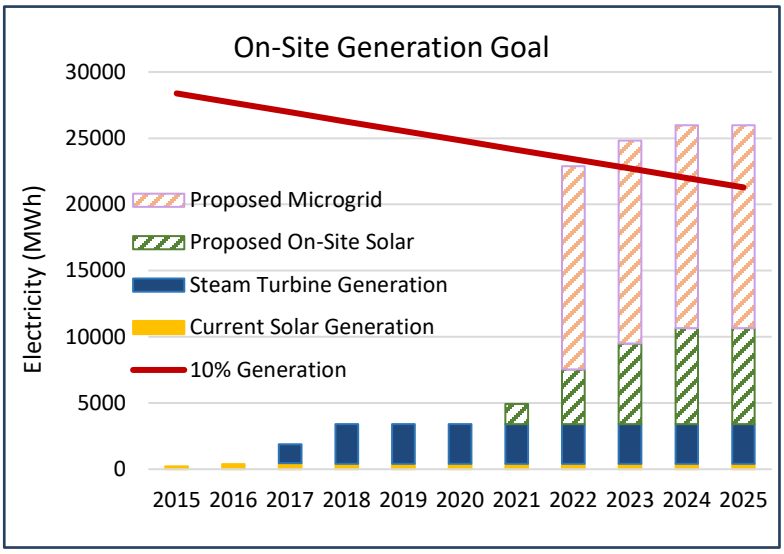
Emory Oxford Rd Electric Switching Station

Efforts to Achieve Targeted Self-Generation

Emory's 2025 Sustainability Vision commits the institution to self-generate 10% of energy used on campus to replace fossil fuel sources and increase campus resiliency. In 2019, Emory generated **3,054 MWh** of electricity from steam and solar production.

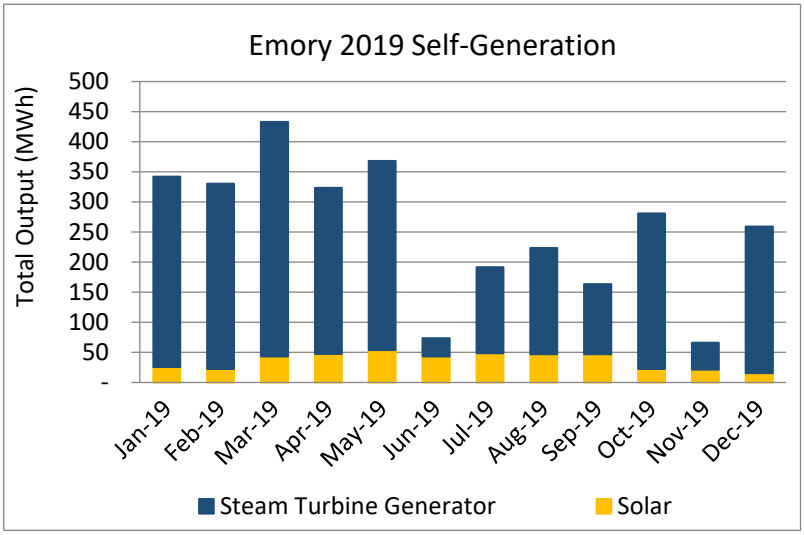
Solar Produced Electricity

To date, Emory has installed four solar projects with a combined capacity of **1.36 MW**. In 2019, these solar projects produced over **438 MWh** of electricity. In 2019 Emory continued to purse a substantial on-campus solar PV expansion project, with over 5MW slated to begin installation in 2020. Emory also continued investigating a 3.5 MW microgrid system that would significantly boost Emory's on-site generation capabilities and resiliency.



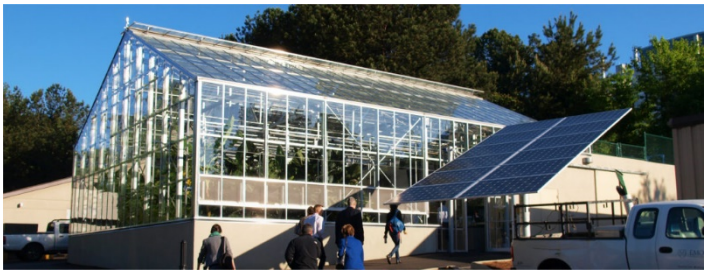
Steam Electric Production

In 2016, Emory commissioned a steam turbine generator that was added into the steam plant for electricity generation. This 1 MW steam turbine uses higher pressure steam to rotate a generator that produces electricity. In 2019, Emory generated **2,616 MWh** of power from the steam turbine generator which equates to approximately 1.2% of energy used on campus.



Boiler 10 that supplies the STG was down in June and November because of unplanned maintenance issues

Efforts to Achieve Targeted Water Reduction

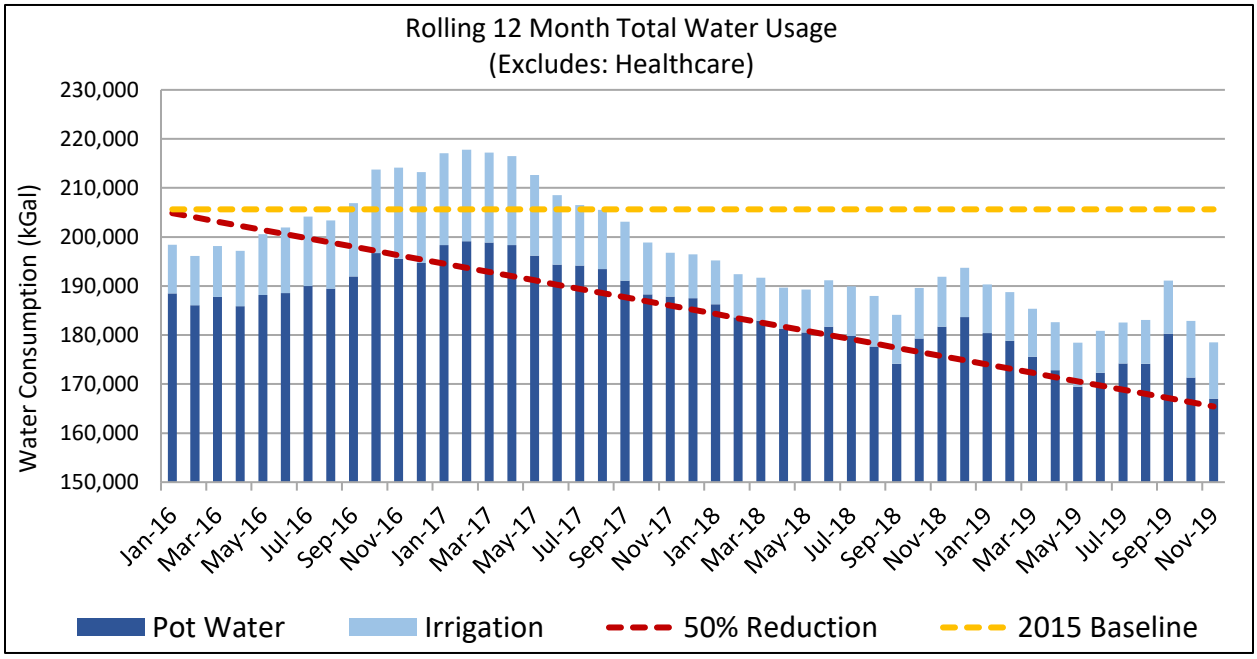


The WaterHub at Emory

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, irrigation, and toilet flushing. This water reclamation facility is the first of its kind in the United States. In 2019, Emory's WaterHub displaced nearly **66 million** gallons of potable water to Emory's major utility plants, providing **75%** of total make-up to cooling towers around campus. Since operations began, the WaterHub has used over 35,000 kWh of solar energy produced from its panels (approximately 7,500 kWh in 2019).

Irrigation

Emory employs 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 uses underground cisterns to capture and store rainwater, which can be utilized for irrigation, thus reducing reliance on water from the utility system. Emory has reduced water consumption **13.2%** since 2015.



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