



# *Efficiency, Scientific, and Sustainability Improvements for Fayetteville State University*

## Challenge

The 2017-2018 academic year saw Fayetteville State University celebrating its 150th anniversary! Founded in 1867, FSU is the second oldest university in the 17-campus University of North Carolina System, and is consistently ranked one of the best educational values in the nation. FSU offers its more than 6,000 students 60 degrees at the baccalaureate, master's, and doctoral levels. FSU students study at the main campus in Fayetteville as well as campuses at Fort Bragg and Seymour Johnson AFB.

Res Non Verba—Deeds Not Words—is FSU's guiding motto. The university administration, faculty, and staff do all they can to live this out through their focus on outstanding education, civic service, and social responsibility. They also encourage their students to live this motto by inspiring them to set high expectations for themselves in their educational, personal, and community lives. FSU is proud of their students, who spend more than 50,000 hours each year helping local organizations

*Guaranteed  
Annual Energy  
Savings \$864,297*



such as public schools, youth clubs, and medical facilities. The impact on students and the community is invaluable.

One of the university's social responsibility initiatives is an aggressive campus-wide sustainability program in which students, faculty, and staff all play important roles. One program priority is the continuous improvement in the university's energy and water use efficiency. In 2011, the university developed an improvement plan for upgrading their physical facilities to address deteriorating and inefficient mechanical equipment and control systems. In addition to providing improved inside environments for students and staff, a key focus of the plan was to extend the school's previously-achieved 30% reduction in energy use to 40% or more.

The university used the State procurement process to solicit proposals from qualified firms. The project was awarded to Brady based on their proven technical expertise and success designing and completing large, comprehensive projects such as the FSU project. The biggest challenge FSU and Brady faced was designing a project that would provide enough energy savings to cover the costs of the improvements.

## Solution

Brady used their expertise in performance-based contracting to design a guaranteed energy savings project that would cost \$10,400,044 to complete and would provide a guaranteed annual energy savings of \$864,297 each year throughout the 17-year performance period. Brady worked with the university administration and facility engineers to design the improvements that would best meet FSU needs and goals.

The project focused on 22 priority facilities identified by the university—facilities with uses as diverse as classrooms, laboratories, a library, an auditorium, and a sports arena. The project included 929,886 square feet of building space.

The improvements were completed in 2014–2016. Examples of the project's upgrades and efficiencies include:

- New chillers and chiller repairs, new condensing boilers, air handler replacements, and cooling tower refurbishing
- Lighting and water system upgrades with energy-efficient components and sensors
- New web-based, open-protocol Tridium™ Niagara AX energy management systems
- Electric and gas sub-meter integration for energy trending
- New digital HVAC controls
- Retro-commissioning of HVAC systems and controls
- New high efficiency motors and variable frequency drives for air handlers and pumps
- Building envelope weatherization to reduce exfiltration of conditioned air and reduce thermal bridging

One major component of the project was the construction of a central utility plant (CUP) in the West Campus area to provide improved heating and cooling at 10 buildings. The CUP was configured to fit in the basement mechanical room of the Lyons Science Annex, thus precluding the need to construct a new, separate building to house it.



The new CUP replaced inefficient chilled water and hot water systems with new high-efficiency systems and controls. Design features of the new CUP include:

- A variable primary system with new plant primary pumps and removal of all existing chilled water and hot water pumps.
- A 16°F chilled water supply and return temperature differential maintained with 2-way pressure-independent control valves (PICV) on all connected chilled water coils.
- An existing 425 ton chiller coupled with two new 250 ton chillers and a new 250 ton centrifugal chiller with adaptive frequency drive (AFD).
- Three new 1,000 MBH gas-fired high-efficiency condensing boilers coupled with an existing gas-fired boiler.
- High-efficiency condensing boilers staged based on load, and the existing boiler only operating during periods of peak load.

Brady and the university also embraced a second unique design challenge: upgrading the HVAC system and controls at the Lyons Science Annex. The Annex houses several science laboratories that require precisely-controlled inside environments as well as air flow controls for laboratory vent hoods. Brady worked with the facility engineer and scientists to design the upgrades, including:

- Moisture eliminators at air intake points
- Reduced airflow in vent hoods to a face velocity of 70 fpm
- Vent hood occupancy sensors to reduce face velocity
- Lab occupancy sensors to reduce ACH

to 2

- Air handler conversion to variable air volume (VAV) to greatly reduce the amount of exhaust produced

## Results

FSU has been operating all of their new systems since April 2016 and enjoying the many benefits of the improvements. The students, faculty, and staff now have a more consistently comfortable learning and work environment. The university's science faculty and students are enjoying the precisely-controlled HVAC parameters needed to successfully conduct their research.

The university realized energy savings of \$1,010,415 during Year 1—that's 17% more savings than initially projected. Add the \$77,207 of savings in O&M time and costs, and the total annual savings is even greater. Based on these Year 1 savings, the projected 17-year savings is more than \$17 million. The total project cost was \$10,400,044, so FSU will have extra savings to cover financing interest or other needs.

The university is also making great strides toward their sustainability program goals. The Year 1 resource conservation achievements include:

- Electricity: 10,620,392 kWh
- Natural gas: 324,321 therms
- Water: 3,203,000 gallons

Comfortable classrooms, precisely-controlled science labs, energy savings, and environmental stewardship. Brady—proud to be a part of the continued success of Fayetteville State University!

