University of Texas - Austin Optimization Case Study

OPTIMUM ENERGY

Enduring partnership delivers innovation, efficiency and energy savings

TEXAS
The University of Texas at Austin

Austin, TX

Higher Ed
Industry

15+
Years with Optimum

72,000 Tons
CO_2 Prevented per Year

3.7 M
Square Feet Added (2009-2019)

Project Details & Scope

Chilling Stations: 5 stations (CS3–CS7), 63,000 tons total capacity

TES Tanks: Two tanks – 4.33M gal + 5.33M gal = ~22,000 tons over 4.6 hrs

Chilled Water Production: 146 million ton-hours

Peak Cooling Delivered: 37,534 tons

Conditioned Space: 19.6 million sq ft

Cooling Hours: 8,760 hours/year

Control System: Allen-Bradley PLC + OptimumLOOP® + OptiCx®

Pre-Optimization: 0.79 kW/ton

Post-Optimization: 0.59 kW/ton

Electrical Energy Savings: 29.2 million kWh/year

Peak Load Reduction: 4.2 MW

CO_2 Reduction: 72,000 tons/year

Executive Summary

To meet campus growth needs, the University of Texas at Austin has found that it's far more economical to be more efficient than to invest in new power production capacity. Working in partnership with Optimum Energy, UT has achieved what seemed impossible: reducing the chilled water system's overall energy usage even as the campus grew significantly.

Efficiency improvements began in 2007, when Juan Ontiveros, UT's associate vice president for Utilities and Energy Management, partnered with Optimum Energy to optimize Chilling Station 6 (CS6) using OptimumLOOP® and the OptiCx® platform. OptimumLOOP® uses patented power-based relational controls to dynamically adjust flows and condenser water temperatures—bringing cooling cost as low as 0.3 kW/ton in the winter and improving campus efficiency from 0.79 to 0.72 kW/ton.

Challenge: Gaining Efficiency from an Already Efficient System

One challenge was the physical hydraulic constraints affecting flow in the campus' chilled-water distribution loop. Using a real-time hydraulic flow model, the two teams added new instrumentation and a coordinated multiple-plant pumping algorithm, with Optimum engineers using CS6 to control system differential pressure and the other chilling stations to control flow. "It really worked—it started to drop our kW/ton," says Ontiveros.

The model also revealed the system was over pressurized; pumping too much water created false building loads and excess steam to compensate. Running at 8 psi differential at peak and 2 psi in winter cut 1,500 hp of pumping energy and dropped campus ton-hours and steam usage.

Finally, better visibility into the campus loads via OptiCx® enabled raising the chilled water temperature up to 44 degrees F. based on real-time conditions—historically, it was 39 degrees year-round. Campus efficiency further improved from 0.72 kW/ton to 0.63 kW/ton.

Going the Last Mile: Predictive Thermal Energy Dispatch

Thanks to their long partnership, Optimum and UT engineers could think differently about how to boost the efficiency of a system already operating at peak performance. Could Optimum Energy develop a solution that would use power generation data and the weather forecast to predict how to dynamically handle cooling and optimize thermal energy storage capabilities? Optimum engineers believed it would work.

On very hot days, the load could go from about 40 MW low to 65 MW in a short time. But if the system knew ahead of time how much stored water to discharge during the day, that should make it possible to flatten the curve.

Optimum first captured historical plant data and weather data going back 3 years to include the range of seasonal conditions and other variables affecting campus power production. Using OptiCx®, the team built an automated control strategy that uses weather forecast information to determine power requirements for the entire campus 48 hours in the future.

The team also had to solve for balancing the loads on the combined cycle pairs of a combustion turbine (CT) and a steam turbine (ST). Running the turbines higher at night improves efficiency, and lowering the daytime peak creates capacity for the campus to grow. So OptiCx® raises the cooling load at night, running the most efficient chillers to charge the tanks; during the day, it discharges the stored chilled water and continues to run the most efficient chillers while keeping backup machines on standby.

"It's been very surprising," says Ontiveros. "We were used to seeing differential loads of 20 MW; now it's 4 or 5 MW. Our goal is to get it totally flat to base-load the CTs, which reduces stress on the machines as well as improving efficiency."

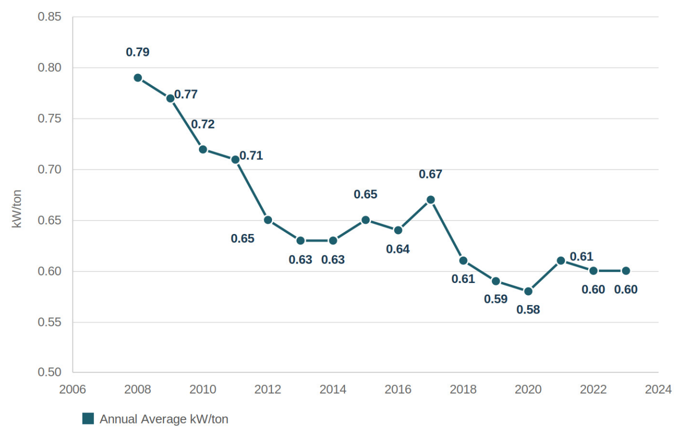
> ***"The secret to our success is having the right balance of plant equipment, marrying that with the optimization and dispatching opportunities Optimum provides, and doing it in a way they don't compromise or fight each other. When they do good, we do good."***
>
> **— Juan Ontiveros, Associate Vice President for Utilities & Energy Management, UT Austin**

Result: Savings That Defy Expectations

Collaborative problem-solving and Optimum's dynamic solutions paid off. Overall annual chilled water plant energy use is 0.59 kW/ton. Total annual power plant operating efficiency is 88.59%. Since 2008, the chilled water production's overall energy use has remained flat, despite the addition of 3.5 million square feet of buildings.

"We're now using the same amount of energy we did before we added CS7," says Ontiveros. "And we reduced our fuel use. You're not supposed to be able to do that."

Compared to the baseline year of 2008, Ontiveros has seen savings of 29.2 million kWh/year, a 4.2 MW peak load reduction and an annual CO_2 emission reduction of 72,000 tons.



Project Benefits

- Energy savings
- Reduced electrical demand
- Reduced water consumption and water treatment costs
- Cost savings
- CO2 emissions reduction
- Improved equipment life
- Improved resilience
- Time savings for equipment maintenance
- Reduced plant operator stress

"I think we both have learned a lot," says Ontiveros. "Together, we take a very methodical approach. And Optimum also forced us to become almost religious about accurate data." The UT Austin partnership demonstrates what's possible when a university commits to a long-term optimization strategy—continuously pushing from basic chiller optimization to predictive thermal dispatch, proving a campus can grow significantly while keeping its energy footprint flat.