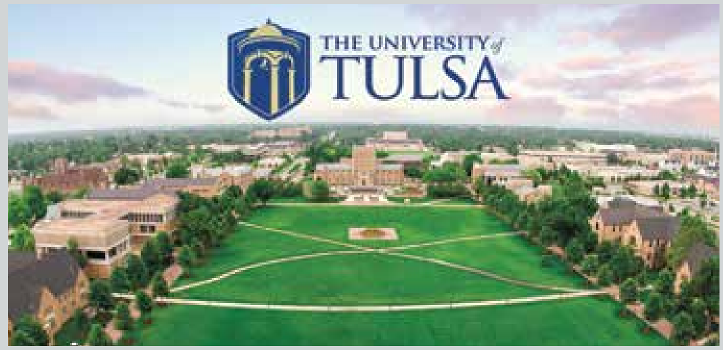
Case Study:

University Scores Big Savings with Chiller Optimization

SMART energy OPS® OPERATIONS PERFORMANCE SERVICE

Hudson Technologies Global Energy Services installed SmartEnergy OPS™ in May 2012 on six chillers that serve The University of Tulsa (TU) campus. A seventh chiller was added to SmartEnergy OPS™ September 2014, to provide a total system cooling capacity of 7000 tons. Benefits of SmartEnergy OPS™ in the chiller plant system operations, maintenance and reliability have been significant. In the third year of operations with SmartEnergy OPS™, TU reduced its kW/ton by 25% from the baseline, with annual savings of $51,000.

SmartEnergy OPS™ identified that critical maintenance actions were needed to prevent failure and unplanned shutdown of three of the seven chillers from a plugged heat exchanger inlet. If not corrected, this situation could have resulted in the disruption of an unscheduled shutdown and an expense of $300,000 to restore the chillers to their design condition.



Customer

The University of Tulsa (TU) is a private educational institution founded in 1894 on 200 acres in Tulsa, Oklahoma. In 2014, the campus served more than 4,500 students and employed more than 1,200 faculty and staff. The Physical Plant manages the campus utilities and facilities, which is comprised of more than 100 buildings, including classrooms, labs, residence halls and sports facilities, as well as Gilcrease Museum.

The university is mindful of the impact that new construction has on its energy footprint. As TU grows, administrators want to ensure that their utility infrastructure is as efficient as possible and supports their sustainability initiatives. Managing peak load and optimizing energy usage is a cornerstone of these efforts.

Challenges

Before implementing SmartEnergy OPS™, TU faced many challenges familiar to other organizations seeking to improve chiller system operations. They had two legacy automation systems that did not collect or interpret the data needed for continual performance improvement. Their existing monitoring equipment did not provide accurate temperature data necessary for Fault Detection and Diagnostics, making system optimization difficult.

> **“Over the past five years, TU has had a 17% increase in load, based on the square footage of new buildings. Yet we’ve seen less than a 1% increase in total energy usage. Because our central chiller plant is our biggest energy user, optimizing its operations is our first line of defense.”**
>
> *Michael Bolien*
> *Manager of Central Plant Operations*
> *The University of Tulsa*

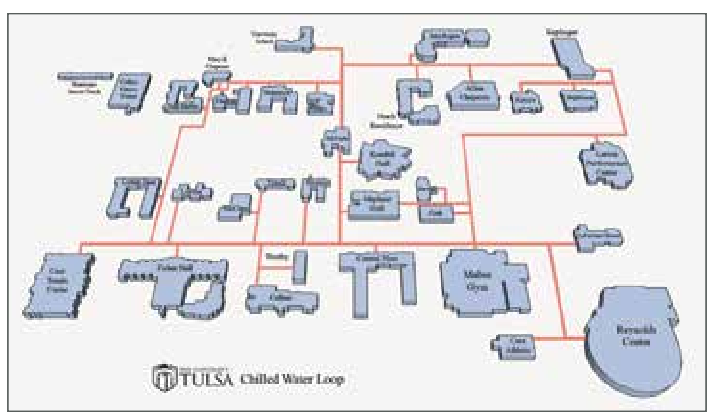


Figure 1: Chilled Water Loop

Solution

SmartEnergy OPS™ brought a comprehensive set of solutions together that addressed these challenges. First, calibrated sensors were installed that collect the data required for managing chiller system performance. Second, data were collected from March 2012 to October 2012 to establish an accurate operating baseline (kW/ton). The data were analyzed by the SmartEnergy OPS™ proprietary algorithms and reviewed by the Hudson energy engineer assigned to the site. The accurate data, software engineering analysis and the Hudson energy expertise were the basis of the recommendations for the chiller system operating improvements. Finally, university staff was trained on using SmartEnergy OPS™, which supports continual system improvement.

Recommendations for system improvement have been implemented by TU, with assistance from the Hudson Technical Account Manager. Implemented projects have included chiller sequencing, cleaning heat exchanger bundles, reducing Entering Condenser Water Temperature and load balancing.

SmartEnergy OPS™ provides the information needed for a least-cost preventative maintenance program. For example, a 1000 ton water-cooled chiller was operating at an average efficiency of 0.686 kW/ton, as shown in Chart 1 below.

Using the Continuous Part Load Value (CPLV) curve developed for this chiller and SmartEnergy OPS™ diagnostics, Hudson recommended heat exchanger tube brushing[1]. After cleaning, the chiller achieved an average efficiency of 0.497 kW/ton, shown on Chart 2. This translates into cost and energy savings of almost 27% for this chiller.

SmartEnergy OPS™ identified that critical maintenance actions were needed to prevent failure and unplanned shut-down of three of the seven chillers. If not caught early, the plugged heat exchanger inlet could have led to the unplanned shut-down of 42% percent of the chiller system capacity, resulting in unscheduled chiller system downtime and a disruption to the university's functions. And it would have cost an estimated $300,000 to restore the chillers and fluids to their design condition.

Overall, the benefits of SmartEnergy OPS™ have been significant:

- **Real-time chiller performance data provides management with the information they need to take action.**
- **Operators see real-time cost impacts of changes to load, condenser water temperature, and tube efficiency.**
- **Verified cost savings help justify future improvement projects.**
- **Preventative maintenance avoids unscheduled down-time and big repair expenses.**

In the third year of operations with SmartEnergy OPS™, TU reduced its kW/ton by 25% from the baseline, yielding annual savings of $51,000.

1 For more on CPLV, see *Calculated Part Load Value Essential to Optimizing Chiller Performance* at http://www.hudsontech.com/global-energy-services/tech-briefs/.

Chart 1: Impacts of Heat Exchanger Fouling on Chiller Performance

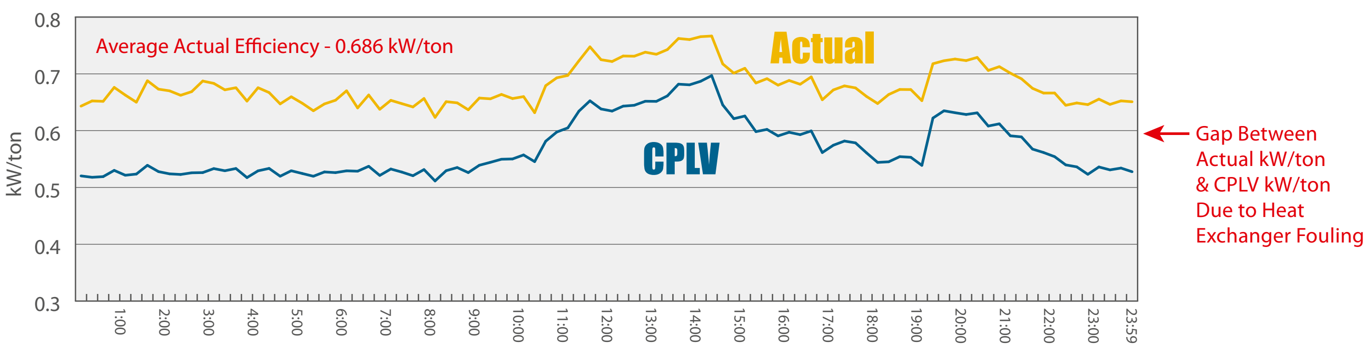


Chart 2: Chiller Performance After Heat Exchanger Cleaning