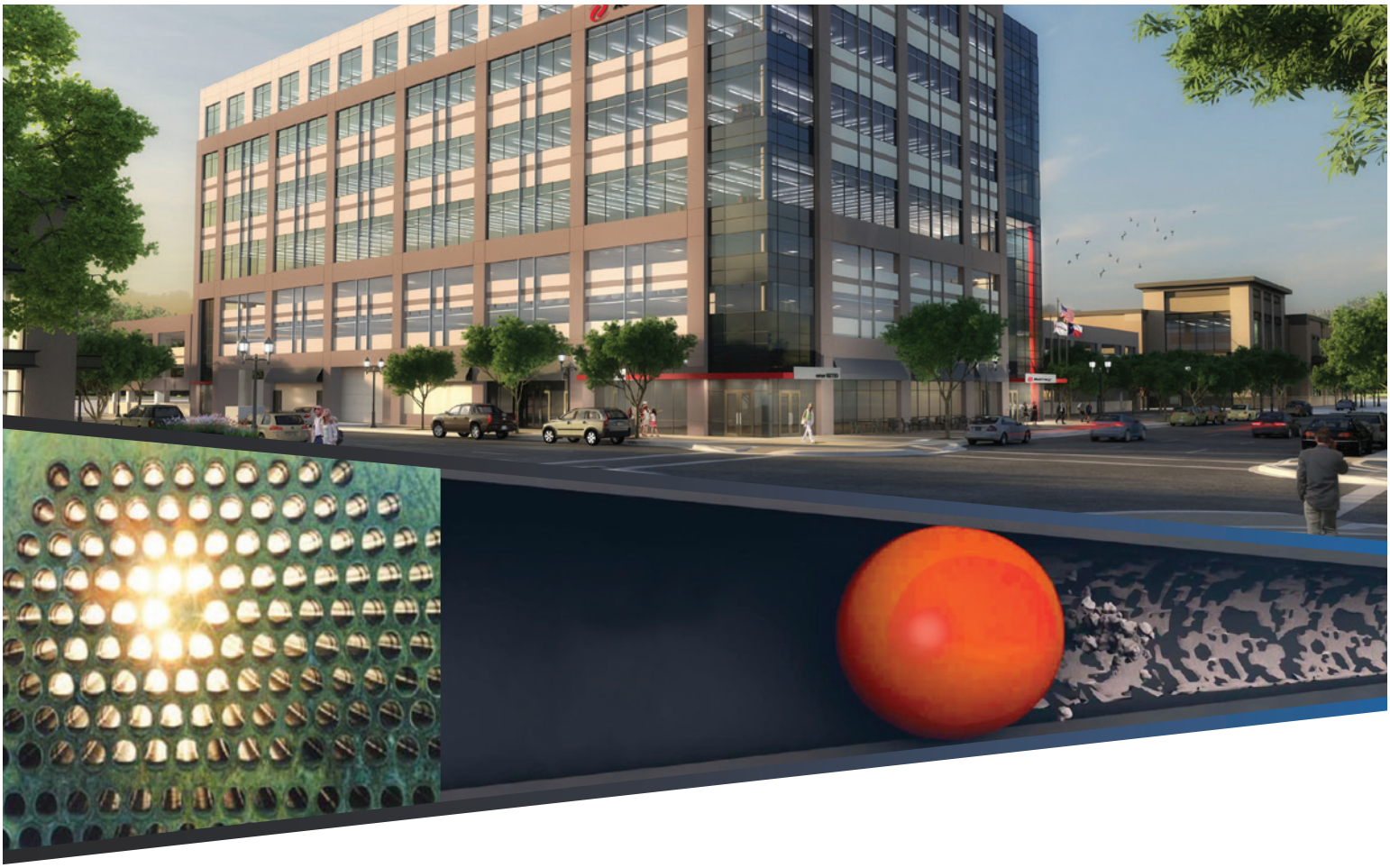
Simple, continuous heat exchanger cleaning

AN INNOVAS TECHNOLOGIES® CASE STUDY

Xcel Energy



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INNOVAS TECHNOLOGIES

INTRODUCTION

Xcel Energy is one of the largest combined electric and natural gas utilities in the country and is a recognized industry leader in delivering renewable energy and reducing carbon and other emissions, efforts that put the company on a path to a more sustainable energy future. Specifically, Xcel Energy provides power generation and district cooling services in 8 states in the western, southern and midwestern US. Capable of generating over 17,000 MWs of power, Xcel Energy serves over 3.3 million electricity customers and over 1.4 million natural gas customers throughout its service area. Also, Xcel Energy provides district cooling in Colorado. Xcel Energy is a highly innovative company as demonstrated by its announcement in 2018 that it aspires to deliver 100% carbon- free electricity to customers by 2050—the first major US utility company to set such an ambitious goal. Mike O'Malley, embracing Xcel Energy's commitment to sustainability excellence, found an opportunity to significantly improve chiller efficiency in the district cooling plant he manages in Denver, Colorado. Mike's knowledge of the negative effects of condenser tube fouling and his search for a method to improve chiller efficiency led him to Innovas Technologies for the solution.

CHALLENGE

As is so often the case, adopting innovative technology requires a high degree of evaluation and consideration regarding a new approach's impact. In Xcel Energy's case, Mr. O'Malley knew there was room to improve chiller efficiency through tube fouling management. Subsequently, Mike served as the thought leader for integrating the Helios Tube Cleaning System® onto a single 2,500-ton chiller for a seasonal evaluation. The plant has excellent data acquisition systems and in Mike's opinion, it would be easy to determine the impact of the Helios installation over the course of a complete cooling season.

In Xcel Energy's case, the biggest challenge was freeing capital funds to purchase a Helios TCS on a short notice. Mike O'Malley was successful in finding a funding opportunity and was able to program in the new system. Once funded, the evaluation was enacted. Mike understood the large potential savings and was the key leader in getting the program started.

SOLUTION

Installed on a 2,500-ton chiller in the downtown Denver Central Cooling Plant, the Helios Tube Cleaning System® was run throughout the normal cooling season in 2018. Chiller operation and performance data was recorded from the same chiller from 2017 before it was equipped with the Helios. As the data demonstrate, the Helios Tube Cleaning System® significantly improved chiller efficiency and increased chiller cooling output during the 2018 cooling season.

THE LESSON

The lesson continues to be reinforced at Helios Tube Cleaning System® installations throughout the country. As previously stated, when the tubes on either side of a chiller remain clean and free of fouling, the chiller efficiency improves and operating costs reduce. This is a generally well-known fact, but it is sometimes hard to quantify. In Xcel Energy's case the savings are solidified by the data and equate to a solid payback. Most organizations ask the same question, "We believe the data at the other facilities, but how much will the system save us at our organization?" The answer can usually be found by analyzing the historical chiller operations data. Assuming the data is supplied by reliable/calibrated sensors, the approximate cost of fouling-related inefficiency can be identified. Once the data is analyzed a consistent truth is exposed. No facility using water-cooled chillers is immune from fouling-related loss. None. Until now.

While typical chiller tube-fouling losses will vary from place to place based on the quality of the water source, local air quality, and water treatment programs, the growing data collection from chillers operating with Helios systems confidently suggests a savings of 6% to 10% in energy expense at over 70% of locations. The remaining 30% is split equally with half experiencing efficiency losses above 10% and half below 6% savings opportunity. How far below? The lowest potential efficiency improvement in an evaluated chiller has been 3.5%. Its payback was still under 3.5 years. With the introduction of the Helios Tube Cleaning System®, the tube fouling-related waste can be completely eliminated.

RESULTS

Consistent with the results from other installations, the chiller showed immediate results after Helios installation, even with a sophisticated water treatment program already in place. In 2017, prior to installation of the Helios system, the chiller ran consistently less efficiently than it did in 2018 after the installation of the Helios. As demsontrated in **FIGURE 1**, with a Chilled Water Supply Temperature (CHWST) of 38F and Entering Condenser Water Temperature (ECWT) of 75F, the chiller efficiency improved by an average of 9%. When the ECWT increased to 80 F, as shown in **FIGURE 2**, the average chiller efficiency improved by 12%. Additionally, the chiller cooling output capacity increased due to improved heat transfer, with the chiller producing as much as 200 tons of additional cooling as shown in **FIGURE 3**.

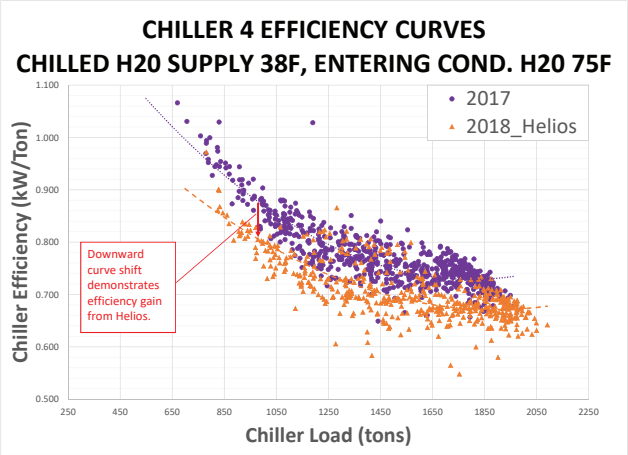


FIGURE 1
Chiller Efficiency Comparison from 2017 (pre-Helios) to 2018 (post-Helios) at 75 F Entering Condenser Water Temperature.

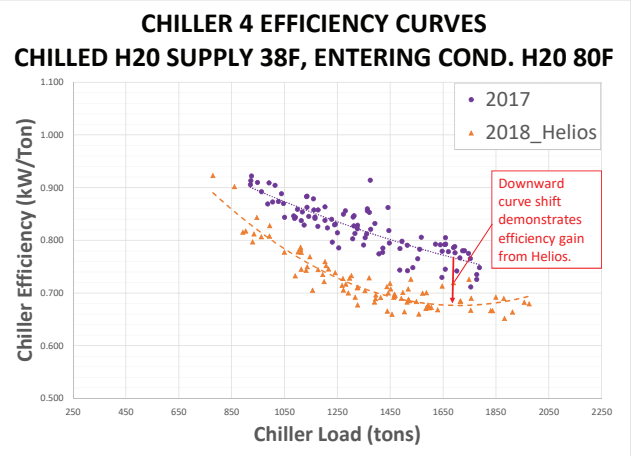


FIGURE 2
Chiller Efficiency Comparison from 2017 (pre-Helios) to 2018 (post-Helios) at 80 F Entering Condenser Water Temperature.

> "We used a third party to validate Innovas' savings numbers and they turned out better than claimed."
>
> **MIKE O'MALLEY**
> **COOLING PLANT MANAGER**

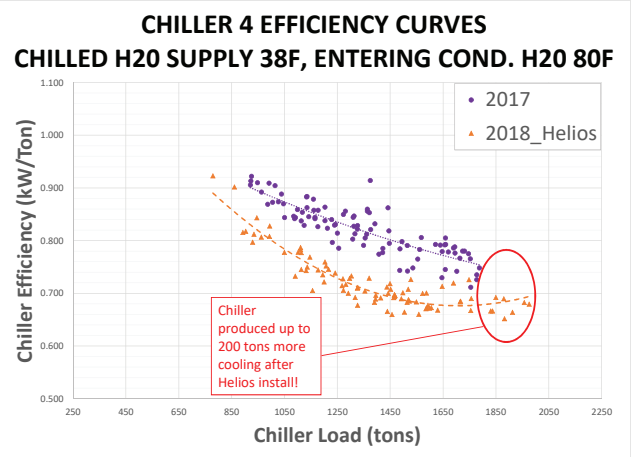


FIGURE 3
Chiller Cooling Capacity Increased As Much As 200 Tons After Helios Tube Cleaning System® Installation.

SUMMARY

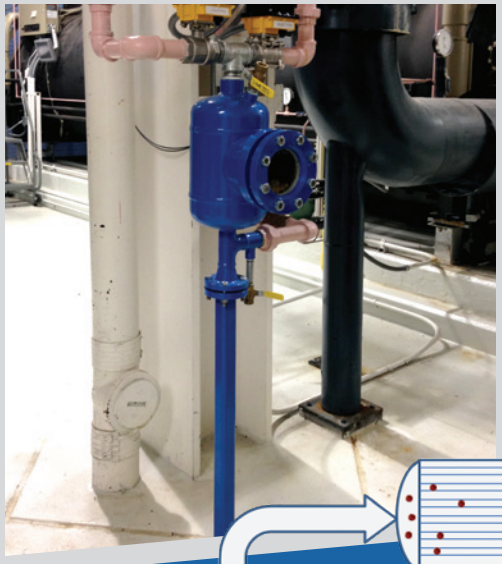
In 2018 Xcel Energy achieved optimal efficiency in one of their downtown Denver Central Plant chillers because of the adoption of the Helios Tube Cleaning System®. The result is significant cost savings and improved sustainability. The Helios result is consistent benefits including energy cost savings, reduced greenhouse gas emissions, and elimination of workload associated with tube fouling in the Central Heating and Cooling Plant chillers.

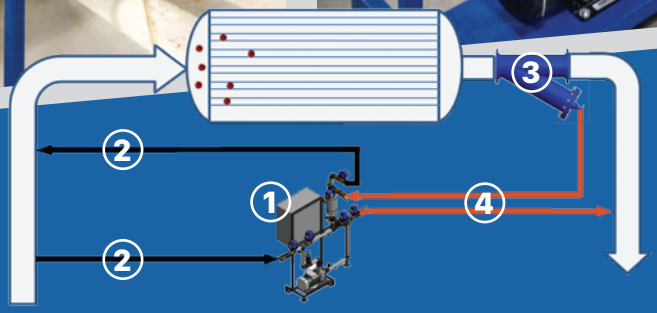
Xcel Energy Case Study Summary Results	
Average Chiller Efficiency Gain:	4%
Chiller Capacity Increase:	Up to 200 tons
Annual Energy Savings:	180,000 kW-hrs
Annual Cost Savings:	$20,000
Project Lifetime CO2 Emission Reductions:	2,200 Tons
Project Lifetime Savings (15 Yrs):	$410,000

FIGURE 4
Summarized Chiller Efficiency Impacts of Helios Tube Cleaning System® Installation.

The Helios Tube Cleaning System® from Innovas improves the energy efficiency of cooling systems

- **Prevents scale**, fouling, biological life and corrosion in heat exchanger tubes
- **Reduces maintenance** and downtime costs by eliminating manual or chemical tube cleaning
- **Extends the service life** of heat transfer equipment





The Helios Cleaning Cycle

The Helios cycle is fully automatic and controlled by a programmable controller.

1. Between cycles, the sponge balls are stored in the Collector and all valves are closed.
2. At programmed intervals, the Controller commands the injection valves to open and pump to start, and the balls are injected into the heat exchanger inlet line.
3. Normal cooling water flow transports the balls through the heat exchanger tubes and into the Ball Trap.
4. The Controller then prompts the collection valves to open and pump to start, and the balls are returned to the Collector, where they are held until the next injection/collection cycle starts.

View the Helios TCS Operation in action at innovastechnologies.com

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