

The Hospital for the University of Pennsylvania Optimization Case Study



Optimization unearths savings in state-of-the-art chiller plant



Philadelphia, PA

Healthcare

Industry

5+

Years with Optimum

\$288,250

Annual Operations
Cost Savings

1.6 Yrs

ROI

Project Details & Scope

Facility: The Hospital for the University of Pennsylvania (Penn Medicine), Philadelphia, PA

Conditioned Space: 1,843,828 sq ft

Cooling Hours: 8,760 hours/year

Lead Plant: 4,500 tons, all-variable-speed
3x 1,500-ton chillers, 3x VSD CW pumps,
3x VSD condenser pumps, 6x VSD cooling towers

Lag Plant: 6,000 tons, constant-speed auxiliary
4x 1,500-ton chillers, 3x VSD CW pumps,
3x constant-speed condenser pumps, 4x VSD
cooling towers

BAS: Johnson Controls Metasys

Solution: OptimumLOOP® + OptiCx® Platform

Pre-Optimization: 0.699 kW/ton

Post-Optimization: 0.511 kW/ton

Energy Savings: 4,434,618 kWh/year (4.4 GWh/yr)

CO₂ Reduction: 7.84 million lbs/yr

Water Savings: Over 1.8 million gallons/yr

Utility Rebate: \$221,731 one-time rebate

Executive Summary

Kathleen Morlang, Energy Manager of the Hospital for the University of Pennsylvania in Philadelphia, has one goal: reduce the energy used by the University of Pennsylvania's research hospital while ensuring a stable, comfortable environment for patients. To that end, she worked with Johnson Controls and Optimum Energy to turn Penn Medicine's modern chiller systems into an ultra-efficient, ultra-reliable cooling plant.

The solution, Optimum Energy's OptimumLOOP® for central plant optimization and OptiCx® platform for operational reliability, led to a rarely seen level of efficiency that's saving Penn Medicine more energy and lowering operational costs more than anticipated. "We're exceeding our predicted savings, and I expect that to continue year after year," says Morlang.

Prior to optimization, the lead chiller plant was already operating at peak efficiency. After Johnson Controls and Optimum Energy completed commissioning, the plant was running at 0.511 kW/ton, an improvement of about 27%, and an unheard-of level for systems without the use of water-side free cooling. The plant has seen annual energy savings of 4.4 GWh/year and carbon emission cuts of 7.8 million pounds.

Challenge: Optimizing an Efficient, State-of-the-Art Plant

On paper, Penn Medicine's state-of-the-art central facility appeared to be operating at peak efficiency prior to the project. Two cooling plants serve the hospital: the lead chiller plant is a 4,500-ton all-variable-speed plant, and the lag chiller plant is an older 6,000-ton plant with constant-speed auxiliary equipment.

Penn Medicine is one of the biggest hospitals in Pennsylvania, with 749 beds and 1,843,828 square feet of cooled space. It must maintain specific temperatures around the clock for patient comfort and safety, putting an immense load on the chiller plant all year. Even in the middle of a Northeastern winter, the base load is more than 2,000 tons.

Nevertheless, Morlang suspected she could wring more energy-saving efficiencies from the cooling system. Because her department competes for funding with lifesaving medical equipment, she needed a solution that could provide quantifiable savings and a quick payback.

Solution: OptimumLOOP® Plus OptiCx®

Morlang chose to increase energy savings through optimization, deploying the solution in partnership with Johnson Controls, which integrates with the facility's existing JCI Metasys building automation system to monitor plant conditions continuously and automatically calculate the most efficient operations in real time.

She also leverages Optimum Energy's OptiCx® platform, which includes the company's engineering support as well as cloud-based analytics, to monitor operations and collect and analyze data, ensuring that the plant is running at maximum efficiency and reliability.

Now Penn Medicine's chiller plant is ultra-efficient and continuously fine-tunes performance in real time while performing operational data analytics. The solution is also more reliable than ever before: it monitors the chillers for conditions that could indicate system failure, alerting Morlang's team to deficiencies before they become real problems that lead to downtime.

"The chiller plant is 10 to 15 percent of our overall electricity bill, so when something goes down and we have to run an inefficient backup plant, it's really expensive," said Morlang. "But with [the optimization solution's] alerts and the second set of eyes on it daily with OptiCx and the Optimum Energy team, we can work together to find out what's going on. It's an amazing benefit."

"We can see the immediate, quantifiable impact. The savings are verifiable— we know that our money is being quickly recovered and that the investment is helping patients."

*— Kathleen Morlang,
Energy Manager,
Penn Medicine*

Result: Extreme Efficiency, Operational Reliability

At the outset of the optimization project, Penn Medicine's chiller plant was running at an average 0.699 kW/ton, meeting today's standards of high efficiency. After full optimization, the plant runs at 0.511 kW/ton.

Since deploying the optimization solution, Penn Medicine is seeing annual savings of over 4.4 million kWh of energy, 7.8 million pounds of CO2 emissions and \$288,250. Because the lead plant required no mechanical changes prior to deploying OptimumLOOP®, the entire savings result from applying the optimization software to existing equipment. The project is providing ROI in under two years. The hospital also received a one-time \$221,731 rebate from its utility.

"In 20 years of experience, I've never seen chiller optimization like this," said Morlang. "It has more depth, it analyzes the system as a whole, and it uses advanced algorithms to adjust for the system you have in a holistic way. We're exceeding our predicted savings, and I expect that to continue year after year."

"After we had the optimization solution in place, we could make better decisions about expanding the plant. I was able to justify spending more to buy better, more efficient equipment than I could have if I didn't have the optimization software," the engineering director said.

Plant Details

Lead Chiller Plant

Capacity: 4,500 tons

Chillers: 3x 1,500-ton variable-speed

CW Pumps: 3x variable-speed

Cond. Pumps: 3x variable-speed

Cool. Towers: 6x variable-speed

Ton Hours: 25,326,853

Lag Chiller Plant

Capacity: 6,000 tons

Chillers: 4x 1,500-ton constant-speed

Penn Medicine Facility

Space: 1,843,828 sq ft conditioned

Hours: 8,760 hours/year cooling