HEALTHCARE CASE STUDY

# Major Hospital in the Midwest

## Phased optimization program returns big savings, enables better expansion decisions

### Overview

One of the first actions for the new director of engineering of a major Midwest hospital was to identify energy-efficiency projects with the biggest potential financial impact. He landed on optimizing the hospital's biggest energy consumer: its chilled water plant. Over two years, he first modernized control strategies and added plant optimization software, and then undertook a plant expansion that set a new standard of energy efficiency.

The hospital's BAS partner, Johnson Controls, engaged Optimum Energy to work with the facilities team, and together they developed a plan to evolve the plant over two years. In phase one, the team changed the pumping strategy, repiped the plant, installed OptimumLOOP® optimization software, and connected to the OptiCx® cloud analytics platform. For phase two, they added two water chillers and three cooling towers based on modeling scenarios Optimum Energy ran to determine maximum plant efficiency and manageability. The optimization project saved the hospital more than $470,000 a year in utility costs. Further savings are expected as the new chillers are commissioned.

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>
> Director of Engineering

"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.

### Challenge: Updating and expanding an unusual plant

The hospital's plant was ripe for optimization and modernization—but it would require careful engineering. The project team faced logistical as well as mechanical challenges: the equipment is spread across two floors in separate buildings, and the original five chillers and 12 water pumps are in different rooms. The plant was configured in a primary/secondary pump scheme with seven chilled water loops, two condenser loops, and no main header in the system. The project team needed to optimize even the oldest water chiller while ensuring that the plant provided 24/7 cooling during the project.

"The biggest challenge was setting a baseline for the plant's energy usage and operation," explained the engineering director. "With our existing monitoring capabilities, we couldn't collect enough data and didn't have total visibility. But Optimum Energy was able to gather all the data we needed."

Establishing that operational baseline set him up to expand the plant in phase two of the modernization project. It also presented a new set of challenges: integrating new, highly efficient chillers that would ensure optimal energy usage across diverse equipment.

## Solution: Hardware and software optimization and expansion, guided by big data

The first step was a large-scale construction project designed to decrease the plant's energy use, mapped out with the help of Optimum Energy's engineers. The team converted the primary/secondary pumping configuration to a primary/variable pumping scheme and modified the piping between chiller locations, creating an optimization-ready plant. With OptimumLOOP deployed, the plant consumed less energy almost immediately and began reducing the hospital's operational costs.

One year after optimization, they were ready to expand the plant's capacity, and worked again with the Optimum engineering team to choose and install the best new chillers. They collected a vast amount of data about the optimized plant's daily operations via OptiCx, and then modeled the plant load using five different chiller models. Optimum Energy was able to demonstrate which model would handle the hospital's load most efficiently. The result: the engineering director could choose new equipment with confidence.

"The energy calculations showed us the impact of each chiller option on our optimized plant, and we could make better decisions," he said. "Because the optimization solution helped me determine the most cost-effective, efficient chillers for our operations, it was instrumental in expanding the plant."

Ultimately, he purchased two 1,000-ton water chillers and three cooling towers. He also updated the pumping system to accommodate the additional capacity.

## Result: Energy savings that beat the projection

The strategy of updating and expanding the chiller plant based on data has paid off. In two years, the plant has become more manageable—despite its increased capacity—and has set new expectations for decreased energy usage. In fact, the optimized plant beat original projections by about $100,000 in 2018. With ongoing software optimization, the hospital expects to save more than 4 million kWh/year and reduce the hospital's annual carbon footprint by more than 2.8 million pounds of $CO_2$.

After setting a new, more efficient operations baseline, the director of engineering is exploring how he can continue to increase the plant's efficiency in the ongoing energy savings program.

"Optimum Energy is as excited about saving energy and optimizing chilled water plants as I am," he said. "They have a real passion for it—and it shows."

## DETAILS

The hospital campus has 1.4 million square feet of air-conditioned space. The plant consists of seven variable-speed chillers: four 1,200-ton, two 1,000-ton and one 1,500-ton. It has four variable-speed primary chilled water pumps, eight variable-speed condenser water pumps, and eight cooling towers. All the equipment is controlled by Johnson Controls' Metasys BAS software.

**Chiller plant specifications**

Cooling capacity: 8,300 tons

Current maximum load: 5,700 tons

Annual chilled water production: 18,029,410 ton-hours

**Plant efficiency improvements**

Annual average plantwide efficiency, pre-optimization: 0.824 kW/ton

Annual average plantwide efficiency, post-optimization: 0.516 kW/ton

**Utility savings (annual)**

Electrical energy savings: 4,105,606 kWh/year

Electrical demand reduction: 226 kW

Percentage reduction in electrical demand: 8 percent

$CO_2$ emissions reduction: 2,843,681 pounds/year

**Financial savings (annual)**

Operations costs saved, projected: $423,811

Operations costs saved, actual: $472,845

Estimated ROI: 1.2 years

**Project benefits**

- Energy savings
- Cost savings
- Automated facilities operations
- $CO_2$ emissions reductions
- Systems reliability
- Improved environmental control

## ABOUT OPTIMUM ENERGY

Since 2005, Optimum Energy has helped customers in healthcare, high-tech manufacturing and other industries reduce energy use in buildings, delivering typical energy savings of 30 percent, improved operating efficiency and reduced carbon emissions. The OptiCx® platform combines technologically advanced HVAC optimization software with world-class expertise in system design and operations. It has helped current customers save over 1 billion kilowatt-hours of electricity, reduce carbon emissions by nearly 765,000 metric tons and save over 250 million gallons of water.



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