ASHE CASE STUDY

ENERGY TO CARE
SUCCESS STORY

INDIANA REGIONAL MEDICAL CENTER

IRMC systematically assesses and corrects inefficiencies, resulting in $225,000 in annual savings.

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INDIANA REGIONAL MEDICAL CENTER

Community-Owned Nonprofit Hospital

Location: Indiana, Pennsylvania | **Square Footage:** 374,000 sq. ft. | **Licensed Beds:** 162

Team:
- Norman Ziemer, PE, CHFM, Director, Facility Management
- Timothy Butler, Integrated Services Consultants
- Edward Campbell, IRMC, HVAC Technician

Overview

Indiana Regional Medical Center (IRMC) is a rural, community-based nonprofit hospital located in Indiana, Pennsylvania, roughly 60 miles northeast of Pittsburgh. The hospital was founded in 1914 with 40 beds and 13 private rooms. Over the years, IRMC has expanded and modernized to meet changing standards of medical care as well as an expanding population base.

Today the main hospital building is an amalgamation of seven buildings, all added during different construction phases. It comprises 374,000 square feet and 162 beds. IRMC is the only full-service medical provider in the county, with seven operating rooms, full-service diagnostics imaging, emergency services, oncology treatment, an urgent care facility, and more.

In mid-July 2015, the American Society for Healthcare Engineering of the American Hospital Association (ASHE) recognized 23 medical facilities nationwide for significantly cutting energy consumption. Each facility received an ASHE Energy to Care Award for its work to slash energy use, reduce operational costs, and free up more resources for patient care. This is Indiana Regional Medical Center's success story.

New Facility Manager Brings a New Strategy

Norman Ziemer joined IRMC as director of facility management in 2009. He came from private industry, where energy costs are calculated as a major component of production, so he arrived in health care already understanding the importance of maximizing energy efficiency as a strategy for reducing costs.

When Ziemer started, the hospital was considering another expansion and upgrade to meet new clinical needs. As an initial step toward learning about the facility, Ziemer worked with Ed Campbell, IRMC's HVAC technician, to take stock of the existing physical plant. Ziemer wanted to understand the capabilities of the existing equipment and how many, if any, additional buildings the infrastructure could support.

They first examined the HVAC equipment: the boilers, chiller plants, heat recovery units, and so forth, and they determined that the equipment was in good shape. However, through a back-of-the-envelope calculation, they noticed that they were using 1,100 tons of refrigeration to cool 335,000 square feet. Ziemer knew of other facilities that used 1,100 tons to service 500,000 square feet. It was clear there were inefficiencies.

Ziemer asked the hospital administration for funding to diagnose the problem and make improvements. At the time, he didn't know how much money they would save, but he knew they could do better. One of their key innovative strategies was to map the physical plant, noting and correcting the many inconsistencies in the design drawings and the actual facility as it was built.

IRMC next teamed up with Tim Butler, Integrated Services and Consultants, a firm specializing in facility operations and maintenance, energy efficiency, and commissioning. Together they crawled through the entire plant, top to bottom, and measured temperatures, flows, and pressures to figure out where the system was losing energy. This information enabled them to put the finishing touches on the process and instrumentation diagram. It also allowed them to identify the bigger energy-loss problems and plan their next steps.

The team created a list of 45 improvements, prioritized them, and then tackled them one by one. Their success is clearly evident. As a result of these upgrades, IRMC went from an 8 to a 25 ENERGY STAR rating in only four years, and they are not finished yet. Ziemer and the team have their sights set on hitting a 75 ENERGY STAR rating.

Objectives

"We knew fundamentally that the central chiller water plant was a good design, but it just wasn't working," explains Ziemer, describing IRMC's physical plant. His first step was to ask for $500,000 to investigate and fix the problems. "As we find them, we'll fix them," he told his administration.

The Game Plan

His game plan was as follows:

- Map and field-verify the HVAC systems to create an accurate process and instrumentation diagram.
- Detect inefficiencies in the physical plant, hospital-wide.
- Improve efficiency, giving highest priority to items with the shortest payback times.
- Implement a team-based approach, to ensure buy-in and communication from all staff.

Solutions

To begin correcting the problems, Ziemer and his team partnered with a mechanical contractor—Larry Ruffner, superintendent of the Limbach Company, LLC—to provide the manpower and material needed to make the needed physical changes in the piping and control system.

Eliminate Recirculation in the Primary Loop and Convert to Two-Way Chilled Water Control Valves

One of the most obvious problems was that the system was recirculating an enormous volume of water in the primary loop and in about six other key spots throughout the hospital. To eliminate recirculation, the team took Ruffner into the equipment room and worked with him on-site to map out the pipe sizes, fittings, and flows that would reduce recirculation. Once they approved Ruffner's proposed budget and work plan, the team made the necessary fixes at night to keep the hospital operating for patients during the day.

They also converted their three-way chilled water control valves to two-way valves to eliminate the inefficient mixing of supply and return water across the cooling coils. “We were trying to push 1,000 or 1,100 tons of refrigeration up to a hospital that wouldn’t take it. So the piping system was recirculating and throwing it back to the main plant.”

With these simple changes alone, IRMC eliminated 6 to 8 degrees F worth of cooling loss. This efficiency gain was impressive enough, but the fact that the water stayed cooler for longer enabled the secondary and tertiary pumps to flow less cold water to maintain optimal temperatures, magnifying the initial efficiency gains throughout the entire system.

As Ziemer notes, systems built in the 1990s suffered from inaccurate assumptions about their hydraulics. They were built using high-quality equipment, but they functioned inefficiently. Simply converting from three-way to two-way valves by installing blanks in the three-ways and putting variable frequency drives on the primary and secondary loops can “do a pretty good job [of enhancing efficiency] for very little money, comparatively speaking,” explained Ziemer.

Install Roof Fans to Improve Air Handling

The main patient tower at IRMC had been built from 1977 to 1978, and it was the source of multiple complaints about stuffy air and other problems typical of sick building syndrome. The building has a 100,000 CFM air handler, and most of the previous efforts to fix the problems concentrated on forcing more air into the building. Ziemer and his team had a different idea. “Everybody likes to focus on the front end of the system, but they forget about the return side, and the return side is every bit as important as getting enough horsepower on the front end,” he explains.

Their solution was to install two 26,000 CFM, 7.5 HP fans on the relief airshaft in lieu of the original gravity dampers. This improved the functioning of the economizer cycle in the air handler, so the system was able to turn the air in the building over more frequently and more efficiently. That, in turn, helped all the pieces of peripheral equipment (including reheat coils and humidifiers) to do their job correctly, using less energy to condition the interior space.

Simultaneously, the team discovered that one of the supposed cooling coils in the main building air handler was actually a heating coil, and its fins were spaced too closely (14 fins per inch) to enable the condensation to drip away. Instead, the moisture got trapped on the coil and was swept back into the building. Changing the coil to a nine fin per inch coil solved multiple problems at once: Approach temperatures improved by 8 to 14 degrees F, the humidity complaints dried up, and the coils and filters could be cleaned more easily.

Install Variable Frequency Drives (VFDs) and Program Deadbands in Radiant Cooling/ Heating Units

IRMC employs a large number of radiant cooling/heating units, where the radiant panel does both jobs. The team recognized that they were mixing hot and cold water and losing a lot of efficiency and energy in these units. Their solution was to install variable frequency drives to balance the hot and cold system hydraulic pressures. As with the air handling issues, this solution yielded multiple benefits: The hot water use fell, since the hot had been running at a higher pressure than the cold, even though it wasn’t needed; the gas and electricity use fell, because there was less call for hot water; and there were fewer complaints of noise and banging when the system changed from heating to cooling and vice versa.

The team also programmed a three-PSI deadband into the pneumatic thermostats, which further reduced the mixing of hot and cold water. This ensures that the system remains static once a demand for heating or cooling is met, instead of immediately switching over.

Create Alarms/Notifications when Staff Override Programmed Controls

Ziemer and his team created a continuous commissioning process, so he and his engineering team are notified whenever staff override the established parameters. The team then checks in to see what prompted the changes. That way they can solve problems as they learn about them, while simultaneously preventing ongoing drift from programmed parameters.

The team also has engaged in regular meetings with hospital staff for the duration of the retrofitting process, so all personnel are engaged in increasing efficiency and understand their role in the process. This helps sustain the gains from implementing energy efficiency measures and eliminates the need for expensive high-end monitoring systems and lock-out controls.

Results

IRMC has seen the following results:

- 14% reduction in electricity use
- 21% reduction in natural gas use
- 28% reduction in hospital energy utilization index (EUI), from 351 to 254 KBTU/square foot/year
- $225,000 in annual savings
- The project paid back the initial investment in 2.2 years, and it continues to accrue a quarter of a million dollars in savings every year.

Ziemer and his team are enormously gratified by their success, and they know they are affecting the bottom line of the hospital as well as decreasing their environmental impact. Their success speaks for itself: they have improved their ENERGY STAR rating by 17 points in just four years.

Internally, Ziemer and his team have also established strong credibility with the hospital's upper management. As Ziemer explains it, "That's what happens when you tell somebody, 'Hey, here's what we're going to do,' and then you go ahead and do it, and it works!" Now he knows that when he presents a case for modernizing equipment or upgrading systems, the financial and operational heads of the hospital will give him a green light. In addition, he has earned a yearly allocation of discretionary capital for facility improvements.

The savings to the hospital are substantial, which is critical during a time of rising health care costs and pressure on the industry to increase efficiency and cut operational costs. In fact, every dollar a nonprofit health care organization saves on costs eliminates the need to generate $20 to $25 in new revenue, according to the U.S. Environmental Protection Agency. Saving on energy costs and utility bills is therefore an effective means of reducing overall operational costs and increasing resiliency and flexibility.

What's next for IRMC?

As for the future: "We only have one benchmark," claims Ziemer. "We want to beat ourselves: all of the utility bills, the expenditures, the consumption. If this month was better than last month, better than last year, we think we're heading in the right direction." Their goal is a 75 ENERGY STAR rating. If they keep registering efficiency gains and continue to earn the good will of IRMC's upper management, they are sure to succeed as well as to garner industry-wide accolades.

**The Energy to Care program, sponsored by Johnson Controls, encourages hospitals across the country to reduce their energy consumption by 10 percent or more over their baseline energy consumption. Since 2009, hospitals participating in the Energy to Care program have tracked more than $67 million in energy savings. The free program includes a robust energy-benchmarking tool in addition to the awards. ASHE congratulates these hospitals for their leadership in reducing energy consumption.*

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