

## Saint Joseph-Mercy slashes energy costs in midst of building boom

Imagine you own a home, facing endless double-digit rate increases for electricity, gas and water, and you decide to increase the size of your home by 25% by adding a garage and a third level. Further imagine that over the next few years, after taking a series of mostly simple energy-saving steps, you actually *cut* your energy bill by tens of thousands of dollars.

This is exactly what Saint Joseph Mercy Health System (SJMHS), a burgeoning health system in southeastern Michigan, has accomplished – on a much larger scale, that is.

Since implementing its comprehensive energy management master plan in 2004, the three-hospital system has saved more than \$2 million in utility and energy operations costs and cut its water, gas and electric usage by as much as 46 percent – all while undergoing a massive expansion program that added more than *half a million* square feet of hospital rooms, OR suites and medical support space. And it did so with a very modest capital budget (even a spending freeze in 2009), realizing an average simple payback (return on investment) of only 1.48 years.

And if the health system stays on track with its energy management plans, it stands to save more than \$7 million by 2014.

Tom Tocco, Director, Facilities Engineering and Construction, attributes his system's success to a series of one-time and ongoing low-cost/no cost initiatives such as reducing needless irrigation and installing inexpensive light sensors, variable speed cooling pumps and air exchange scheduling devices, as well as carefully planned energy efficient design components in every square foot of new built space.

But more than anything, Tocco and his team have managed to find hidden dollars right under their noses the "old fashioned" way. "We take a common sense approach to our energy management strategies," Tocco said. "What we've accomplished here doesn't take an energy engineering firm or high-priced consultant to do." In fact, Tocco said he doesn't allow himself to get too immersed in the language of organizations now setting environmental safety standards of their own. "In that respect, we're kind of unique," he said. "We're not proud. There are many organizations out there that are doing an exemplary job with guidelines and so forth, but we like to pick and choose among all of them and then use those that allow us to best steward our resources and make the most sense for us from a lifecycle cost standpoint."

### The back story

Saint Joseph Mercy Health System is a member of Trinity Health, the fourth largest Catholic health system in the United States. Overall, Saint Joseph Mercy Health System is a regional health care system



Saint Joseph-Mercy's sprawling Ann Arbor campus: In the midst of a building boom that added half a million square feet, the system realized over \$2 million in energy savings.

## BY THE NUMBERS

From fiscal years 2005 to 2008:

that spans five Michigan counties and encompasses 2.7 million square feet of space. The three-hospital health system includes: 537-bed Saint Joseph Mercy Hospital, Ann Arbor, a regional tertiary care academic facility situated on 340 acres in Washtenaw County; Saint Joseph Mercy Saline Hospital, Saline; and Saint Joseph Mercy Livingston Hospital, Howell; and 13 off-campus satellite buildings (including urgent and cancer care).

And like most hospital systems, Saint Joseph-Mercy has faced seemingly endless escalating energy costs and combined utility bills as high as \$10 million a year. From June 2002 to January 2009, water rates had increased nearly 74 percent, while sewer rates climbed by 32 percent.

Anticipating these trends in early 2002, St. Joe's saw an opportunity when the Ann Arbor campus announced a long-term master plan that would add nearly 500,000 square feet of new construction over the coming years.

In addition to replacing its largest inpatient hospital, the system since then has built a new 60,000 square-foot 18-suite surgery pavilion, an all new labor and delivery department, doubled the size of its emergency department (the state's third busiest), added an MRI facility and Center for Digestive Care, built new waste management facilities, and is in the process of completing the second of two new environmentally friendly patient towers encompassing more than 228,000 square feet.

Tocco said he decided to approach his energy conservation measures with a focus on demand side management, looking closely at how his health system *utilizes* utilities, and less on supply side management, which traditionally focuses on how one *buys* energy such as electricity, gas and water. "To us, demand side management presents the greatest opportunity for energy conservation and savings," he said. "In health care, many people are preoccupied with how they're buying their energy and less on how they're using those resources. While there are opportunities on the supply side, those are usually very easy to spot and correct. The demand side is where the biggest bang for the buck is. So that is where we've concentrated most of our efforts."

Working under a strict capital improvement budget, Tocco and his team got to work, overhauling and expanding Saint Joseph-Mercy's power plant, seizing upon low-cost-no cost initiatives and modest capital improvements along the way. This included the addition of chiller and emergency power capacity, and installation of various energy management systems designed to more efficiently cool, heat and conserve water, as well as manage electricity use.

**\$834,783**

Utility savings

**\$317,634**

Operational/contract savings

**\$1.8 million**

Capital avoidance

**1.48**

Average annual payback

WATER USAGE

**45%**

NATURAL GAS USAGE

**17%**

ELECTRICITY USAGE

**7%**



*Tom Tocco (left) and Paul Dobry have collaborated on a host of energy management projects that could lead to \$7 million in savings by 2014. Said Tocco, "I might be what you call 'the champion' of all this, but Paul is the brawn behind it all. His expertise has paid off immeasurably for us."*

While the wheels were in motion on the system's energy conservation program as far back as 1993, things kicked into high gear when Tocco decided to make his long-time contract engineering consultant, Paul Dobry, his full-time utility management specialist in 2004 – two years after the master plan was announced.

The team of Tocco and Dobry believe their energy conservation program adheres faithfully to Trinity Health's stated mission to become more environmentally responsible. (The system has launched myriad programs to create healthier conditions for patients, associates and communities. From increasing associate recycling efforts to constructing major new facilities with recycled products, Trinity Health states that it is strengthening its commitment to developing and implementing environmentally responsible principles.)

"Our energy management goal is simple – to steward the financial resources entrusted to us through sustained reduction strategies in energy dependency, including water, natural gas, and electricity," Tocco said. "That's what we take pride in." And to make sure all 100 employees under his watch were on board with those goals, Tocco knew he needed to address the culture of his department.

"We explained what our purpose was to get them all engaged," he said. "Every single employee of mine has bought into those goals and they clearly understand how important they are. While we knew we needed the overall backing and financial support of administration, we also knew we need full staff support for implementation and sustaining the measures we put forth. If you don't have these things, you're doomed."

In 2005, Tocco and Dobry were able to secure \$300,000 in annual capital improvement funding earmarked specifically for energy saving enhancements. This was in addition to the many initiatives funded through both new projects and renovations. They even boldly promised administration an overall three-year payback on every energy conservation measure he undertook

(they achieved payback in half that time). To say they watched their pennies wisely is an understatement; working closely over the next five years, the two uncovered and reversed a wealth of energy-wasting problems with a series of low-cost/no-cost initiatives.

### **Low cost/no-cost projects**

For little or no money, Tocco and his team have been hacking away at Saint Joseph-Mercy's energy bill for the past five years – one little project at a time. Here are just a few examples:

- **Powering off air conditioning (HVAC) equipment** during long periods of inactivity.
- **Replacing incandescent lights when they burn out with energy-efficient compact fluorescent lamps.**
- **Getting a handle on irrigation.** One significant savings came out of a short meeting Dobry had with the grounds crew responsible for maintaining the 340 acres on Saint Joseph-Mercy's Ann Arbor campus. "It was costing us \$40,000 a year to keep everything lush and green. All I asked them was if they thought we were watering too much," he said. "The supervisor suggested we try cutting back by modifying the watering schedule. This project cost us *nothing* to implement, yet we saved \$18,000 the first year alone." Installing water meters on irrigation and cooling towers was another simple act that resulted in an immediate credit on the system's monthly sewer bill, not to mention dollars saved in conserved water. After installing an \$875 water meter outside a small materials center, for example, the system realized a \$1,000 simple payback of savings in one year. Tocco and Dobry resolved themselves to reviewing their system's overall irrigation plan to see if it was using water needlessly. A small investment in time and a few meters later, they reaped thousands of dollars in water bill savings. "One thing we didn't know was that the sewer services provider would not charge us for irrigation if we were able to show them how much we used for irrigation, they wouldn't charge us for that," Tocco said.
- **Installing and calibrating utility sub-meters to ensure accurate bills and faster problem identification.** "You'd be surprised how many anomalies or utility company 'mistakes' can work against you if you're not watching," Dobry said. Dobry also routinely checks utility bills for errors and late charges. "When you look at a water bill and see a spike, for example, there's a good chance there's an underground leak you don't know about."
- **Eliminating the system's 25 campus water softeners** after discovering the quality of the local water supply no longer warranted them. "We needed these in 1977 when we opened here, but the water quality today is outstanding," Tocco said. As a result, the system is saving more than \$30,000 a year in salt and water.
- **Installing or upgrading right-sized water meters.** Dobry discovered that larger water meters resulted in higher monthly fees than smaller ones. In many campus locations, he down-sized water meters after implementing conservation measures, as the water use was drastically reduced. In one example, reducing to a smaller meter on a 30,000 SF office building saved 10,000 in one year in meter costs alone.
- **Replacing a roof-top unit (RTU) providing air to a medical air compressor room.** Dobry inspected the unit and discovered that a water sprinkler was being used to keep the undersized, inefficient unit cool. He replaced the unit with a new \$3,000 energy efficient RTU, resulting in \$8,300 in water savings in less than six months. "This is just one example," Tocco said. "We've done many of these."

- **Shutting down unused walk-in coolers.** “These kinds of things are right under our noses but our facilities are so huge, they sometimes get overlooked,” said Dobry. “Our eyes and ears help us.” Dobry was referring to an unscheduled walk-through an engineering employee performed on the patient care floors one day, when he discovered several walk-in coolers that were near empty. “We had changed the way we deliver food to the patient floors several years before and most of those coolers were no longer used but remain plugged in,” he said. After unplugging the units, the system realized \$9,000 in immediate electrical and water savings.
- **Using boilers efficiently.** Any hospital engineer knows how expensive it is to operate boilers. Dobry discovered he could de-commission one of the system’s three boilers during the warmer months by utilizing a process called “dry layup,” in which a desiccant is placed in the unused boiler to keep it dry. “That boiler was producing 55,000-pounds of steam per hour at full load,” Dobry said. As a result, the system saved \$8,000 a month when the boiler was in dry layup mode, plus, it increased the life of an asset and avoided maintenance costs associated with keeping the boiler in a standby mode.
- **Air handler scheduling.** In every hospital, air handlers are used to provide exchanges of clean air several times an hour. But what if those machines are working hard to rapidly exchange air in an unused room? Tocco and Dobry reviewed all of the campus’ air handling equipment and connected it to the main computerized facility management system, scheduling power-downs during periods of inactivity, particularly at night. For example, the 18 ORs on the system’s Ann Arbor campus were getting 30 air exchanges per hour – even in the dark of night after everyone had gone home. Dobry programmed the units to go down to 15 air exchanges in the evenings, when the suites were empty.
- **Occupancy sensors.** Installing inexpensive occupancy sensors in areas like OR suites also saved substantial money. “It wasn’t uncommon for those very high-wattage lights to stay on all night long in the ORs,” Dobry said. “A minimal investment ended up saving a lot of money on our electric bill.”

### Energy improvement capital projects

Making wise use of their \$300,000/year capital improvements budget, Tocco and his team have tackled those areas where the energy drain was most pronounced. A few examples:



Installing a variable speed control on one boiler burner at a cost of \$50,411 saved \$28,520 in gas the first year and resulted in a 1.8-year payback.



Irregular maintenance on hundreds of steam traps throughout the campus was costing the system over 44 million pounds of lost steam a year. After implementing a simple inventory and testing schedule, and replacing bad traps at a cost of \$50,000, the system saved more than \$334,000 a year.





Encircling the perimeter of a skylight in the Women's Health Center are T5 high output lamps, which are automatically powered off when there's sufficient daylight coming in.



All new construction makes use of natural lighting, soothing colors and unique design elements in all patient rooms, visitor waiting rooms and public areas. In the evening on the patient floors in Saint Joseph-Mercy's new tower (above), ceiling lights are automatically powered down and wall sconces illuminated to reduce light pollution and create a more soothing environment.

- **Upgrading boiler components.** In a word, "inefficient" was how Dobry assessed two of the campus' main boilers. On one boiler, new combustion controls designed to optimize the air-fuel ratio, including a variable speed control on the boiler burner, were installed at a cost of \$50,411. The system saved \$28,520 in gas the first year and resulted in a 1.8-year payback. Upgrades to another unit were more expensive and complicated, but essentially boiled down to an innovative system Dobry designed that reclaimed escaping flue gases to re-heat water. After installing a new feed water heater, valve and various controls, at a cost of \$284,854, the savings were dramatic: \$100,000 the first year alone, and a payback of less than three years. "An important point to make here is that we're replacing and upgrading aged equipment at or near lifecycle, so that we maximize things," Dobry said. "Your mechanical and electrical systems are worth about 55 percent of your hospital's overall assets, so it's imperative that they be kept in optimal condition."

- **Implementing a steam trap maintenance program.** Among the most overlooked items in any energy plant are these simple devices, which often malfunction if they aren't inspected and maintained on a regular basis. Dobry discovered that the situation was costing the system dearly: over 44 million pounds of lost steam a year. "This is expensive steam that took a lot of money in water, chemicals and heat to create," he said. So Dobry established a simple inventory and testing schedule for the hundreds of steam traps located throughout the campuses of the system's three hospitals. A simple tag on each trap easily showed a maintenance worker when the trap was installed and last inspected. The bad traps were replaced at a cost of approximately \$50,000; the annual savings from conserved steam is more than \$334,000 a year.

- **Lighting retrofit projects.** Particularly in around-the-clock areas of the campus, inefficient lighting is being replaced with energy efficient alternatives. For example, LED exit signs and T8 lamps and electronic ballasts are being used now in public corridors. And high-bay metal halide fixtures have been replaced by T8 lamp fluorescents and electronic ballasts in a warehouse. The project cost \$59,900 and is generating annual savings of nearly \$17,000 – a simple payback of 3.6 years.

- **Automatic lighting controls.** Used in conjunction with Saint Joseph-Mercy's building automation system, these devices in public areas such as cafeterias, atriums and lobbies now operate on dusk-to-dawn schedules and use a global foot-candle sensor to "harvest" daylight and turn off lights when ambient conditions allow. For example, controls placed on one concourse lighting system cost \$5,500 to install and are reaping more than \$3,400 a year in energy savings – a simple payback of 1.6 years. Dobry also is using the controls in all new construction. In the new surgery

pavilion, for example, the outer corridor encircling the pavilion is lined with energy-efficient glass, allowing the outdoors to bath the corridors and even windowed OR suites with natural daylight when suitable.

- **HVAC scheduling controls.** Again by integrating new controls on heating, ventilation and cooling systems, Saint Joseph-Mercy is able to make more efficient use of heated and cooled air. Fan variable speed drives were installed and pneumatic controls have been replaced with digital controls, allowing more flexibility, alarm-capability and remote access. Chilled and domestic water pumps are now cycled on and off more efficiently and hot water temperatures are more evenly set based on outdoor temperatures. In one project alone, a simple digital control retrofit in the materials center HVAC and lighting systems, the \$21,800 project cost was offset by first-year savings of more than \$16,000 – a simple payback of less than two years.
- **Water conservation retrofits.** Various water conservation methods such as tamper-proof faucet aerators, low consumption toilets, waterless urinals, low-flow shower heads, smaller meters and a chemical-free water treatment system (similar to reverse osmosis technology) for evaporative cooling towers have resulted in thousands of dollars in annual savings from lower water and maintenance costs. For example, a pilot water project at Reichert Health, a 250,000 square foot medical office building, saw water-sewer expenditures drop from \$73,168 in 2005 to less than \$25,000 in 2008.

### Energy efficient initiatives in new construction

The significant building boom at Saint Joseph-Mercy over the past five years has given Tocco and his team ample opportunity to “get things right the first time” by implementing energy conserving devices and systems from the ground floor up.

For example, Saint Joseph Mercy Hospital in Ann Arbor this year will complete a major transformation project that includes a new 11-story, 360-bed critical care patient tower (completed in 2009) and a seven-story patient tower (scheduled to be completed fall 2010). The new towers replace the existing hospital structure. The project increases overall hospital space by 296,000 square feet, allowing the patient rooms to double in size and incorporate an innovative design with separate zones for the patient, staff and visitors. The updated infrastructure makes use of natural lighting, soothing colors and unique design elements in all patient rooms, visitor waiting rooms and public areas.



The new "East Tower" on the campus of Saint Joseph Mercy Hospital in Ann Arbor.

“We take our new construction projects very seriously from a lifecycle cost perspective,” said Dobry. “We have just as much going on in new construction activity as retrofitting activity.” Virtually no energy conservation opportunity is being left on the table, including installing the most efficient lighting sources, the lowest kilowatt-per square foot systems possible, variable air flow volume systems, variable speed volume chilled and heated water pumping systems.

“What’s unique about us is our design, construction, maintenance and energy efforts are all coming from the same department,” Tocco added. “It’s a very collaborative process. Lifecycle cost versus

acquisition cost is always considered. We don't 'go green' for style because style can sometimes end up costing you money. We go green to *save* money and reduce our energy dependence."

### **Overall success**

So far, the overall impact of Saint Joseph-Mercy's energy management program has been very positive, Tocco said.

From fiscal years 2004 to 2008:

- Natural gas usage decreased more than 17 percent;
- Water usage decreased more than 45 percent; and
- Electricity usage dropped nearly 7 percent.

From fiscal years 2005 to 2008, the program resulted in:

- Utility savings of \$834,783;
- Operational/contract savings of \$317,634;
- Capital avoidance of \$1.8 million; and
- An average annual payback of 1.48 years, based on capital expenditures.

For Tocco, the major "takeaways" from this experience include creating an energy conservation "mindset," cultivating a culture of engagement and improvement among staff and investing in expertise. "I might be what you call 'the champion' of all this, but Paul [Dobry] is the brawn behind it all," Tocco humbly stated. "His expertise has paid off immeasurably for us."

"Tom's a great cheerleader," added Dobry. "If you don't have someone constantly conveying the message between the staff and administration, you'll never get and sustain the backing you need. When you keep reinforcing the message and acknowledging everyone who has contributed to your success, they take ownership in those efforts."

"We've been so successful because we've doggedly looked for every conceivable opportunity to modify our use of energy so that it works most efficiently for us – not the other way around," Tocco added. "We continually measure and verify so we can sustain our savings. Energy management is now an integral part to planning for any new construction. This is an ongoing process, and the momentum we have is nearly boundless."

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