JOHN MUIR MEDICAL CENTER

When this hospital needed to modernize their cooling plants, they assembled a creative Design/Build team that worked intelligently to provide a comprehensive, cost-effective, quality project.

BY VINCENT SCOCCIA

Back in 1992, we at John Muir Medical Center (Walnut Creek, CA) knew it was time to modernize our cooling plants. Some of the reasons included:

- We needed to get our energy costs down.
- The hospital had expanded and the original cooling capacity was no longer great enough to meet our cooling needs on the hottest days of the year.
- Our chillers were old, becoming less reliable, and required parts that were getting hard to find — repair costs were escalating. They also used CFCs, which we wanted to eliminate to meet environmental standards.
- Our oldest cooling tower was situated too close to a fresh air intake, and we wanted to move it for indoor air quality (IAQ) reasons.

Our goal was to assemble a comprehensive project with enough cost-saving benefits and features to get our administration and budget committee to "buy in."

As a healthcare facility, we've faced increased pressure over the years — partly as a result of the growth of *managed care* — to reduce and control our costs. Through this project, we knew we could find a way to reduce our utility bills and save our organization money.

Plant History

John Muir Medical Center was constructed in 1964 as a 100,000-sq.ft. facility. Cooling was provided by a 260-ton centrifugal chiller. In 1974, a 100,000-sq.ft. expansion was added, along with another centrifugal chiller sized at 560 tons. These two chillers were housed in what we now refer to as "cooling plant one."

In 1989, another 168,000-sq.ft. hospital wing was built. Two 200-ton centrifugal chillers were added to condition this new space — they were housed in "cooling plant two."

In total, the hospital had grown from 100,000 sq.ft. to 368,000 sq.ft. (total additions: 268,000 sq.ft.). We had reached a point where our total cooling capacity could no longer meet our cooling needs, especially on the hottest days of the year.

Additionally, the chillers in cooling plant one were getting old and were much less efficient than new chillers hitting the market. Another problem was that they used CFCs. We wanted to eliminate the need for these "banned" CFCs because of environmental concerns and because our costs to obtain them were escalating rapidly. Before long they'd likely become unavailable altogether.

The Project Team

John Muir Medical Center

- Vince Scoccia, director of plant services
- Robert Foster, operations supervisor
- John Van Winkle, construction manager

Energy Resource Associates (ERA) (Engineering Firm)

- Jim Waltz, P.E., president
- Craig Shulenberger, E.I.T., design/project engineer

Linford Company (Design/Build Construction Firm)

- Bill Call, project manager
- Phil Robins, project superintendent

Synergy is said to exist when the "whole is greater than the sum of the parts." This happens on a construction project when a team is set up where everyone — each chosen for what they bring to the table — can freely and openly contribute to the process.

On this team, each person brought different experience and perspectives. We had people who knew the practical "nuts and bolts" aspects of a construction project, as well as the technical and management sides. We had facility representatives, experts from a Design/Build mechanical contracting firm, and engineers who had plenty of Design/Build mechanical experience.

We chose ERA and Linford because we worked with them in the past. There are hidden costs in "retraining" new contractors, engineers, and technicians. These firms knew our facilities and requirements. Patient care is our first priority and we can't afford to have any code violations — we could trust ERA and Linford to do a quality job without any errors.

As we envisioned the project, we also wanted to relocate our oldest cooling tower. It was located directly in front of a fresh air intake. If Legionella were ever to develop in the cooling tower pans, it could easily be carried into the hospital through the fresh air intake. By moving the cooling tower, we would address a major IAQ concern.

Assembling An Assessment Team

During the early phases of project conception, our operations supervisor Robert Foster and I pondered over the issues for quite some time. We knew "why" we wanted and needed to do the project. We had a good idea of what we wanted to accomplish. We also had ideas as to how we wanted to address the issues and what we needed to do to convince administration to approve the funding. What we needed was additional input and assistance.

At this point, we brought in Jim Waltz from Energy Resource Associates (ERA), a Livermore, CA-based mechanical, electrical, and structural engineering firm, who had worked with us on previous projects, to discuss our needs and ideas. Jim was very familiar with the evolution of our plant and especially with our energy management system (he also tracks our energy utilization). Years ago, Jim developed a hybrid tracking system for us that tracks energy use and compares it to relative square footage growth rate. Over the years, our utilization per square foot was increasing. Something had to be done to reverse this trend.

Our team looked at what seemed like hundreds of possible solutions that would efficiently meet all our needs. We looked at the present and future costs of various forms of energy and refrigerants. We evaluated types and manufacturers of equipment, combinations of equipment, controls, and other components. We completely assessed the need for a new cooling tower(s), and reviewed places to put it/them.

With Jim's help, we identified "hidden" opportunities beyond saving energy and money to:

- Add capacity
- Improve reliability
- Simplify operations and maintenance
- Improve comfort.

As a team, we developed a final concept which entailed:

Install two new 550-ton, electrically-driven centrifugal chillers in cooling plant one. The new chillers would use 1/3 less electrical energy than the original chillers. Using the same amount of electricity as the old chillers, they would provide an ad-

ditional 300 tons of cooling capacity. They would also use environmentally safe refrigerants and fit in the existing space.

Rearrange the cooling water piping and pumps. On hot days, excess capacity from cooling plant one would automatically go to the second cooling plant. Although a chilled water tie-in pipeline currently existed, it only functioned during mild weather.

Consolidate the cooling towers into a single location by demolishing the two existing single towers and building a new dual-tower installation. The two new cooling towers would increase the efficiency of the new chillers and make good use of the oversized cooling tower water piping that already existed. Elimination of the oldest existing cooling tower would ease our IAQ concerns.

The conceived project made maximum use of existing facilities and carefully limited the scope of construction work to only one of the two central cooling plants. It had a budget of approximately $1,300,000.

Obtaining The Funds

In operations, it's important to look at the difference between a "dollar saved" and a "dollar earned." To "earn" a dollar, the organization incurs expenses including labor, material, taxes, and overhead. After these expenses, they're lucky to keep 5% of that dollar.

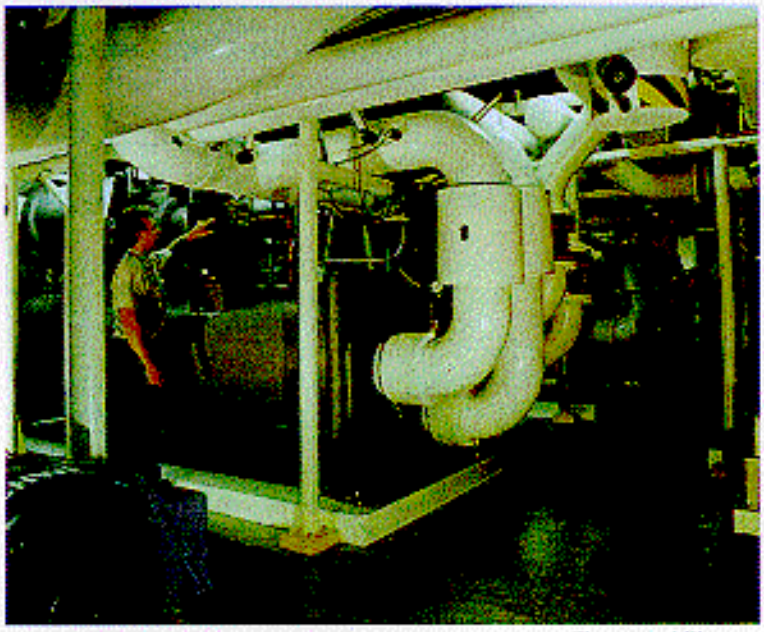
On the other hand, when you "save" a dollar, the organization gets to keep the whole dollar. Therefore, the value of a "dollar saved" as compared to a "dollar earned" is worth more than 19 times the dollar earned. This is the kind of logic that budget approval committees want to hear, and exactly the type of reasoning we used to get our "energy saving" project approved.

I began by presenting the project to the hospital COO to whom I report. It was later placed into the budget process and after several budget presentations to administration and the budget committee, it was approved. The hospital planned to pay cash for the project. We had a great deal of confidence in the team we assembled to design and build the project, so we had faith that we'd see high returns on the investment.

Design And Equipment Selection Phases

When the actual design phase began, Jim Waltz added Craig Shulenberger, a design/project engineer from his firm, to the team. Craig had an extensive background in similar projects.

This was a very interesting part of the whole process. We went from knowing exactly what we wanted to construct, only to begin a whole new round of questions and answers.



The new chillers were disassembled, rigged through an existing area, and reassembled in the available space in an existing cooling plant.

Basically, the project scope stayed the same, but selecting the equipment became the real challenge. Choosing the main components and dealing with each prospective vendor took a great deal of time and patience. We wanted to get the best equipment for the project at the best price.

At this point, to help the equipment selection process move along smoothly, we also added Linford Company — an Oakland, CA-based Design/Build contractor — to our team. We had worked with this firm before, and knew that their experience with selecting reliable equipment would be invaluable.

During this phase, we had to rule out most chiller manufacturers because as the piping design became more concrete, we realized that due to our confined space, only certain chillers would fit in the available space.

We selected other items individually, including pumps, variable speed drives, valves, and controls. We chose each component based on a combination of factors including quality, efficiency, value (based on what we could afford), ease of maintenance, and product availability.

By now, we had also added an OSHPD (Office of State Healthcare Planning and Development) project inspector to the team (in California, OSHPD is the entity that issues construction and retrofit permits for healthcare facilities — it's not done at the local level). We thought this would ensure a complete project that would run smoothly through the approval process. We couldn't afford delays because we wanted to have the new project completed before summer. OSHPD approved

Construction Challenges

This project was much more than a mere "chiller change-out." The team had to:

- Relocate the medical air compressor and vacuum system receiver tank to free up desperately needed space in the refrigeration machinery room
- Demolish existing cooling towers, chillers, piping, and electrical
- Demolish non-structural walls adjacent to the refrigeration machinery room to provide a pathway for bringing the new "knocked down" chillers into the refrigeration machinery room
- Install temporary chilled-water piping to bypass the demolished chiller plant so the second chiller plant in the other hospital wing could provide temporary chilled water on unseasonably warm days during the winter construction period
- Build new chiller and pump foundations in the refrigeration machinery room, construct a unique "floating" steel platform for the cooling towers on the existing roof, and build new condenser water pipe supports (which were integrated into the existing roof structure)
- Rig the chiller components into the refrigeration machinery room; assemble and mount the chillers on their foundations
- Construct a chilled water and condenser water piping support structure within the refrigeration machinery room and install the chilled water and condenser water piping, pumps, valves, and other accessories
- Rig the cooling towers into place and mount them on their structural platform on the roof
- Install condenser water piping on the roof
- Install architectural enclosures (lightweight steel framing and corrugated metal/styrofoam and fiberglass field-constructed panels) around the new cooling towers
- Install framework and grating for walkways over condenser water piping
- Add new breakers and feeders to unit-mounted chiller starters, variable frequency drives, and feeders, starters, etc. for the new cooling tower fans
- Install phase-to-phase chilled water transfer pump, including piping, variable frequency drive, and electrical
- Automate the new plant through the hospital's existing building automation system (add new control hardware, perform programming functions, customize computer graphics, and recommission the re-vamped system).

the design. Minor items were changed during the OSHPD back check process.

A Temporary Detour

Around this time, we were finalizing plans for the design and placement of two new cooling towers. I became concerned that their profile was becoming rather obtrusive as they grew in height to satisfy the low (energy saving) condenser water temperature we wanted, and not interfere with the existing roof structure. I started to wonder what the City might say if this was brought to their attention.

To be a "good neighbor" and to ensure code compliance, I decided to inform the City about the cooling towers. Even though we had the required OSHPD approvals, the City still insisted we lower the height of the cooling towers, even though there was no ordinance supporting this mandate.

At first, our team figured we could solve the problem by using four smaller cooling towers (instead of the two tall ones). But that would cost an additional $250,000!

This added cost would put the project too far over budget, enough so that we might have had to cancel the project or at least put it off for another year.

After several brainstorming sessions, Bill Call, Linford's project manager, suggested we could still use two cooling towers — they would just have to be smaller. At first, the other engineers thought this was improbable, but after a closer look and some re-engineering, they were able to make it happen. Since the new towers would have the highest maximum horsepower available, along with multi-speed fan motors, they would operate well below maximum capacity most of the year, and they wouldn't use much more energy than the original cooling towers we were going to use! We were excited that we could still proceed with the project.

The Project Begins

Linford Company was awarded the project. Some examples of how this firm added value to our project and helped us save money are:

1. The original concept called for excavating behind the administrator's office and cutting a hole in the concrete foundation wall for equipment access to the chiller room. Linford suggested buying chillers which could be disassembled to allow rigging through the existing areaway and then be reassembled.

2. As mentioned earlier, Bill Call saved the project from going too far over budget by

suggesting two lower profile cooling towers rather than four.

3. By designing a floor-mounted steel support system for the chiller room piping, they saved a great deal of labor cost. This also meant they didn't have to hammer-drill hanger inserts into the slab under the administrator's office and disturb him with noise and interruptions.

Linford faced several construction challenges. For one, the job required a fast-track schedule. While the project was released for construction in November 1994, waiting for OSHPD approval on a change order delayed demolition of the existing chiller plant until January 1995. The schedule required the new chillers be on-line 18 weeks later to beat the hot weather.

To meet the schedule, Linford immediately detailed all piping systems and prefabbed them in their piping shop. They also scheduled the set-up and tear-down of cranes on weekends to minimize disruptions to the doctors' parking areas.

When it was time to install the two new cooling towers, timing was critical due to heavier than normal rainfall. They began tying-in pipe and removing the old cooling tower at 2:00 a.m. on a Sunday morning. The work was finished and the new cooling towers were up and operating eight hours later!

Another special part of the construction process was ERA's involvement with the plant automation controls. They detailed the modifications to our existing (and somewhat antiquated) digital control system and worked in the field with the contractors during installation. They then commissioned and programmed the system and created a custom graphic showing the entire two-plant chilled water operation on a single computer screen.

For more details see the sidebar "Construction Challenges."

The Approach Worked

Construction was completed in early summer 1995. During its first summer in operation, the new equipment (housed in cooling plant one) performed extremely well. While ERA's design assumed that both chiller plants would be needed on the hottest days, the new plant alone (with the help of ERA's interplant "transfer" pump) was able to support the entire facility all summer long! This performance far exceeded our expectations, and let us completely avoid the electrical demand charges that we would have incurred had both plants been running — about $30,000. This was *in addition to* our original savings estimates.

Architectural enclosures were built around the new cooling towers.

Perhaps the original estimated annual savings of $50,000/yr. may not seem overly attractive considered against the $1,300,000 project cost (approximately $1,200/ton for 1,100 tons). Yet a 4% return on a restoration, facility upgrade, comfort, and indoor air quality project is what Jim Waltz refers to as a "real silver lining." In addition, Pacific Gas & Electric's "Retrofit Efficiency Option" rebate program kicked in a $27,000 rebate to help out.

All in all, it just goes to show how important the team concept is to a successful project. By adding ERA to the team during the conceptualization phase, we got valuable help solidifying our ideas and making them marketable to our budget committee. Because ERA knew the direction we wanted to take early on, they also had a "head start" during the design phase. And because we added Linford to the team during the design phase, they provided valuable, cost-saving input *before* construction began; when construction *did* begin, they already knew exactly what had to be done to make the project work and to complete it within the tight time-frames we required.

When all parties cooperate in the design, budgeting, and construction phases of a project, the payoffs are tremendous. We at John Muir Medical Center certainly got the best deal possible for our dollar. Not only was the project a big success, but it was fun and educational, too!

Editor's Note: *James Waltz, ERA, and Bill Call, Linford Company, provided special assistance and technical information for the preparation of this article.*

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