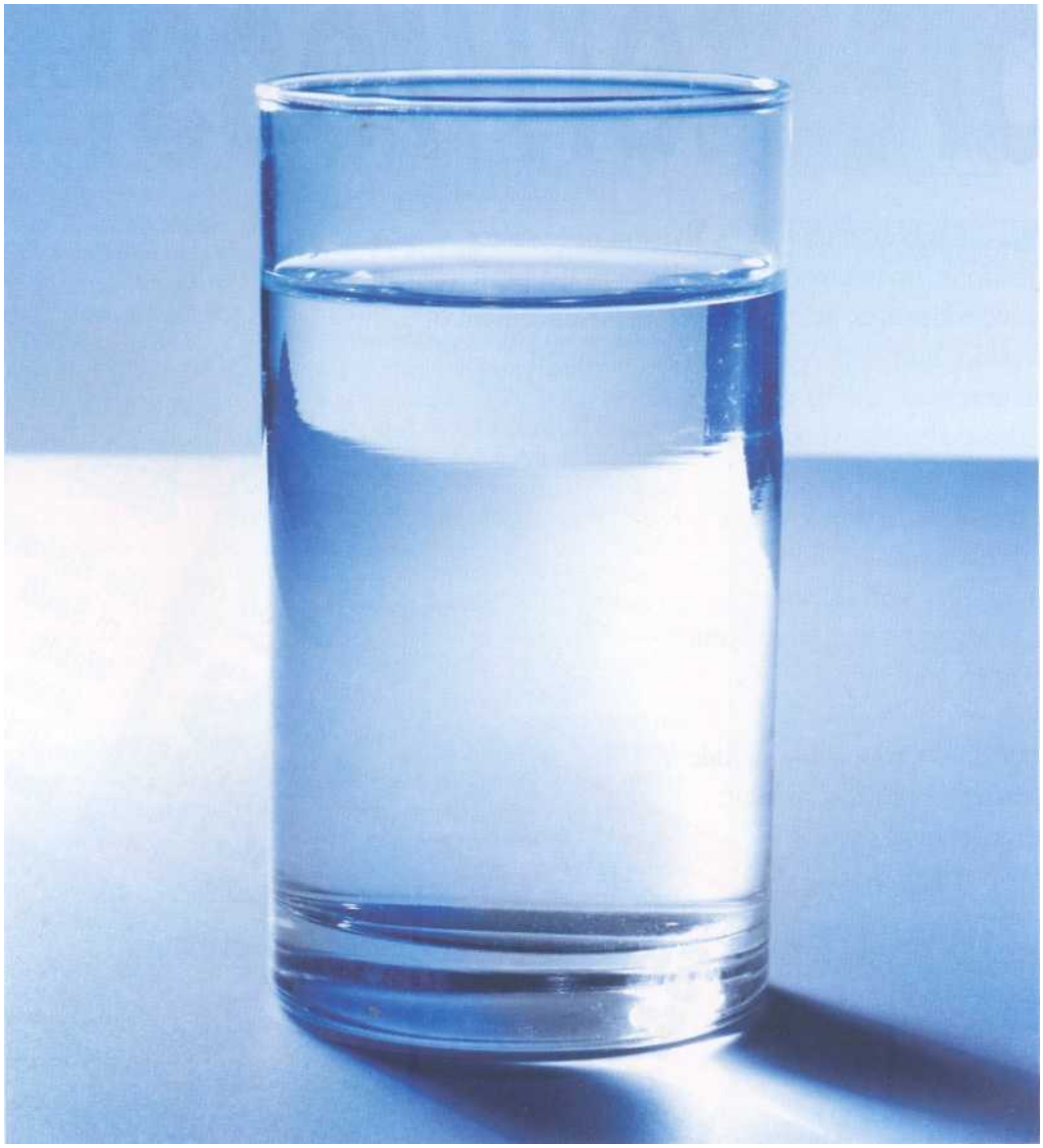
Minimizing Cost



BY AMY SORKIN KURLAND

Water transportation is costly enough as it is, but with electricity rates continuing to rise, many in the industry are working even harder than ever to find new technology that will reduce those costs. The challenge is more difficult than it may sound. And that's partly because whenever one creates a new water transportation system, cost can never be addressed in a vacuum. The sister issues of water pressure and water quality are always part of the picture as well, which brings up the age-old question: How can you create a system that lowers costs without compromising water pressure or quality?

One company has created a pump-scheduling software that successfully balances all the elements mentioned above. It's called Derceto (from the San Francisco based Derceto Inc.), and it's already being used by a handful of utilities in the United States. Derceto pump-scheduling software has proved, even in its earliest design, to be very effective in reducing energy costs for water transportation and delivery for consumers. And the best part of all: Not only does it lower energy costs by automat-

Maximizing Quality

Energy costs appear to have a one-track mind lately: They just seem to keep wanting to go up.

ing pump scheduling in response to changing demands, but it does so while maintaining-and often improving-water quality and pressure simultaneously.

Time for Something New

In an ongoing attempt to reduce the extensive costs of water distribution, The East Bay Municipal Utility District (EBMUD) in Oakland, CA, which serves a large portion of the eastern San Francisco Bay area, had been seeking a new pump-scheduling system since before 2000. It first discovered the software at an American Water Works Association Research Foundation (AWWARF) workshop.

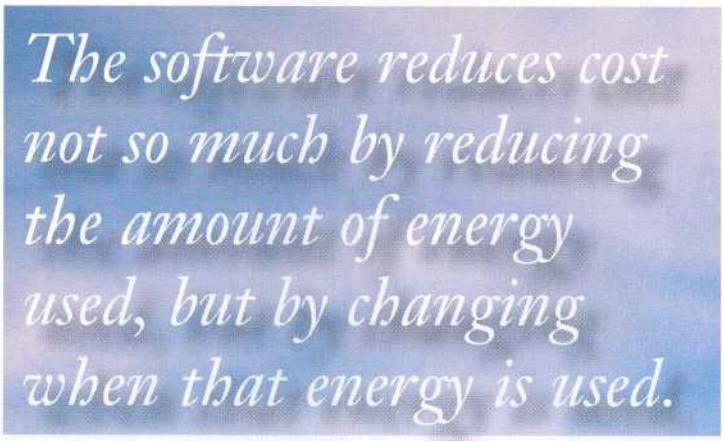
EBMUD contacted Derceto and was provided with a product demonstration. Ultimately EBMUD produced a request for proposals, which was sent to numerous software and water engineering companies to identify other software programs for the optimization of water distribution. After an extensive evaluation, EBMUD selected the Derceto software based on its functionality and implementation record.

In addition to EBMUD, the Derceto software is currently being used by the Wellington Regional Council in Wellington, New Zealand, as well as by three other utilities in the United States, including the Washington Suburban Sanitary Commission in Maryland, the Water District Number One of Johnston County (Water One) in Kansas City, KS, and the Eastern Municipal Water District in Perris, CA.

When EBMUD installed Derceto in August 2004, it did not completely replace the existing systems-far from it. Instead, the Derceto software is overseeing 15% of EBMUD's distribution pumping plants.

Although this may not sound like much, the Derceto-controlled pumps actually account for 25% of the utility's total pumping costs.

The first thing to know about the software is that it reduces costs not so much by reducing the amount of energy used but, rather, by changing when that energy is used. Some energy is reduced through efficiency gains because of the pump choices it makes, but mainly it lowers costs by using storage in the system to meet the demand when energy is expensive and pumping when it is cheap.



In short, the program decides which pumps to use and how to run them to achieve the most efficient combination of pumps. "It manages flow from the plant and throughout the distribution system by balancing price and hydraulics through demand prediction and pump scheduling automation," explains Simon Bunn, chief executive officer of Derceto. "Our system does not always reduce the amount of energy used; it just changes when you use it, so the overall cost is lower. It automatically controls water distribution to maintain the water supply and pressure for the customer at lowest cost, which is primarily an electricity cost."

Optimizing pump and valve schedules is the name of the game here. The software connects directly to the user's SCADA system. The live data provided by the SCADA is then used by the program to adapt in real time to water demand and then select the lowest cost solution for water production and distribution. Once the program makes this decision, it automatically outputs directly to pumps and valves.

Here's a typical day in the life of EBMUD's software. First, it looks at the upcoming day and makes a reasonable estimate of demand for what the water needs will be. It determines not only how much water will go through these areas, but how much will be used each hour. Once the software compiles this information, it can then decide how much will be needed to satisfy customer demand, filling storage tanks and deciding when to release them.

"Savings strictly come from the software program's ability to predict future demands and to develop and execute the lowest-costing pumping plan to meet those demands," says Richard Sykes, manager of maintenance and construction at EBMUD, who was the manager of water operations and maintenance when the software was installed at the utility. "For instance, let's say it's Wednesday. We get the weather, the current water demands, and some estimates of weather pattern for the next few days. The program has enough information to know what those water patterns are for this time of the year. What it tries to do is to avoid pumping during peak hour areas while still meeting our goals for making sure there's enough water to meet customer needs."

Because the system runs in real time, it recognizes and reacts to both the evolving changes in demand throughout the day and unexpected demand such as fire flows. This is, of course, one of the reasons it works as

well as it does. Not only is it continually able to readjust the pump schedule, but it gives the operators a heads-up that changes are impending in case they need to make a manual change at the water treatment plant.

Never Underestimate the Power of a Contract

Apart from being impressed with Derceto's approach, an important factor that swayed EBMUD into its decision to buy the software was the particular contract the vendor offered, known as a shared savings contract. Instead of paying for the total cost of the software up front, EBMUD made only a small up-front investment. The agreement was that EBMUD would make further payment only after Derceto showed that the software worked. From that point on, for the next four years, EBMUD paid a percentage of the energy costs saved through the use of the Derceto software. So EBMUD's out-of-pocket cost was actually quite modest.

"We ended up negotiating with them," continues Sykes. "They didn't have a product that would fit our system, and we didn't want to fund the full development of the system. So the contract states that we'll share the savings with them over a period of several years. Our benefit is in the savings in the long term. Initially about 50% of our savings will go to Derceto and diminish over a five-year period. We made an initial payment of approximately $100,000 up front; that's all."

Although the contract is an excellent way for a business to purchase new and expensive technology with little risk-and it was ultimately a worthwhile choice for EBMUD-there are some challenges in regards to the contract that EBMUD is discovering after the fact. "I think the contract is good with experimental and untested software because if the software doesn't perform, you're not obligated to pay for the product, in which case the primary cost is strictly your labor," starts Dave Beyer, senior civil engineer at EBMUD. "The challenge is that the tracking of the savings can become a very labor-intensive task. You have to be on target and in agreement with the software vendor every month." So as to facilitate this process, Beyer used a baseline tool to help both parties more easily come to the same savings conclusions.

"One of the challenges in utilizing a baseline tool in determining the savings is resolving disputes in the baseline tool's results," says Damon Hom, associate engineer at EBMUD. "This has occurred from time to time and has required a significant amount of Derceto and EBMUD staff time to resolve. To date, all disputes in the savings calculations have been resolved equitably with full acceptance by both parties."

Beyer also points out that there are energy tariff changes, and because of those you have to modify the baselines as often as the energy tariff changes. This occurs approximately once a year. In 2006, however, EBMUD's energy tariff changed four times. "Also, with any significant capital improvements on your system, you have to adjust the baseline too. In short, anything that significantly changes how you operate the facilities will affect the baseline. This heightens the probability of dispute," adds Beyer.

On the other side of the coin, Beyer points out that a shared savings contract is unique in that it allows a company to purchase technology it probably would not otherwise be able to afford or finance. "Water utilities tend to be more conservative, and we don't usually invest in untested technology. As a result, they often have very limited financial support for projects of that nature."

The Cost of Quality

But enough with all the talk: It's time for numbers. Since the software has been live at EBMUD for well over a year now, what kind of savings has the utility seen? The vendor and EBMUD estimate savings of about $360,000 to $370,000 for the first year. "This was on a $2.6 million energy bill," says Bunn. "For the second year we have done better in percentage terms, but it was a lower water-demand year, so the dollars are about the same."

Since the software costs approximately $600,000 to $1.5 million, cost can certainly be a prohibiting factor for many companies-especially considering it would appeal most to those companies actively seeking to cut costs. But Bunn is confident that the payback will come back rather quickly. "If you don't get a payback in two years, we'll be surprised," he says. "We even say in some of our contracts that if this doesn't happen, we don't get paid." In the case of EBMUD, the savings started to kick in as early the same month the system went live.

Other software benefits-in addition to lowering energy costs-kick in immediately. As mentioned earlier these include improving the quality of the water and protecting the water pressure for the consumer. Water quality deteriorates with age, so it's important that tanks turn over in less than five days. "Our software, being automated, is very consistent in achieving turnover. Manual operation makes this much harder to achieve as shift changes and duty rosters make it difficult for operators to know when a tank was last drained down and replenished," Bunn maintains.

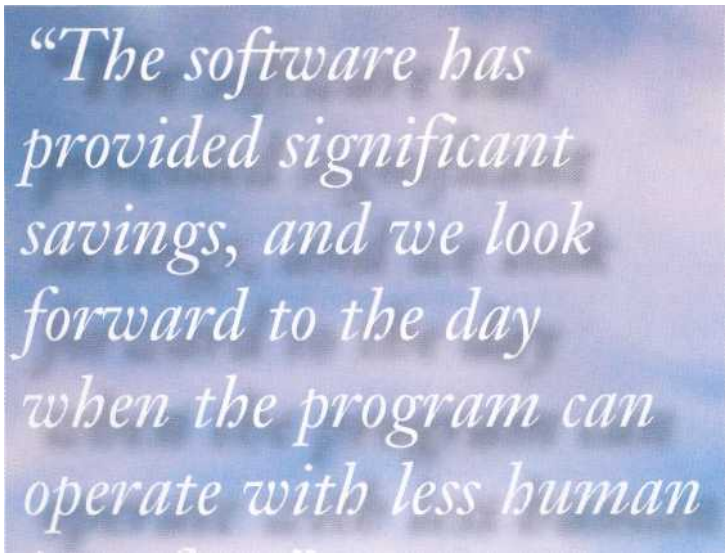
As far as water pressure is concerned, there's a delicate balancing act the utility must achieve to ensure that just enough water pressure is delivered to the consumer, but not too much. Too much pressure leads to pipe breaks, which are obviously undesirable. So how does the software address this issue?

"During the day, when demand for water is high, you might need to use four pumps in a pressure zone to achieve this goal," starts Bunn. "At night, one pump might suffice. Since operators don't always know what's happening to demand, it's easy to have too few or too many pumps running. The program is always calculating expected pressure in each zone and makes decisions in real time to turn on the appropriate number of pumps."

That Demanding Demand

One unique feature of the software is how well it deals with shifts in demand. "It's automatic because it has to make very quick decisions, since things are changing all the time," says Bunn. For instance, the weather may suddenly change. Or you might get a weather change on one side of a hill but not the other (e.g., in San Francisco). Equipment failure is another thing that might require a change. "The software makes all those decisions. It actually plans out, 48 hours ahead of time, what it wants to do. But the key is that every half-hour it updates its plans based on what has happened. If necessary, it will change its previous decisions and try to find a better solution. But it must solve all this while taking care of the other things like hydraulics and quality, because what may be ideal in terms of cost may be bad for quality."

A prepared pump schedule is too simple, says Bunn, as it does not account for changes. To be successful, a program has to be automatic and adaptable at the same time. "It must be pragmatic, it must be precise, and it has to work." Although it's automated, the program was also designed to be interactive so as to add to its adaptability. Operators can intervene when they want to. For instance, if they know there's going to be lightning later on in the day, they can preempt the machine and ask for increased storage levels in case of fires. The most common situation in which an operator may intervene is when there's an equipment failure. In this case they can tell the program that a certain pump is unavailable before it has to work it out for itself from the SCADA data.



What Does "Automated" Mean?

The Derceto system automates EBMUD's pumping plant operations in that it evaluates project demands, and sets and implements pumping schedules without operator input. Bunn likes to explain the degree of automation in this way: "It's like an autopilot on an aircraft. The autopilot can fly the plane from A to B automatically, but it's always nice to know there is a pilot on hand if needed. The program does control a system fully automatically, but there is significant opportunity for operator interaction."

However, this does not fully automate the distribution system operation or allow for fewer distribution operators in our control center. Currently EBMUD's control center is staffed with two operators on day shift and one operator at night.

"Our operators still have jobs," says Sykes. "The system did not provide so much efficiency that we could eliminate staff. The operators are needed to provide oversight of the system and to respond to alarms and unusual conditions caused by the automated operations. The system requires frequent override by operators. Our operators are also engaged in controlling the 80% of our distribution system that is not operated by the Derceto system."

"A SCADA only shows you the past and where you are now. Derceto shows you where you are now and where you'll probably be in the next 48 hours," says Bunn.

And what about keeping this complex application up-to-date with changes in the hydraulic network? "All the various software applications can be monitored through secure remote access," Bunn says. "The software also gives a daily e-mail report, unless something goes wrong such as loss of SCADA communications. Then it will report instantly by sending us an e-mail. We can fix most things remotely." The vendor also has staff that will come out to the site when necessary.

Putting the Pieces in Place

Derceto software runs on a standard office PC. At EBMUD, installation simply entailed putting two servers in the control room. Two technicians went out to EBMUD, with a rep, to determine where the servers would go. They checked out communications and installed the servers, and that was it.

The training of the user's employees, however, is an extensive process typically undertaken over a two-month installation phase. There's a lot that can be done with this software, so there's much that needs to be learned before an operator can take advantage of its full capacity. "You can override things and see the impact your

override might have," says Bunn. "For instance, consider taking a pump station out of service. Maintenance may want to shut it down for four hours to do work on it. With the software you can schedule this outage and simultaneously see the cost impact this will have on energy. Then an operator can investigate different timing for the outage and see when the least cost impact will occur. The training will tell an operator how to use this flexibility in scheduling to make well-informed decisions. You can override, change flow rates, see which equipment is available, and deal with a variety of what-if situations."

For EBMUD operators, learning to use the software has not been the greatest challenge, however. "The challenge lies in interpreting what it's doing and whether or not it is meeting our operating criteria. We have to look at what it's telling us to do, figure out why it's doing that, and either acknowledge it or override the pump schedules and do it our way," says Beyer.

"The operators don't have problems with the technology, but they sometimes question the solution, as the schedules can be different from our historical operations," adds Hom. "To understand this new operation you need to look beyond the individual pump schedule and to look at the entire system the program is controlling. The software allows you to go through the screens quickly so you can assess the situation."

Adjusting to Change

Although this is new software, there's a sizeable number of pumps it's overseeing, and it requires a completely new way of managing water distribution. EBMUD has spent more time than was expected simply adapting to the software. "It's clearly led to efficient operations from an energy cost standpoint," begins Sykes, "but we have a very complex system and it has been difficult to implement, technically [to develop the program] and culturally for operators to adapt from hands-on operations to somewhat of an oversight role."

EBMUD had assumed early on that the fact that the program still requires operator interaction would not be an issue. "But now we think it may have been better to automate everything as much as possible," shares Beyer. "This would allow the operator's role to be more of a position of oversight, with less time spent manually inputting data and manually operating the system. Our operators spend a significant part of their day managing, interfacing, and reporting their concerns with the program. Engineers in turn respond to the operator's concerns. In general, we find that the software and contract require significantly more time to manage than first anticipated."

Many of these issues are the result of growing pains, the inevitable learning process that comes with installing new technology in a new application. Even with the extra effort EBMUD has experienced to adapt to this new technology, the company appreciates the savings it has delivered. "The software has provided significant savings to our energy bills, and we look forward to the day when the program can operate with less human interface," says Beyer. But even in its earliest stages, Derceto's software provides tangible results and promise for a better, more efficient distribution technology in the years to come. DE

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