At What Cost, Energy?

As prices climb, utilities rethink processes, emphasize conservation

When it comes to rising energy costs, Jack Herring is — at least for the time-being — feeling better than most people in his position.

It’s not that there isn’t ample reason for concern. Between 2003 and 2005, fuel oil prices nationwide rose 50%, and coal went up 20%. Since 1999, natural gas has shot up a whopping 300%.

That’s all according to a July report by the Edison Electric Institute (Washington, D.C.).

It’s just that in Hannibal, Mo., where Herring serves as general manager of the Board of Public Works, wastewater treatment plant (WWTP) operations have yet to feel the impact of rate increases. In fact, when the board’s current 11-year wholesale electricity contract expires in January 2009, the city of 17,600 will have been paying less for electrical power than it did 10 years earlier.

“We were lucky,” explained Herring. “When we negotiated our electricity contract in 1998, deregulation was the key word. We were able to sign an 11-year contract and implement a rate reduction.”

While there are other “Hannibals” around the country — cities that locked into long-term energy contracts when the time and the price were right — they are the exception, not the rule, according to Larry Jentgen, vice president of EMA Inc. (St. Paul, Minn.). And their days are numbered.

Jentgen said his firm, which provides automation and management consulting services for water and wastewater utilities, is seeing more utilities grappling with energy-related issues. Given the dramatic price increases of recent years — and doubts that prices will again return to the lower levels of yesteryear — many have begun to change the way they look at energy.

Learning From Experience: A Design—Operate Approach

Paul V. Nolan and Jim Condon

When Sioux City, Iowa, decided to move from a short-term to a long-term operating contract, it had to decide whether to rehabilitate its existing plant or to construct a new one. Municipalities making such decisions face many challenges — in the form of applicable laws, political concerns, market changes, and financial constraints, among others.

The city encountered stumbling blocks and delays along the way, and although the results of the process were not ideal, they brought to light many of the issues that municipalities in similar situations should consider carefully.

The Sioux City Wastewater Treatment Facility, a regional treatment plant located on the Missouri River, receives domestic, commercial, and industrial wastewater from surrounding communities.
Table 4. Cost Comparison

<table>
<thead>
<tr>
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<th>Proposal</th>
<th>Contract</th>
<th>Estimated Cost for City Operation</th>
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</thead>
<tbody>
<tr>
<td>First year O&amp;M/total fixed component</td>
<td>$4,132,940</td>
<td>$4,948,876</td>
<td>$4,424,183</td>
</tr>
<tr>
<td>Third year O&amp;M/total fixed component</td>
<td>$4,469,554</td>
<td>$4,666,841</td>
<td>$4,763,236</td>
</tr>
<tr>
<td>Total nominal O&amp;M costs (20 years)</td>
<td>$104,151,898</td>
<td>$114,485,355</td>
<td>$115,513,896</td>
</tr>
<tr>
<td>Difference</td>
<td>0</td>
<td>$10,333,457</td>
<td>$1,028,541</td>
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In the design and construction administration and O&M contracts in September 2004.

This unique design–operate approach did not generate the anticipated results. As Table 4 indicates, in the final analysis, the expected O&M cost savings were marginal at best.

Legislative efforts should be undertaken to modify Iowa law to allow for design–build. The city approached local legislatures and tested the waters, asking them to submit draft language that it had prepared, but lobbyists immediately shot down the idea. In the absence of such legislation, both operating cost and construction cost savings cannot realistically be achieved.

Municipalities need to spend a great deal of thought and care in developing the RFP and any addenda to ensure that it is clear, concise, and not subject to much interpretation. While the use of an oversight committee is undoubtedly good public policy in a major long-term project, its implications need to be weighed carefully.

On the positive side, the partnership was able to make guarantees for effluent quality, odor control, maintenance, and process equipment repair and replacement. Long-term operating costs are now stable, allowing for predictability in user rate setting.

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Making Sense of Asset Management

David Mason and David Vago

Asset management is one of the hottest topics at utility management conferences and workshops. Many of us think we should be doing something about asset management, but we’re struggling to get our arms around it. There is a general misunderstanding of what it is, as well as a lack of a common language to discuss it.

You may be asking yourself, “What is all the buzz of asset management about? Why is implementing an asset management program so complex? Where do I start?” Some of us have made asset management seem so cumbersome and complex, by creating lengthy documents and extensive spreadsheets, that we are missing the real business application of this approach.

So what is it? Asset management is a disciplined, deliberate, and systematic approach to making informed decisions about assets. It involves seriously considering and determining what your core business is. Asset management is a process...
that focuses on your organization’s mission and goes beyond maintenance and repair activities — and beyond software. It includes engaging key internal and external stakeholders to identify their expectations regarding service delivery, defining the specific assets that are needed to meet those expectations, and identifying how their failure can defeat your mission.

You can develop an organizational culture that focuses on deploying limited resources effectively and efficiently to ensure that you are managing assets wisely. Asset management establishes a business case for selecting alternative courses of action.

At the same time, asset management is also a great liberator. By defining and then focusing on a core mission and level of service, we become free to prioritize maintenance efforts. We can focus on the assets critical to the mission and give less attention to those that are less critical. If a piece of equipment’s failure will not cause a mission failure, we might just be free to let that piece of equipment run to failure before we fix it.

The 2006 edition of the International Infrastructure Management Manual (Version 3, published by the Association of Local Government Engineering NZ Inc. [INGENIUM], National Asset Management Steering Group, in New Zealand) defines asset management as: “The combination of management, financial, economic, engineering and other practices applied to physical assets with the objective of providing the required level of service in the most cost-effective manner.” Sound familiar? Every operator I know will recite something very similar when asked what an operator’s responsibility is.

Where We’ve Been

Asset management is not new. In fact, some might say it has been at the foundation of capacity management, operation, and maintenance (CMOM), GASB-34 (the Government Accounting Standards Board reporting requirement), and to a degree, recent vulnerability assessments. Water and wastewater operators and maintainers have been managing assets all along.

The problem is that we’ve been making decisions about assets without first thinking through a formal strategy for repair, rehabilitation, and replacement. Instead, we have relied heavily on the frequency of unplanned and unscheduled repair events. In many situations, such decisions are made in the heat of a crisis, usually when a piece of critical equipment has failed and requires immediate attention.

Due to a lack of planning, we must rely on anecdotes, rather than recorded documentation, to piece together a history of failures to justify costly and untimely rehabilitation or replacement. Even with well-documented equipment repair and maintenance records, we find ourselves planning for the future by looking in the rear-view mirror. We’ve lacked a process to help us estimate an asset’s remaining useful life and to allow us to optimize our decisions about deploying resources in the most effective and efficient manner.

Where We’re Going

We want to know how to sell asset management to our executive management, water and sewer board members, town councils, city managers, and mayors. Even consultants are trying to figure out how to sell engineering services as a means to accomplish asset management, while vendors are hawking software as the asset management solution.

If we accept the mission-based nature of asset management, then it clearly cannot be accomplished at a management retreat or training seminar. It requires new thinking and cultural change. But that’s not to say that managers cannot derive huge benefits by changing the way we think about assets and incorporating some basic principles into our workplace.

Managers can lead a transition away from business as usual — and what we’ve come to think of as conventional wisdom — to achieving business results with a return on assets. An example of this transition is moving away from inter-

val-based maintenance activities, which have little effect on eliminating equipment failures, and toward condition-based activities that can prolong the asset’s remaining useful life. Many of us have experienced the frustration of increasing the frequency of preventive maintenance activities, only to find no improvement in equipment failures.

A Systems Approach

It might sound silly, but one of the first things you need to do is to identify your assets. Few of us have had the opportunity to do this beginning with a clean sheet of paper. We’ve inherited previously installed maintenance management systems or have in one way or another inherited systems that reflect old thinking.

You may find that identifying assets in a practical way requires new thinking. We suggest starting at a macro level, as you would when identifying the single point of failure in a vulnerability assessment. For example, consider selecting a plant, unit process, or pumping station as the asset rather than every single piece of rotating equipment or stick of pipe in the ground. Think in terms of systems, so you can readily identify the components or combinations of components required to meet demand and deliver the expected functionality and performance. This may be less cumbersome than you expect, and it will help you identify the system’s truly critical assets.

This paradigm shift is a significant departure from thinking of assets as the federal grants program of the 1970s did — and as many public-sector finance departments do. The finance department’s mission of accounting for assets and our mission of operating and maintaining a collection of assets are different, and they require us to define assets somewhat differently. Finance departments typically require putting asset inventory control numbers on everything, including file cabinets, computers, and even telephones, and accounting for these items annually. Each item is considered an asset. While this type of
“asset tracking” may be important from an accounting standpoint, it does little to help the maintenance director decide which pieces of equipment need to be kept running at all costs and which can go down for a day or two. And it does not help prioritize spending the utility’s precious few maintenance dollars.

When taking a systems approach, an entire system, such as the collection system, pumping station, major trunk lines and interceptors, or plants, can be considered the asset. Of course, you can divide these into subsystems, which will help identify critical components. Ask yourself, “What do I absolutely need to operate the system?” and focus your thinking on function and demands placed on the system.

Let’s consider an automobile as an illustrative example. Comparing a car to a plant is not as far-fetched as it may seem. There is little question that everyone would consider a car an asset. It represents a significant capital investment for most of us. Everyone has different expectations for service and performance, depending on whether the car is used as a working vehicle, a sport or recreation vehicle, a family car, or a collectible. In any case, functionality is derived from the components of an asset functioning as a unit.

To ensure that the car performs as intended, we identify and prioritize its components, either consciously or unconsciously, into several individually maintained items that work together to deliver a certain level of functionality and performance. These maintenance items could include the power plant (engine), the guidance system (wheels, steering, and instrumentation), safety (lights, horn, and windshield), structure (body components), and aesthetics and comfort (interior options and radio).

If the power plant or guidance systems fail, the car can’t fulfill its purpose. These components are most critical, so we want to ensure, to the greatest extent possible, that they never fail. As a result, we maintain components such as spark plugs, oil, tire pressure, and ball joints in the guidance system. Then we make decisions about how often we should check these components and service them. We’ll check tire tread depth and change the tires when the tread wears down to a certain point.

We also recognize that safety components are of high importance. So we inspect or test them at some regular interval. We periodically check the lights, and if we see that one has burned out, we may decide to either replace them all or step up the frequency of inspections.

Since the aesthetic features are not necessary for the car to function, they might be serviced as time permits or when they fail or are damaged.

Do we repair every paint chip, check the tires every day, change oil every week, or fill up with gas twice a day? Probably not. Somewhere in the process, we decide on a frequency for maintenance based on performance and condition. Of course, with new or refurbished assets, if we know what signs indicate that an asset is failing, we can monitor them on a more regular basis from the beginning, to ensure that we catch the problem at its outset. Then we can alter either the types or the frequency of maintenance activities in response to the problem.

We can think of a treatment works or buried infrastructure the same way. For a plant, the unit processes, treatment systems, and even individual pieces of equipment could be considered components. For the piping network, components would include pipes of various sizes, pressure zones, drainage basins, and lengths from one reference point to another (manhole to manhole).

Changing our paradigm from thinking of a plant as a collection of assets to thinking of the plant as an asset helps identify critical equipment. Redundant pieces of equipment, which are maintained but are not required to meet demand, don’t need to be considered to initiate an asset management program. For example, if a school has a fleet of 15 buses, and only 12 are needed to bus kids to school, what are the assets? Each of the 15 buses? No — the asset would be the fleet.

Setting Priorities

Once you identify critical assets, you can answer the question: What activities do I need to perform today, tomorrow, next week, and next year to ensure that I
can continue to meet the system's demand and expected levels of service and functionality?

Maintenance and repair activities represent only one of several stages in an asset's life cycle, but it is the longest stage — perhaps as much as 90% of the asset's life cycle (see figure, p. 8). This is where operators and maintainers spend the greatest amount of time. Doesn't it make sense to emphasize proper planning, scheduling, and execution of maintenance and repair activities?

Doing the right things the right way to extend the useful life of an asset, by embracing best practices, lies at the heart of asset management. Remember, there's no benefit to doing things well if they shouldn't be done at all. If more frequent preventive maintenance activities don't reduce equipment failures, they're not necessary.

Like GASB-34, asset management is a forward-looking process. GASB-34 can be just a financial exercise that starts with the original purchase price of an item and then projects a straight-line depreciation over a somewhat arbitrary period of time, which results, at least on paper, in a fully depreciated asset at the end of that period. But an effective asset management program forestalls equipment failure and prolongs the asset's useful life.

Consider the value of a critical pump that had a reported anticipated useful life of 20 years. Now, assume that you apply best maintenance practices and available technologies in such a way that extends the pump's useful remaining life an additional 25, 30, or 50 years. That's asset management!

A well-defined asset management program focuses our attention on what matters most today and in the future. It ensures that critical assets will continue to meet the required level of performance throughout the system's life.

Unfortunately, such a strategy cannot produce benefits that can be realized in a year. Asset management will not reduce the annual operating budget overnight. However, in the long run, it will result in the need for smaller capital-funded equipment rehabilitation and replacement projects and smaller rate increases to fund the capital program.

Taking a global look at your assets will help you define your core business. Using what you learn in this process to extend an asset's useful life for an additional 5 or 10 years is what asset management is all about.

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Going Deep
A growing number of cities explore storing treated wastewater underground

In places that face seasonal water shortages, it's an idea whose time appears to have come: storing treated wastewater deep underground during rainy months, and then pumping it back up to the surface for irrigation purposes during dry ones.

Such underground water banks are "one of the hottest new applications" of aquifer storage and recovery (ASR) technology, according to David Pyne, president of ASR Systems (Gainesville, Fla.). In some quarters, they're also the source of some controversy.

ASR technology itself — which involves injecting treated water into an aquifer through a deep well — is not new. In fact, there are at least 72 fully permitted ASR well fields in 17 states that house more than 300 fully permitted and operating ASR wells, according to Pyne, who recently completed an inventory of these sites for the American Water Works Association Research Foundation.

The vast majority of ASR sites, however, are used to store treated drinking water. It's only been in the last decade that cities have begun to explore their potential for storing treated wastewater that can later be used to irrigate golf courses, public parks, and other areas, reducing the demand on a city's potable water supply.

That's where the controversy comes in.

"It's one thing to take reclaimed water and use it on lawns and golf courses," said Mark McNeal, chief executive officer of ASRus LLC (Tampa, Fla.). "It's another to put it into what is perceived to be a pristine aquifer." Critics worry that the water could mix with and contaminate groundwater that could be tapped for public use, he said.

Such critics were particularly vocal when officials in Sarasota County, Fla., announced plans to drill three ASR wells capable of storing up to 757,000 m³ (200 million gal) of treated wastewater at a county utility complex. A legal battle ensued for more than 2 years. The County only recently was cleared to resume work on the project.

Economics Driving Interest
Arizona was among the first states to allow ASRs for reclaimed water, and today operates about 16 such wells, according to Payne. There is also one in New Jersey and a handful in Arizona that are fully permitted.

In other states, such as Florida, interest is increasing now that the Florida Department of Environmental Protection (FDEP) has adopted rules regulating their