The official publication of APPA: The Association of Higher Education Facilities Officers

Facilities Manager

Volume 10 Number 1 Winter 1994

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From The Editor

Steve Glazner

Despite the continued shrinking of budgets and staffs, and the attendant expansion of workloads and responsibilities, innovative and efficient energy and utilities management still provides money-saving opportunities for educational institutions. Lighting retrofits, demand side management and other partnerships with local utilities, upgraded automatic systems, and innovative natural gas purchasing and distribution programs are just a few ways in which campuses are benefiting from energy savings. Basic conservation measures alone will not do the job.

We invited Dr. Mo Qayoumi of San Jose State University to serve as our field editor for this theme issue of *Facilities Manager*. Mo is well known to members of APPA through his many articles, books, annual meeting papers, and presentations at the Institute for Facilities Management. He has selected four articles that are intended to give the reader a small taste of the wide range of issues that show how "energy and utilities management" continues to be a highly ranked topic in APPA opinion surveys. As a followup, APPA will publish a book later this year that will collect these articles with others to discuss emerging technologies, the future of cogeneration, specific lighting strategies, energy auditing and benchmarking, and energy monitoring, reporting, and accounting.

Also in this issue, we welcome Val Peterson, director of facilities management at Arizona State University and former APPA President, as our new columnist for the Focus on Management department. Val draws on his tremendous campus facilities expertise to discuss issues that emphasize the people we work with in our departments. We eagerly look forward to his quarterly columns.

Finally, I'd like to take this opportunity to say goodbye to a staff member I've known and respected throughout the nearly twelve years I've been with APPA. Fritz Saint-Leger will retire this month after serving APPA and higher education for more than fifteen years. His attention to detail, his steady seriousness and subtle humor, and, most of all, his goodness will be greatly missed by the APPA family. We wish him well, and we thank him for his many contributions to the association. ■

APPA

News

Building Commissioning: The Time Has Come

by John A. Heinz, P.E.
Director of Engineering
University of Washington
Seattle, Washington

Just what is commissioning? Commissioning is a programmed series of design and construction documentation and testing activities that are performed specifically to ensure that the finished facility operates as intended. Or, if you prefer shorter definitions, makin' it work! Either way, it is not easy if you don't approach it correctly.

On the other hand, it *is* easy if you begin at the beginning and proceed with conscientious determination to develop a smooth-running program. To facilitate the membership to that end, APPA is developing a two-day workshop to present the information we have developed to date. The agenda for the workshop is included later in this article.

Why Commissioning?

There is a certain class of complex building designs that, in all likelihood, simply will not work unless a formal commissioning program is correctly employed. This is a reality for large and small institutions alike, particularly when building a complex science building with VAV HVAC systems, perhaps VAV fume exhaust systems, energy conservation systems, and DDC environmental control systems. For the small college, which may not have the luxury of a technically strong operations staff, commissioning could easily be the most important part of the project, notwithstanding quality design and quality construction.

In September 1991, at the annual meeting of PCAPPA, I made my first presentation on the subject of commissioning. The audience was appropriately attentive but perhaps less than enthusiastic. Commissioning was not well defined then, and most attendees probably felt already overburdened with existing facilities operation requirements and unstable budget conditions and felt they didn't need a new issue to develop and promote. I felt, however, that it was time to begin the education process in preparation for the time when commissioning would truly become a critical component in the overall process of facilities development. I can now assure you that that time has come.

Since it is predictable that maintenance and operations funding will continue to diminish, the capital construction program must turn over to the operations staff a fully functional facility. There are too many horror stories about new facilities that took several years to wring out, sometimes never to the expectations of the design intent. This can no longer be allowed to occur.

Maintenance and operations program funding is not intended to and cannot be expected to save dysfunctional buildings. The reasonable alternative is to require the capital program to formally commission each new facility and deliver a fully functional building to the owner. That is simply not too much to ask.

We have been developing a comprehensive commissioning program for our new buildings, especially four sophisticated new science buildings. We didn't start in time to properly incorporate commissioning requirements in the A/E agreements or the construction contract documents for these buildings. Each includes something, but not a complete program. From these experiences we have now refined our requirements. Two major buildings to be bid in early 1994 will include commissioning requirements in Sections 01450, 15995, 16995 and Division 17, Commissioning.

Undoubtedly, you have seen advertisements or received flyers from organizations offering commissioning workshops. A number of them have come across my desk. A word of caution for the institution: Commissioning must be a comprehensive, all-inclusive process. The whole building must be taken through a series of functional performance tests. It is not good enough to commission only one aspect of the building.

In that regard, electrical utilities are promoting commissioning and offering services accordingly. The legitimate underlying motive for doing so is to optimize the operation of the ECMs (energy conservation measures) incorporated in the design, some of which have been funded by the local utilities. However, that does not usually result in a comprehensive commissioning of the whole building. I am concerned about the misrepresentation that inadvertently occurs in regard to a proper understanding of the total scope of commissioning.

Similarly, I have seen offerings for commissioning workshops and find the content is focused upon HVAC systems. That is perhaps the major component for building commissioning, but it is far from a complete program. I then become concerned for the functional performance testing of the interaction of the HVAC systems with the life safety systems, emergency power provisions, etc. The workshop agendas generally don't indicate these broader considerations.

Save Money and Improve Performance

To help you learn how to take full advantage of the benefits of commissioning (saving money and improving performance), the APPA workshop will discuss the roles of the consultant, contractor, test engineer, commissioning agent, and owner. This includes the subcontractors, vendors, balancing and testing firm, subconsultants, and owner's operations staff—all of whom have a stake in the total effort. We will discuss the commissioning process, equipment testing, systems functional performance testing, inter-system functional performance testing, scheduling, documentation, training, costs, advertising for and selecting a commissioning agent, and anything else that comes to mind along the way. Two of the presenters are plant engineers at the University of Washington. The third presenter is one of the nation's leading engineers in the commissioning business. The intent is to present a well-rounded workshop of considerable value and direct application for attendees.

In addition to the presentation of these topics, a package of A/E agreement requirements and construction contract specifications sections will be provided for attendees to take with them. These may be adapted to suit local conditions regarding consultant and contractor services.

The first presentation will be offered in Denver, Colorado, March 18-19, 1994. In order to minimize time away from work and take advantage of optimum airfare and lodging costs, the workshops will be scheduled for Friday and Saturday (the second day ends at noon).

For many institutions, commissioning could be one of the most important new ventures for the 1990s. It should be considered to be an inexpensive insurance policy specifically designed to avoid taking over a dysfunctional facility that does not meet the design intent. If you have not had previous commissioning experience, I can assure you the workshop will be a quantum leap in the right direction. ■

Environmentally Conscious Design

The American Institute of Architects (AIA) has produced a series of videotapes to help architects and others in the building industry gain information and skills needed to develop an environmentally sound building.

Videos are excerpted from the AIA's Building Connections video teleconference series and the AIA/EPA symposium, Building to Save the Earth.

The videos feature panel discussions among expert architect, engineers, planners, and developers, as well as demonstrations of practice tools and techniques through innovative building and community case studies. Subjects include energy efficiency, site planning, materials specifications, recycling and waste management, and more.

Tape 1: *Energy and Resource Efficiencies*, Tape 2: *Healthy Building and Materials*, and Tape 3: *Sustainable Communities* are each ninety minutes long. A fourth tape, *Case Studies in Environmentally Responsible Design*, presents case studies on the Audubon Society Headquarters in New York City, the Rocky Mountain Institute in Snowmass, Colorado, the Way Station in Frederick, Maryland, and more.

Tapes 1-3 cost $47 each or $95 for all three. Tape 4 costs $57. For more information, call 800-365-ARCH (2724). ■

Dr. Mohammad Qayoumi, right, receives the University of Cincinnati 1993 Distinguished Young Engineer Executive Award from Dr. Constantine Papadakis, Dean of the UC College of Engineering.

Qayoumi Receives Award

Mohammad H. Qayoumi recently received the 1993 Distinguished Young Engineer Executive Award at the Seventh Annual Conference of the University of Cincinnati College of Engineering. Qayoumi received the award for his "outstanding achievements and conspicious early success as a professional engineer."

From 1979 to 1984, Qayoumi earned four advanced degrees at the University of Cincinnati: master's degrees in both nuclear engineering and computer engineering, a doctorate in electrical engineering, and an MBA in finance. During that time, he worked as a staff engineer, director of technical services, and director of utilties and engineering service. He also taught engineering and math courses. He has a bachelor's degree from the American University of Beirut, Lebanon, and a certificate in total quality management from San Jose State University.

Qayoumi is at present associate vice president for administration at San Jose State University (CA). In 1989 he received APPA's Meritorious Service Award, APPA's highest individual honor. He has written numerous articles and book chapters, has taught at the APPA Institute, and is the author of APPA's book *Electrical Distribution & Maintenance*. ■

From the President-Elect

by Charles W. Jenkins
Facilities Administrator
Saint Mary's University
San Antonio, Texas

So far, I've spent my time as President-Elect doing the two things that everyone who preceded me in this office must surely have done. They are 1) everything the President says to do, and 2) dream of the time when I'll occupy APPA's Oval Office. I enjoy them both very much.

Every APPA President must come to the office determined to sustain the momentum of programs established by previous administrations, but also with an agenda that will leave his or her own mark on the office and the association. My personal agenda is leadership, leadership, and leadership. I chose that theme because you, the members, indicated in the opinion survey conducted just over a year ago that the topic of leadership skills was high on your list of things for APPA to pursue. Also, it's a subject of some interest, even fascination, to me. I read and study about it a lot. I even wrote a book review on leadership in this issue of the magazine.

I asked President Kerby if I could start my agenda early, as in during her term, and she graciously told me to go ahead. As a result, I gave a talk on leadership at the Milwaukee Institute for Facilities Management and the CAPPA and MAPPA regional meetings. I was a little apprehensive because, as those of you who heard the talk will recall, I opine that facilities officers, by and large, are superb managers but lousy leaders. I go on to suggest some activities that are more leadership than management and urge the audience to do them. Since there is clear criticism in the talk, I was prepared to change course if it flopped.

It didn't. On all three occasions, the speech was well-received. I was glad, but not surprised, to learn that APPA members are open to suggestions for change. I thank those of you who complimented the speech and also those who may have disagreed but remained courteously silent. If you missed the talk, it will appear in printed form in a monograph on leadership to be published by APPA.

I admit, shamefacedly, to having thought that my predecessors were filling an obligatory square by ecstatically praising the hospitality and warmth of the hosts and guests at the regional meetings they attended. They weren't. It was genuine. Ann and I had such a good time with our own crew at the CAPPA meeting, hosted by Kirby Vahle and the staff of the UT Southwestern Medical Center in Dallas. I was, once again, very proud of my own region. A couple of weeks later we traveled to East Lansing, Michigan, to Michigan State University and the MAPPA meeting. Ron Flinn, Deborah Dohm, and all the folks who took part in the program just watered our eyes with their excellence. We had a marvelous time with those lovely midwesterners. Ann and I both came away with a standing offer to join a barbershop quartet from the local area. I sing pretty good tenor; I'm still not sure how she qualifies.

We've also had some committee meetings. In November, the Executive Committee met in Alexandria at the APPA office, and in December we all came back for a combined meeting of the three standing APPA committees. I'm always impressed by how smoothly those things run, thanks to careful preparation beforehand by the Alexandria staff. We reviewed progress toward the goals of this year's operating plan and began to rough-in next year's plan. Things are in good order. Between those meetings I went to New Orleans with Diane Kerby, Walt Schaw, and Wayne Leroy to represent APPA at the Council of Higher Education Management Associations (CHEMA) meeting. That was educational and enjoyable, and I'm now better equipped to represent APPA as an elected officer.

APPA's annual meeting this year is in my hometown of San Antonio. The Educational Programs Committee is putting together a superb program of presentations on topics of great interest to us all. I visit occasionally with Host Committee Chair Jack Pellek, and he tells me they're planning to make the best of San Antonio's attractions available to attendees. Plan to be there; we'd love to see you all in the River City.

It's a great pleasure and an experience both rewarding and humbling to serve APPA and its members. Thanks for the opportunity. ■

Meet your Regional Presidents

ERAPPA

Philip L. Cox
Cornell University (NY)

SRAPPA

Jim Roberts
Georgetown College (KY)

MAPPA

Larry Quick
Art Institute of Chicago (IL)

CAPPA

Kirby Vahle
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RMAPPA

Gordon A. Bulat
University of Alberta

PCAPPA

Chris Christofferson
California State Polytechnic University/Pomona

AAPPA

Sam Ragusa
Griffith University (Aus)

Fritz Saint-Leger Retires From APPA Following 15 Years of Service

Having served APPA longer than any other staff person, Fritz Saint-Leger, APPA's membership and accounting assistant since June 1978, will retire from the association effective January 31, 1994.

A native of Haiti, Fritz graduated from the University of Haiti Law School in 1958, and received a degree in accounting from the university in 1962. He practiced law in Haiti for twelve years and also worked with the Central Bank of Haiti. His first trip to Washington, D.C. was to study finance at the International Monetary Fund in late 1967. In 1970, he emigrated to the United States and settled in Boston until 1977. He then moved to Washington and eventually answered an ad in the paper for a job at APPA.

When Fritz joined APPA, his supervisor was Gloria Saenz (later Diez-Garcia), and the executive director was Paul Knapp. There were eight staff members total and a roster of only 900 members. During his tenure Fritz has seen APPA develop into a staff of sixteen and a roster of individual members surpassing 4,300.

"You can't serve an association without a membership," Fritz said. "Membership should be the key department in any association, because you must keep the members happy and serve them well. If not, you're going to lose those members. Every association must make its members their top priority."

As for retirement, Fritz's ultimate goal is to return to Haiti and continue his law practice. However, he cannot yet do so because of the unstable political situation in his home country. "I'm retiring from APPA," he said, "but not from other activities. I want to continue to serve people."

Upon reflection of his impending retirement, Fritz offered a final message to members and staff: "I hope that the members will continue to work together to serve the university community. I will miss all my coworkers at APPA and wish them all the best. After more than fifteen years at APPA, the staff becomes like a family. I also want to take this opportunity to thank all the Boards of Directors I have served for the full support they have always given me." ■

Capital Notes

Barbara Hirsch

Energy and Environment

National Environmental Technology Act (S 978)—The Senate Environment and Public Works Committee cleared a bill October 5 that would create a National Environmental Technology Panel within the White House Office of Science and Technology Policy. The panel would be responsible for unifying the efforts of ten federal agencies that spent approximately $4 billion on environmental technology development last year.

The bill would also establish an EPA Bureau of Environmentally Sustainable Technologies to fund green technology development. A total of $236 million would be authorized over the next three years, mostly for cooperative research grants. Research and development projects would be funded on a cost-shared basis, with the government providing not more than 50 percent of the cost. However, small businesses could receive funding for up to 75 percent, and in some instances the matching-fund requirement could be waived entirely. Twenty-five percent of bureau funds would be set aside for ventures with small businesses.

In addition to funding research, the EPA bureau would establish a database of new developments in environmental technology and technical and financial assistance available for projects. Under the provisions of the bill, federal agencies with cleanup budgets exceeding $50 million would be required to devote a minimum of 1.25 percent of their funds to R&D of environmental technologies, providing an estimated $137 million in additional funds.

House Hazmat bill—On October 26 the Energy and Commerce Committee completed work on HR 2178, a simple reauthorization that would extend the law through fiscal year 1997. HR 2178 was set for Public Works and Transportation markup on November 9, but on November 8 Public Works surface transportation subcommittee Chairman Nick J. Rahall II (D-WV) reintroduced the Hazmat bill (as HR 3460) with several new provisions, including the following:

- A $12 million annual appropriation for training in fiscal years 1995 to 1998;
- A study on radar detectors to determine whether they contribute to accidents, or if the technology could have any safety applications for truckers;
- Language regarding the installation of billboards on certain state-designated scenic byways;
- A $2 million annual appropriation to fund a feasibility project for tracking hazardous materials shipments and providing information on hazards in case of a spill;
- A study on whether maximum security prisons would be able to evacuate prisoners in the case of a nearby hazardous materials spill; and

A study to determine the safety of open-head fiber drums in transporting hazardous materials.

The studies and additional appropriations add $12 million to $13 million a year to the $18 million program. Energy and Commerce Committee aides say panel members are concerned about the amount of additional funding. They would also prefer to eliminate the billboard section, which they say is not relevant to the bill.

Retroactive liability takes a pounding at November 4 Senate Superfund hearings—On November 4 representatives of business groups and insurance companies testified before the Senate Environment and Public Works subcommittee on Superfund, recycling, and solid waste management regarding alternative liability strategies. Although each company presented different proposals to alter the Superfund liability structure, they almost unanimously opposed the current retroactive liability system, and expressed a willingness to pay for cleanups through additional corporate taxes or insurance surcharges. If retroactive liability is eliminated, the EPA would be responsible for cleaning up older sites. Bernard J. Reilly, testifying on behalf of the Chemical Manufacturers Association, was the lone supporter of the current system. He said that he supports the extension of the retroactive liability because industry is able to clean up Superfund sites in a more efficient manner.

Panel members are split along party lines on the issue of retroactive liability. Environment and Public Works Chairman Max Baucus (D-MT) and subcommittee Chairman Frank Lautenberg (D-NJ) favor retaining the current system, whereas Sens. Robert C. Smith (R-NH) and John W. Warner (R-VA) support reform.

House Government Operations Committee clears EPA elevation bill (HR 3425) for floor action—On November 4 the House Government Operations Committee cleared a bill to elevate the EPA to Cabinet level status. The Senate passed a similar bill (S 171) on May 4.

Provisions of the House bill would

- Reform the contracting process;
- Require the development of a strategic business plan and performance measuring at the new Department of Environmental Protection (DEP);
- Establish a chief information officer;
- Create a Bureau of Environmental Statistics;
- Create an Office of Environmental Justice; and
- Require advisory committees to have balanced representation and disclose potential conflicts of interest.

An early amendment requiring risk and cost benefit analysis was withdrawn early in the markup.

Telecommunications Infrastructure

House authorizes appropriations for telecommunications infrastructure—On November 8 the House passed the Telecommunications and Information Infrastructure and Public Broadcasting Facilities Assistance Act of 1993 (HR 2639), which would provide grants and loans to local governments, universities, medical centers, and other nonprofit organizations, including

- $250 million in matching grants to help cover the cost of connection to the

Barbara Hirsch is APPA's director of government relations.

information superhighway; and

- $70 million in grants to help governments and nonprofits build public television and radio stations. The grants would cover up to 75 percent of construction costs.

The bill would also

- Create a government clearinghouse on distance learning and telemedicine projects;
- Reauthorize the National Telecommunications and Information Administration (NTIA) for two years at $28 million per year; and
- Move the National Endowment for Children's Television to NTIA and authorize $6 million annually for fiscal years 1995 and 1996.

Regulatory News

EPA proposes enhanced monitoring program under the Clean Air Act—The EPA has proposed a new enhanced monitoring program as required by section 702(b) of the Clean Air Act. See October 22, 1993 *Federal Register*, p. 54648. The program would require owners or operators of major stationary sources of nonhazardous air pollutants, as well as sources subject to existing national emission standards for hazardous air pollutants, to perform enhanced monitoring at significant emissions units of air pollution. Enhanced monitoring data would be used to determine the compliance status of affected emissions units with certain applicable emission limitations or standards.

The enhanced monitoring and compliance certification program is a new initiative under sections 114(a)(3) and 113(e) of the act. Historically, the burden has fallen on the EPA to determine whether or not a stationary source is in compliance. After an initial determination, the EPA generally relies upon surveillance techniques, such as inspections and citizen complaints, to target sources for further compliance demonstrations. The requirements of section 114(a)(3) shift this burden to the owner or operator who must document and report whether an emissions unit remains in compliance with applicable emission limitations or standards over time.

EPA lists categories and regulatory schedule for air emissions from other solid waste incinerators—See November 2, 1993 *Federal Register*, p. 58498. The EPA has published its final rule on source performance standards and emission guidelines for other solid waste incinerators (OSWIs). The list of OSWIs includes the following:

1. Small municipal waste incinerators (with capacities of 39 tons/day or less);
2. Residential incinerators;
3. Agricultural waste incinerators;
4. Wood waste incinerators;
5. Construction and demolition waste incinerators;
6. Crematories; and
7. Petroleum-contaminated soil treatment facilities.

The effective date of this rule was November 2, 1993. For further information, contact David Painter, Industrial Studies Branch, Emission Standards Division (MD-13), U.S. Environmental Protection Agency, Research Triangle Park, NC 27711; 919-541-5515.

EPA proposes rule on stratospheric ozone—The EPA has proposed annual baseline production consumption allowances for methyl bromide and hydrobromofluorocarbons (HBFCs). See November 9, 1993 *Federal Register*, p. 59630, and March 18, 1993 *Federal Register*, p. 15014. The baseline amounts and 1991 production and consumption figures are needed so that the EPA can issue a final rule freezing the U.S. manufacture of methyl bromide and HBFCs.

In March 1993, the EPA issued a proposed rule to freeze production and consumption of these ozone depleters to 1991 levels beginning January 1, 1994. The freeze would continue until January 1, 2000. The EPA has plans to ban the manufacture of methyl bromide by January 1, 2000 and to phase out HBFCs by January 1, 1996.

For further information contact Peter Voigt, Stratospheric Protection Division, Office of Air and Radiation (6205J), 401 M Street, SW, Washington, DC 20460; 202-233-9185.

EPA sets temporary limits for nonmetal residues—On November 9, the EPA set temporary limits for nonmetal residue that boilers and industrial furnaces must meet to qualify for the Bevill exclusion from federal hazardous waste regulations. See November 9, 1993 *Federal Register*, p. 59598. The Bevill Amendment is named for Rep. Tom Bevill (D-AL) who introduced it in the 1980 RCRA amendments. Bevill devices include cement kilns, lightweight aggregate kilns, coal-fired boilers, and primary smelters. The effective date of the rule was October 15, 1993.

For general information contact the RCRA Hotline at 800-424-9346 or 703-920-9810. For technical information, contact Shiva Garg, Office of Solid Waste (OS-322W), U.S. Environmental Protection Agency, 401 M Street, SW, Washington, DC 20460; 703-308-8459.

OSHA Handbook for Small Businesses available—The Occupational Safety and Health Administration (OSHA) has published a handbook to assist small businesses in complying with OSHA regulations. The publication is available through the Government Printing Office, Superintendent of Documents, Washington, DC 20402; 202-738-3238. Publication number is ISBN 0-16-038266-1.

APPA offers free online legislative and regulatory news—APPA members, do you have access to Internet or Bitnet? If you do, you can subscribe to the online APPA *Government Relations Update* at no charge! The bulletin comes out every Monday when Congress is in session. To be included on the distribution list, please leave a message directed to my attention on the "Subject" line at appa@bitnic.bitnet or appa@bitnic.educom.edu. In addition to your e-mail address, please provide your name, address, and phone number for our records. ■

Focus on Management

Professionalism and Facilities Management

H. Val Peterson

For many years I have been convinced of the need for all facilities management employees to function as professionals. I believe there can be professionalism at all levels within the organization. If the facilities management organization is to be successful as a campus service unit, it is imperative that every custodian, every trades worker, every groundskeeper, and, indeed, every employee function as a professional within his or her own field of endeavor. Being an integral part of the college or university, these employees work within a professional campus environment and cannot afford to be anything less than professional in their approach to their jobs.

Since I espouse this philosophy within the facilities management organization that I direct, some people have asked me, "What do you mean by saying that facilities management employees should be professionals?" and "How do you define a professional?" A definition of professionalism that I like was found posted on an office wall in a hospital. The definition read as follows:

> **Professionalism is not a gift.**
> **It is a wage earned by education, effort, performance, and commitment.**

Professionalism implies not only competence, but also the manner in which work is accomplished. A few years ago at an APPA regional meeting, Lou Volpe of Johnson Wax heard me mention professionalism and shared with me his own definition of what constitutes a professional. Volpe stated the following.

> When we call someone a 'professional' we are complimenting that person for possessing many attributes. A professional is an expert, one who has mastered a body of knowledge, who is competent in a particular field. A professional who is committed to his or her field is committed to truth. We admire professionals, and we need them. We admire them for their specialized knowledge and competence, and we need them to live in a world made dizzy by a continuous explosion of knowledge! Yet, when we approvingly assign the word professional to someone, we are speaking of more than knowledge, more than just talent, more than expertise, we are speaking of someone who is able to take that knowledge, talent, and expertise and use them well. A professional is one who both listens to the truth and acts on the truth. In the quality of that action is measured the quality of the professional.

Those of us working within higher education have struggled through some pretty hard times, and in many ways there seems to be no immediate relief in sight. And yet the true professionals within our ranks will find ways of getting their assigned tasks accomplished. The facilities management organization should be an integral part of the professional core within the institution. Facilities management departments need to be a part of the solution to the problems facing the institution, not a part of the problem itself.

The measure of how we perform in times of evolving structural changes and declining budgets will determine the level of our professionalism. As Lou Volpe said, "In the quality of that action is measured the quality of the professional." I believe that as a profession we will meet the challenge. What about you as an individual? ■

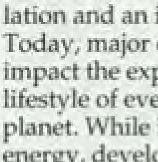
Val Peterson is director of facilities management at Arizona State University in Tempe, Arizona. Starting with this issue he will write the Focus on Management column.

Decisions concerning energy use impact the expectations, attitudes, and lifestyle of every single human being on this planet.

ENE

A N O V E

by Mohammad H. Qayoumi, P.E.



Life on earth has been made possible by energy. Humankind's ability to harness various forms of energy has played a major role in our becoming the dominant species on the planet. The extensive use of fossil fuel provides the means for sustaining a rapidly growing population and an improved standard of living. Today, major decisions concerning energy use impact the expectations, attitudes, and lifestyle of every single human being on this planet. While industrialized nations thrive on energy, developing countries are recognizing the relationship between energy use, economic growth, and quality of life. Therefore, energy costs and availability have a significant influence on societal goals, e.g., employment, standard of living, gross domestic product, preservation of the environment, etc.

Today, the world's energy consumption is about 346 quads (quadrillion Btus) and is projected to increase at an average rate of 1.6 percent per annum until 2010. In other words, energy consumption will increase to between 450 and 500 quads in the next two decades. Most of the consumption growth will be in the Third World countries. Since the world's energy reserves are limited, the upward pressure on energy prices will continue. Let us examine the long-term energy supply trends.

The world's oil reserve is projected at one trillion barrels. Oil prices are expected to gradually increase for the next two decades, from the current price of $19 per barrel to between $20 and $38 by 2010. Therefore, the high price of $50 per barrel seen in the 1970s is not expected to be repeated. Oil consumption will rise at the rate of 1.3 percent annually. The world natural gas reserve is about 4,885 trillion cubic feet, and the consumption will increase by 2.2 percent annually. The total world coal reserve is 1,145 billion short tons. The annual consumption will increase from 5,100 million short tons per year currently to between 6,200 to 6,700 by 2010.

In the United States, the increase in coal use is mostly due to electrical utilities. In addition, the share of total energy consumed from natural gas will increase from 21 percent currently to 24 percent in the 2010. The reasons for the shift to natural gas are several. First, natural gas plants can be built quickly and cheaply and have many environmental advantages. Also, there has been a downward trend in the price of natural gas in the past few years. Gas

Dr. Mo Qayoumi is associate vice president for administration at San Jose State University, San Jose, California. He is the coordinator of the special program on energy and utilities management at APPA's Institute for Facilities Management, and he was the field editor for Facilities Manager's *theme issue last winter on environmental issues. Qayoumi is a frequent speaker and writer, and he serves on APPA's publications advisory board.*

RGY: RVIEW

consumption by electric utilities will double within the next two decades. Similarly, the consumption in the industrial sector will increase by 25 percent. The political pressures to phase out nuclear energy will also serve as a catalyst here. Many plants that had originally been planned as nuclear have been converted to natural gas.

Although the energy intensity (defined as total energy consumed divided by gross domestic product) in the United States has dropped in the past two decades, energy consumption for buildings has steadily increased. For instance, building energy consumptions increased from 22 quad in 1970 to 30 quad in 1989. That is why U.S. buildings account for an increasing share of energy: 27 percent in 1950, and 36 percent in 1990. Currently, 60 percent of electricity and 40 percent of natural gas is used by buildings. The U.S. education sector consumes about 10 percent (about three quad) yearly, which is a significant amount. So by the virtue of our size, the educational sector makes an impact on energy consumption.

In contrast to the supply side approach of past decades, the next two decades will emphasize demand side management (DSM). Every day more and more electric utilities are recognizing the benefit of DSM and offer many attractive programs that are mutually beneficial to both the utilities and customers. DSM programs thus far have predominantly been offered by electric utilities. However, there is an increasing trend to see evidence that similar plans will be offered by gas utilities as well.

The deregulation of natural gas and partial de-facto deregulation of electric utilities—i.e., the presence of independent power generators, legislation on wheeling power—has created new challenges and opportunities for facilities administrators. In the past, an engineering background was sufficient to prepare an individual for an energy manager position. However, to be successful in this role today, knowledge of utilities accounting, finance, commodity pricing, and more are also essential prerequisites. Unfortunately, there is no single university curriculum that provides the total body of knowledge required. That is where APPA and other professional societies can serve an important role in this regard.

As we move toward the next century, it becomes more obvious that energy management will no longer mean following a collection of energy conservation recipes applied through imitation. By contrast, it requires us to rethink energy in the context of total resources management in the institution. This is accomplished by reexamining the fundamental constraints and flexibility—i.e., energy cost and supply projections, reliability and multiple fuel capability, environmental concerns, utilities deregulation, demand side management, new technologies—and create alternatives that are practical and robust. Next to labor cost, energy costs will continue to be the highest expenditure for every plant budget. Given the complexity of issues, we will only be able to rise to the future challenges and develop globally optimal solutions by an organized, systemic, and systematic approach.

In order to titillate rather than to satiate your interest in the issue, we offer a number of articles that address different aspects of energy management. We hope you find them informative and useful. ■

The National Energy Policy Act of 1992:

Implications for Meeting O

by Robert C. Johnson and Diana M. Schmidt

ENERGY

The Energy Policy Act of 1992 (EPACT) is the first comprehensive federal energy policy legislation since enactment of the National Energy Act of 1978. This act provides a statutory basis for restructuring wholesale electric generation markets and lays the groundwork for deregulation of the generation of electricity.

Although many of the EPACT provisions will affect large users of energy indirectly, there are several major provisions of EPACT that will affect large energy users directly. These provisions

1. Require states to consider integrated resource planning and conservation-oriented incentives for utilities;
2. Offer financial incentives for improving energy efficiency and for states to promote energy efficiency; and
3. Increase the Department of Energy's authority to collect data, particularly from industrials, regarding energy use.

The goals of EPACT are to:

1. Implement the President's national
2. Stimulate domestic energy producti
3. Promote energy efficiency.
4. Increase competition in the electricit
5. Reduce consumer energy costs.
6. Promote renewables and alternative
7. Reduce dependence on foreign oil.

Energy Efficiency

Title I, which deals with energy efficiency, is the longest title in the act. The thrust of this title is to mandate energy conservation and, to a lesser extent, water conservation. These mandates are to be implemented in two ways: 1) New efficiency standards and/or testing and ratings procedures imposed on a broad range of end-use equipment and appliances, including building structures; and 2) States are encouraged to require utilities to be a facilitator of so-called demand side management (DSM) or energy conservation programs and to use utility ratemaking procedures as a funding mechanism for promoting DSM programs. Subtitle A of this title establishes and promotes energy efficiency standards for new buildings and energy efficiency ratings for homes.

Integrated Resource Planning (IRP) and Demand Side Management

Subtitle B of the act encourages states to promote DSM programs. DSM can be defined as a technique for controlling demand for electricity during peak-load periods. These programs are usually sponsored by regulated utilities and funded at ratepayer expense.

This subtitle requires all states to consider adopting three new ratemaking standards with respect to 1) integrated resource planning (IRP), which compares supply and demand side options on a systematic and comparable basis; 2) cost recovery for DSM programs and measures that make them at least as profitable as supply side measures; and 3) rate changes that encourage investments and efficiency measures in the generation, transmission, and distribution of power. Each state regulatory agency with ratemaking authority over regulated electric utilities must consider the adoption of each standard after public notice and an evidentiary hearing. The law does not mandate adoption of any particular standard.

Energy Needs

IRP is a planning and selection process for new energy resources that evaluate the full range of alternatives including new generation capacity, power purchases, energy conservation and efficiency, cogeneration, and renewable energy resources in order to provide adequate and reliable service to electric customers at the lowest possible cost.

How do the act's IRP requirements affect large energy users? While many states developed IRP rules before the act went into effect, the act will ensure that every state considers such rules. IRP is important to large utility customers for several reasons, but primarily because of its implications for the cost of energy service. The premise of IRP is that efficiencies that can be found in the end-use sector are a resource just like coal, gas, or conventional fuels, and that consideration of end-use measures to reduce the need for electricity (DSM) must be on an equal footing or "integrated" with consideration of more conventional capacity additions (supply side measures). For some utilities IRP programs can cost millions of dollars and, in some instances, may exceed the costs of large utility construction projects that were considerably over budget and controversial.

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The cost of IRP depends in large part on what type of IRP rules a particular state chooses to enact: whether the regulations are prescriptive and detailed, and whether regulations require the utility to consider environmental externalities in their planning. The costs of complying with IRP are generally passed on to the ratepayer, and if IRP regulations require detailed modeling and unnecessary analysis and reporting, those regulations will be costly to all ratepayers and particularly to larger customers. If IRP regulations require consideration of environmental externalities (social and environmental impacts external to the utility and its ratepayers), utilities will no longer make resource choices oriented toward providing service at the lowest possible cost to its ratepayers. The cost implications of requiring utilities to consider environmental externalities are open-ended and potentially quite substantial. Clearly, burning natural gas is desirable from an environmental standpoint. The cost, however, relative to other available fuels, is clearly prohibitive. Furthermore, natural gas is a finite resource better used for other purposes.

In addition to cost implications, there are regulatory implications of IRP that are dangerous to ratepayers. Some states have implemented forms of IRP that conflict with regulatory principles and laws that have protected ratepayers in the past. For example, some IRP regulations contemplate regulatory approval of utility plans and allow utilities a "rate case presumption of prudence" for actions taken pursuant to their plans. Such regulations could shift the burden of proof to ratepayers to show that costs were imprudently incurred and could prevent commissions from disallowing the costs of an abandoned project.

Finally, the premise of many IRP advocates that energy conservation is inherently beneficial is detrimental to large customers who are efficient, high-volume users of energy. Conservation or demand side management programs are only beneficial if they are efficient and reduce costs. A utility's choice of demand side options that is based upon a "conservation at all costs" view particularly, increases the cost of energy service for the larger end users who would otherwise receive the efficiency benefits of load growth through lower rates.

Not only does the act require states to consider IRP rules, but it also requires states to consider allowing utilities to recover demand side management costs in order to make DSM measures at least as profitable as supply side measures, and to consider ratemaking changes that encourage investments in efficiency measures. Most states use IRP rules to require utilities to extend their business activities to the customer (or demand) side of the meter. Some advocates of DSM programs claim that such programs can minimize customer's total cost of energy services, including societal costs incurred as a result of environmental externalities. DSM programs attempt to influence ratepayer appliance and equipment purchase and usage behaviors (i.e., "manage" the demand side) by offering cash incentives to participating ratepayers. Utility DSM programs frequently offer financial incentives to defray some or all of the costs of high efficiency appliances and end-use equipment, weatherization measures, and control technologies intended to help ratepayers use energy more efficiently. Incentives might include cash rebates, low (or zero) interest loans, free installation or other services, and special rates.

Financial incentives, such as those that states are required to consider under the act, are sometimes deemed necessary to

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compensate for market imperfections or barriers that allegedly prevent the adoption of energy efficiency improvements even though they may already be cost effective for the ratepayer to carry out. Many DSM advocates argue that traditional regulation creates a strong "disincentive" to the implementation of DSM programs that emphasize conservation. This disincentive is created by the perception that lost sales (conservation) do not contribute to earnings and may reduce utility profits.

DSM advocates have proposed a number of regulatory mechanisms, often through the IRP regulatory process, for correcting this perceived disincentive. These include incentive rates of return and so-called "decoupling" procedures such as automatic adjustments or automatic cost recovery for DSM expenditures through utility fuel adjustment clauses. These incentives may be in addition to the savings resulting from energy use reductions and may constitute a subsidy.

The inclusion of demand side options in a utility's planning increases the size of the utility's resource planning problem as many more alternatives need to be considered and analyzed. Additionally, the consideration of demand side options requires information not only on a utility's own decisions, but also on its ratepayers' choices of energy consumption.

It is important for ratepayers to participate in IRP proceedings, including those mandated by the act, to protect their interest in avoiding the substantial unnecessary costs that IRP regulation can impose on ratepayers.

Appliance and Equipment Energy Efficiency Standards

In addition to its IRP and DSM provisions, the energy efficiency title of the Energy Policy Act is far reaching. It addresses energy use in residential, commercial, and industrial buildings, including government facilities, by putting into place programs to encourage energy efficiency and by building on existing programs that require specified levels of energy efficiency. The legislation also builds on existing programs by mandating energy performance standards and labeling programs for products such as windows, commercial, and industrial equipment, lamps, plumbing products, discharge lamps, distribution transformers, and electric motors. The act also mandates the provision of information regarding commercial office equipment and luminaries. Overall, the legislation attempts to enhance energy efficiency in the residential, commercial, and industrial sectors by using more stringent standards for buildings and by establishing standards for energy-intensive products.

Several provisions of Title I specifically address industrial energy efficiency. These sections continue to be quite controversial; the earlier House and Senate versions of these sections were the focus of intense industry lobbying efforts. Fortunately, the overall federal "reach" of these provisions and the potential for adverse impacts on industry were substantially reduced.

Section 131, entitled "Energy Efficiency in Industrial Facilities," requires the Department of Energy (DOE) to offer grants to industry associations for establishing voluntary target programs for energy efficiency improvements. By March 1, 1994, the DOE is to evaluate and report to Congress regarding mandatory energy efficiency reporting requirements and voluntary energy efficiency improvement targets for energy-intensive industry.

Section 171, which involves collection of data from end users of energy, requires the DOE to conduct Manufacturing Energy Consumption Surveys (MECs) at least once every two years. Prior to enactment of this legislation, MECs were conducted on a triennial basis. The survey forms must be redesigned to allow for expanded collection of data on 1) the use of nonpurchased sources of energy, including solar, wind, biomass, geothermal, waste byproducts, and cogeneration; 2) participation in government and utility DSM programs; 3) fuel use by user subgroups; and 4) energy efficiency and load management programs, including the effects of building construction practices such as those designed to obtain peak load shifting.

Electricity

The electricity title of EPACT is arguably the most far-reaching title of the act. The title amends both the Public Utility Holding Company Act (PUHCA) and the Federal Power Act (FPA) to provide for the competitive restructuring of wholesale electricity markets. Subtitle A authorizes a new class of power producers called "exempt wholesale generators" or EWGs. EWGs include nonutility "independent power producers" (IPPs) and utility-owned or controlled "affiliate power producers" (APPs). EWGs benefit under the act by being exempt from the regulatory and other barriers imposed by PUHCA. Subtitle B gives the Federal Energy Regulatory Commission (FERC) broad discretion to order and establish rates, charges, and terms and conditions for third-party transmission services. EWGs will be able to seek transmission orders from FERC to gain access to distant markets. Industrials now may own or operate wholesale generating facilities without having to resort to qualifying facility (QF) status under the Public Utilities Regulatory Policies Act.

Enactment of legislation is only a first step toward the development of a truly competitive power market. FERC must also promulgate rules implementing many key provisions of the electricity title of the act.

Exempt Wholesale Generators

For the first time the act provides that a utility or independent, unregulated organization may construct and operate an electric generation station that will be exempt from regulation by state utility commissions. This is the first step in the deregulation of electric generation and will have a significant and dramatic impact on the obtaining of electrical service in the future. In effect, this means that the EWG can enter the marketplace for the sale of electric power that it generates or sells on a wholesale basis to other utilities, municipalities, electric co-ops, or any distributor of electric service to end users. The price for this electric power will be unregulated.

Although a major goal of the act is for market forces to play a greater role in electricity, the EPACT will require increased regulation at both the federal and state levels. The act amends the Public Utility Holding Company Act to allow easier entry into electric generation markets and to assure transmission access for newcomers to the market. However, the act requires FERC and the states to consider regulation of these markets.

Just as states must consider IRP and DSM regulation, they must also, pursuant to Section 712 of the act, make a determination whether it is appropriate to implement certain enumerated standards relating to long-term wholesale power purchases by utilities. Among these standards are the effect of such purchases on utility cost of capital, reliability of energy supply, and whether particular long-term wholesale power purchases should receive advance approval or disapproval.

Some states have already initiated such proceedings, and some of these proceedings have already been concluded. In proceedings that are continuing, it is important for customers to protect their interests. Utilities and independent power producers can use proceedings under Section 712 to shift the risk of disadvantageous long-term power purchase contracts to ratepayers by seeking advance approval of such transactions. Additionally, it may be that adoption of any standards under Section 712 would put ratepayers at a disadvantage by discouraging potentially economic transactions; regulation inhibits the utility's flexibility in purchasing power, which adds to cost and could cause power purchase opportunities that are to ratepayers' advantage to be lost.

Transmission Access and Pricing

There are a number of important provisions in Subtitle B of the electricity title that relate to transmission access and pricing. EPACT amends the Federal Power Act to permit any electric utility or any person generating electric energy for wholesale to apply to the FERC for an order requiring a "transmitting utility" to provide transmission services, including enlargement of transmission capacity. Here the term transmitting utility means any electric utility, qualifying cogeneration, or small power production facility that owns or operates transmission facilities used for the sale of power in wholesale markets. End-user QFs may be able to use the transmission provisions of this section to access distant purchases with more favorable prices, although the FERC may not give such a permissive interpretation to the act.

FERC may not issue orders for transmission if the services require enlargement of transmission capacity and the transmitting utility subject to the order has failed, after making a good faith effort, to obtain the necessary approvals or property rights under applicable laws. FERC is required to set rates for transmission services (used here to include charges, terms, and conditions) to permit recovery of all costs incurred in providing transmission services. The act requires that costs of providing services be recovered from the person requesting service rather than the transmitting utility's existing customers.

Survival in the Future

The deregulation of natural gas pricing that has occurred and the future deregulation of electricity generation require all large end users of energy to develop "utility" expertise and actively participate in the energy markets in order to assure reliability of supply at a proper and reasonable cost. The best way to obtain this expertise and ensure your ability to satisfy the energy needs of the facilities for which you are responsible at a reasonable cost is to actively participate in all regulatory proceedings that affect your suppliers. This can be done independently or as a member of a group of end users with common interests.

Conclusion

Clearly, it is a present policy of the federal government to commence deregulation of electric generation. This policy is reflected in the Energy Policy Act of 1992. Of necessity, it will eventually mandate open access to large users of electric service so that they will have access to a variety of sources of electric power and not just the regulated electric utility.

Large users of energy must be vigilant for opportunities to reduce energy costs, through monitoring legislative and regulatory developments (particularly those mandated at the state level by EPACT), by monitoring conservation and energy efficiency activities and, most importantly, by participating in appropriate regulatory proceedings that affect your facilities. ■

Energy Conser Projects and Their Posi

by M. Reza Karkia, CCP, DBA

ENERGY

This article presents a preliminary assessment of the economic potential offered by the energy conservation industry and the promise it offers in contributing positively to the U.S. economy. For the purposes of illustration, I will present an analysis based on some of the most popular types of energy projects that are currently being developed nationwide.

Tapping the full potential of the energy conservation industry will require approximately $36 billion in capital expenditure. Such a program could yield a local sales tax income of $1.7 billion, expand the job base by 65,000 persons over a five-year span, create a utility savings of nearly $7 billion per year to the nation's businesses and government, conserve an average demand of nearly 27,000 MW, avoid nearly $41 billion

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of capital costs for the construction of new power plants, and eliminate nearly 62.5 million tons per year of environmental emissions. Also included are recommendations for additional efforts at the highest levels within the industry and the government to develop a strategy by which the nation can fully and rapidly tap into the economic potential offered by the energy conservation industry.

A Look at the Energy Conservation Industry

Of the total energy we use in the United States, approximately 36 percent is consumed by the building sector. Within the commercial building sector, typically 42 percent of the energy is used in the form of electricity for lighting, heating, cooling, and miscellaneous applications. On a nationwide basis, lighting represents approximately 17 percent, cooling represents approximately 14 percent, and heating represents approximately 41 percent of the source energy used. Although the actual mix of energy varies widely depending on geo-

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graphical location and type of occupancy (office building, hospital, school, etc.), lighting, heating, and air conditioning generally represent the largest of the energy intensive operations in commercial and institutional buildings.

Over the last ten years, and particularly during the later half of this period, certain types of energy conservation and demand side management projects have become quite popular for reducing the utility costs of buildings. Lighting retrofits involving electronic ballasts, reflectors, occupancy sensors, and other forms of lighting controls have gained immense popularity. This is partly because they can be implemented with minimal or no engineering effort and have a high rate of return. Similarly, in the HVAC area, variable frequency drives, economizer controls, energy efficient motors for large HVAC equipment, thermal energy storage (TES), high efficiency chillers, and direct digital controls (DDC) have been extensively used to enhance the part-load efficiency and control of HVAC equipment. In all likelihood, the drive for reducing utility costs and achieving high energy efficiency will continue unabated through the balance of this century and beyond.

As the energy conservation industry continues to forge ahead at an accelerating pace across the country, it is silently yielding two key benefits that are of immense importance to the nation and the populace: 1) it is reducing the environmental pollution caused by fossil fuel combustion, and 2) it is helping the national economy. While the environmental benefit has been well publicized in the past, the economic benefits and job base created by the energy conservation industry have not received as much publicity. Although, under a recessionary climate, the nation as a whole appears to be trying desperately to get over the economic slump. Industrial leaders and governments alike are examining every conceivable strategy to beat the slump. It is time that we review and recognize the potential contribution that energy conservation offers to the national economy.

Potential Savings Through Energy Conservation

For the purposes of illustration, we will consider a hypothetical "average" commercial facility. For simplicity, let us consider the simplest and surest type of energy conservation projects. We will assume a one million square foot, fifteen-to-twenty-year-old commercial or institutional facility. We will consider three simple conservation projects that appear to be quite popular in the electricity conservation field: 1) lighting energy conservation through the use of the T8 lamps and electronic ballasts, 2) lighting energy conservation through use of occupancy sensors, and 3) HVAC energy conservation through the use of variable speed drives.

Typically, an average commercial facility would use approximately 14 kWh/gsf/year. At a lighting power density of 2.2 watts/gsf and a lighting duration of 3,200 hours/year, lighting energy use in the facility will be approximately 45 percent of the overall electricity use. Likewise, at 400 gsf/ton of air conditioning and a 1 kW/ton of air conditioning equipment, the air conditioning electricity use will be approximately 8 percent. Large fans and pumps, which typically use up to 1.5 hp/gsf, would use approximately 22 percent. Then there are the process loads, office equipment, small fans, and small pumps, which can use the remaining balance of 25 percent. Thus, the lighting and large fan areas typically use 67 percent of the overall electricity use.

Next, we'll look at the type of lighting retrofit potential that is typically found in such a facility. If we assume a mix of 1-lamp, 2-lamp, and 4-lamp fluorescent lighting fixtures in the ratio of 1 percent, 25 percent, and 74 percent respectively in terms of connected load, it can be shown that the overall number of fixtures will be approximately 17,000 to yield a watts/gsf of 2.2. T8 lamps and electronic ballasts can save approximately 9 watts, 22 watts, and 42 watts in typical 1-lamp, 2-lamp, and 4-lamp fixtures respectively, using magnetic ballasts. Putting these together, it can be shown that the lighting electricity use in the hypothetical facility can be cut by at least 30 percent[1] using T8 lamps and electronic ballasts alone.

Implementation will require various material, labor, and processing resources. In the above example, under current pricing for lamp disposal, ballast disposal, new T8 lamps, and new electronic ballasts, retrofitting 17,000 old fluorescent fixtures will cost approximately $100,000 for lamp and ballast disposal[2], $140,000 for new T8 lamps, $400,000 for new ballasts, and $180,000 for installation labor. The overall project will therefore cost $820,000. Assuming an average electricity rate of $0.08/kWh, such a project typically has a simple payback period of five to six years.

Let us now consider the second sample project, namely, installation of occupancy sensors. Generally, occupancy sensors can be economically applied to a typical space that has at least 500 watts of lighting load. If we assume conservatively that only 20 percent of the facility can utilize this form of control, approximately 280 kW[3] of lighting load could be potentially connected to the sensors. Turning off this load for as few as two hrs./day, and five days/week, could save approximately 150,000 kWh/year for the whole facility. In terms of material and labor resources, a typical project of this type would cost $25,000[4] in materials and $15,000 in labor costs. The overall project will have a simple payback of three to four years.

Finally, let us consider the third sample conservation project, namely installation of variable speed drives on the large fans. Since each facility is unique in terms of its HVAC systems, the potential for this type of a project can vary significantly from site to site. However, for the purposes of illustration, let us assume on the conservative side that only 30 percent of the existing fan horsepower can be controlled through variable speed drives. Modulating the speed of twenty large fans at an average fan size of 20 hp can yield an energy savings of approximately 360,000 kWh/year[5]. On a facility-wide basis, such a project will cost approximately $100,000 for materials and equipment, and another $40,000 for labor. The overall project would have a simple payback of five to six years.

Table 1 presents a summary of the sample projects described above. As shown, the hypothetical facility offers potential for a minimum of approximately $1 million worth of projects, which could save approximately 2.33 million kWh/year, and save approximately $186,000/year in utility costs. In terms of unit numbers, the potential may be summarized as follows.

- Capital cost of energy conservation projects-$1.00/gsf
- Energy savings (kWh/gsf)-2.3/gsf
- Utility cost savings ($/gsf/Yr.)-$0.19/gsf

While the actual numbers could vary considerably up or down—depending on a variety of factors including age of the facility, geographical location, type of occupancy, etc.—it is not unreasonable to consider the above as a conservative estimate of "typical" conditions for facilities that are more than fifteen to twenty years old and have not been retrofitted with energy conserving measures.

Let us now evaluate the various kinds of economic benefits we can associate with such a $1 million dollar project. Table 2 summarizes a preliminary assessment of the benefits to the

TABLE 1

HYPOTHETICAL MILLION SQUARE FEET FACILITY

SAMPLE PROJECT POTENTIAL

Item	Lighting Retrofit	Occupancy Sensor Control	Application of Variable Frequency Drives	Total	Per GSF
Project Cost	$819,238	$40,744	$140,000	$999,982	$1.00
kWh Savings	1,816,100	146,897	362,556	2,325,553	2.33
Cost Savings	$145,288	$11,752	$29,004	$186,044	$0.19
Simple Payback (Years)	5.6	3.5	4.8	5.4	

local economy. Analysis shows that per every million square feet of facility, local governments could expect a sales tax revenue of approximately $46,000. Furthermore, the local job base could increase by approximately 8.2 person-years of skilled workers and one person-year of professional workers.

As pointed out earlier, the above numbers have been derived for a limited number and types of conservation projects. It is quite conceivable that many large old institutions offer potential in many other areas including those associated with envelope measures (insulation, glazing) and heating system upgrades (boiler tuning, trim controls, air conditioning system efficiency measures, steam trap maintenance programs, stack gas economizers, etc.). The maximum upside potential can therefore be considerably higher.

The Economic and Environmental Impact

Let us consider an extension of this concept to the commercial sector nationwide. Based on the best available information published by the Energy Information Administration, there are an estimated 62.9 billion square feet of commercial floor space nationwide. Of this, an estimated 49 billion feet represents lighted space. This includes a variety of commercial spaces including educational institutions, offices, health care facilities, office space, mercantile areas, etc. If we assume that only 72 percent of this commercial space could be retrofitted with energy efficiency measures, the magnitude of the conservation potential is phenomenal (see Table 3).

A preliminary analysis shows that retrofitting 36 billion square feet of space will result in an average electric demand

Item	Lighting Retrofit	Sensor	Variable Frequency Drive	Total
Material cost	$536,336	$26,891	$98,000	$661,227
Installation labor cost	$183,064	$13,853	$42,000	$238,917
Subcontract (processing) cost	$99,838	$0	$0	$99,838
TOTAL CONSTRUCTION	$819,238	$40,744	$140,000	$999,982
Engineering & Management Cost (10%)			$99,998	
Estimated Sales Tax to State/Local Gov't (at 7%)				$46,286
Labor rate ($/Hr.) (Burdened)	$18	$30	$45	
Labor Hours	15,717	462	933	17,112
Skilled Workers/Technician Person-Years (1)	7.6	0.2	0.4	8.2
Professional Hours (Burdened, at avg. $50/Hr.)		2,000		
Professional Employment Person-Years				1.0

TABLE 2

ESTIMATION OF LOCAL ECONOMIC AND JOB BASE BENEFITS

(1) Does not include labor involved in the finished products used for the retrofits.

reduction of approximately 27,000 MW, involve capital funding of approximately $36 billion, create utility savings of approximately $6.8 billion to the nation's private and public facilities, and will produce a sales tax revenue of approximately $1.7 billion. Furthermore, if the average cost of new power plant construction is conservatively estimated at $1,500/kW, an average reduction of 27,000 MW means an avoided capital cost of approximately $40.5 billion in the construction of new power plants. On the job front, the conservation projects will employ approximately 58,000 skilled workers and 7,000 professional people over a five-year period. In terms of environmental benefits, 82 billion kWh of energy conservation per year means 61.75 million tons/year of CO_2 reduction, 0.45 million tons/year of SO_x reduction, and 0.25 million ton/year of NO_x reduction from power plants across the country.[6]

Obviously, these estimates are preliminary in nature and one could develop more refined estimates through additional research. Some industry experts have reported energy conservation potential several times larger than the estimates presented above.[7] In all likelihood, these savings are quite conservative and can be potentially exceeded. Nevertheless, the analysis does point out one thing very clearly: the energy conservation industry can play a major role in contributing positively to the nation's ailing economy. If it is truly a national priority to give the economy a boost, expand the job base, enhance energy efficiency, and improve the quality of the environment, it is time to evolve strategies by which industry and government can join together and develop conservation projects at an accelerated pace.

Experience has shown that several major hurdles need to be overcome before a conservation project or program can be developed within any organization. Some of the common problems that have plagued the industry include the following:

- Lack of visibility and commitment for energy conservation at the executive level;
- Lack of dedicated staff to pursue development of energy conservation measures;
- Inability to fund projects due to lack of capital;
- Lack of incentive to middle management for implementing and expediting projects;
- A complex justification process for getting projects underway; and
- Lack of understanding of the technical, financial, and economic aspects of a conservation program.

Taking an Active Role

During the last several years, the nation's utilities have taken an active role in promoting energy conservation and demand side management, and they have provided numerous forms of technical assistance and financial incentives. These have definitely helped to a large extent. The Department of Energy and the Environmental Protection Agency have also taken an active role promoting energy and environmental consciousness nationwide. However, more participation may be necessary at the highest levels within both industry and government to accelerate the pace at which these projects can be developed. Such additional efforts must have one simple goal: to develop a strategy by which the nation can fully tap into the economic potential offered by the energy conservation industry and use it in time to give the needed economic boost across the country.

From a facilities officer's viewpoint, these types of conservation projects can offer benefits in a variety of ways. First and foremost, if there is a crunch on the operating budget, you can utilize private financing to implement the projects and save utility costs. If there is a management directive to trim operating staff, justify use of such staff to start a conservation program and minimize the extent of staff cuts. It is conceivable that many air quality management districts may offer a "pollution credit" for the savings produced by conser-

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Energy: An Overview

by Mohammad H. Qayoumi, P.E.

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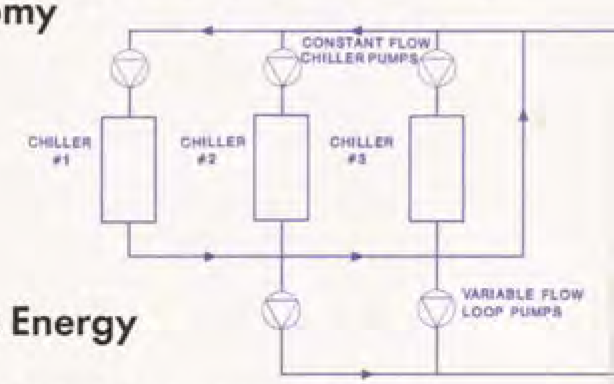

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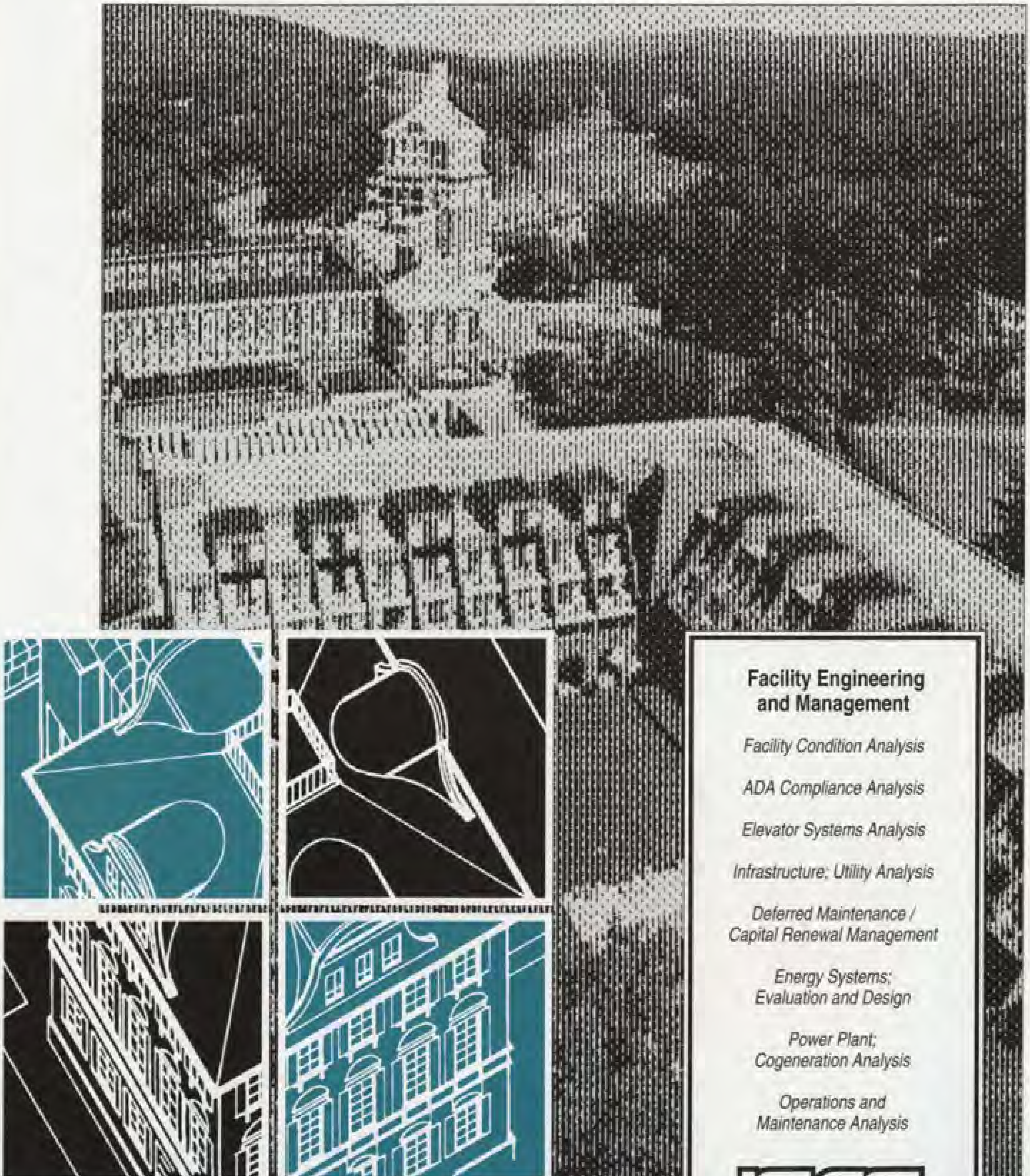

Facility Engineering and Management

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Item	Value
Total floor space in commercial buildings (gsf) (2)	**49,590,000,000**
Breakdown by Type: (2)	
Assembly	11.9%
Education	14.1%
Health Care	4.1%
Mercantile	22.9%
Office	17.7%
Public Order & Safety	1.2%
TOTAL	71.9%
Potential Commercial Floor Space Area (gsf)	35,655,210,000
Capital Cost of Projects (@ $1/gsf)	$35,655,210,000
Expected Energy Savings (@ 2.3 kWh/gsf)	82,006,983,000
Average Demand Reduction (MW)	27,336
Nationwide Utility Cost Savings (0.19/gsf)	$6,774,489,900
Estimated Sales tax to local governments ($)	$1,650,337,050
Estimated Job Base—Skilled workers (Person-Years) (1)	292,373
Skilled Workers employed over a 5-year program	58,475
Estimated Job Base—Professionals (Person-Years) (1)	35,655
Professional persons employed over a 5-year program	7,131

TABLE 3

ESTIMATION OF GROSS ECONOMIC POTENTIAL DUE TO CONSERVATION PROJECTS

(1) Does not include manufacturing job base involved in producing finished goods. Part of this may occur in other countries.

(2) Source: Lighting in Commercial Buildings, March 1992, Energy Information Administration, DOE/EIA-0555(92)1

vation projects. Use the opportunity to get such credits, which could be either resold at a price, or banked for accommodating potential facility expansion at a later date.

Whether one looks at it from a microscopic standpoint at a single facility, or from a global standpoint from a national level, conservation programs can offer multiple payoffs, including making the so-called weakening job base more solid throughout the country. ■

Notes

1. Experience of the author through nearly $100 million of energy project development activities at various California State University campuses indicates that achieving lighting energy savings of 30 to 40 percent is realistic.
2. Assumes disposal cost of $0.10/lamp, PCB contaminated ballast disposal cost of $3.50/ballast, new lamp cost of $2.50/lamp, $22/new ballast, and $12/fixture in labor costs. These prices are based on the author's experience at the most recent $2 million lighting retrofit project at the California State University/Fullerton campus in 1992.
3. Based on an "after retrofit" facility lighting load of 1.4 MW.
4. Assumes 272 sensors, at an average load of 1,040 watts each.
5. Assumes a 1) total of 900,000 kWh used in fans that are connected to variable speed drives; and 2) 40 percent reduction in fan energy use per fan.
6. Assumes an average reduction of 1.6 lbs. $C0_2$ per kWh; 5.3 grams $S0_2$/kWh, and 2.8 grams of NO_x/kWh. See note 3.
7. Estimated lighting energy conservation potential of 290 billion kWh has been reported by Virginia Hines. See note 3.

References

1. Energy Information Administration, *Lighting in Commercial Buildings*, DOE/EIA-0555(92)1, March 1992.
2. Energy Information Administration, *Annual Energy Outlook*, with projections to 2010, DOE/EIA-0383(92), January 1992.
3. Hines, Virginia, "EPA's Green Lights Program Promotes Environmental Protection, Energy Savings and Profits," *Strategic Planning for Energy and the Environment*, Winter 1990-91.

Improving District Cooling System Performance

by Warren W. Weeks, P.E.

ENERGY

The opportunities for improving the performance of central chilled water systems efficiency and load carrying capacity are numerous. Most are relatively low in cost to implement when viewed in light of their potential reductions in operating and capital costs. However, many facilities administrators, faced with the immediate service demands of the campus community, have not been able to take advantage of the savings that exist in improving the efficiency of many systems.

As the potential savings in large central systems can easily be in excess of $100,000 per year, the facilities administrator should seriously consider the option of hiring a qualified engineering firm to perform a complete system evaluation that would identify and quantify the modifications offering the highest operating cost reductions. It may also be possible to secure these services on the basis of a shared cost savings agreement, and thus avoid the out-of-pocket expense for the system evaluation. Another option would be to integrate the system evaluation as a component in the development of a phased migration away from CFC-based cooling equipment or as an integral part of a demand side management program, funded in whole or in part by the local utility.

When one considers that more than one third of the energy input to operate a central chilled water system is expended for pumping and not cooling water, it is obvious that identifying opportunities to reduce these costs is worthy of careful evaluation. Reductions in that system operating cost most likely will exceed 10 percent. Not only is energy consumed in pumping the water, but the process will eventually result in heating of the fluid, and that heat will have to be removed by

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the refrigeration equipment. For every four kilowatt hours consumed in the pumping of chilled water, one ton of cooling capacity will be used solely for the purpose of disposing of this heat and will not be available to serve connected loads. The same is true for condenser water and cooling tower fan energy; however, the inefficiencies are far less dramatic.

Even small reductions in chilled water flow will yield significant savings. The power required to pump water through a given system varies as the cube of the flow (the power of three) and any reductions will lower operating costs, and at the same time will free up existing capacity currently used to remove the heat of these parasitic loads. If the flow were reduced in an existing system by only 10 percent, the pump horsepower and cost would be reduced by 25 percent. To put this in monetary terms, a hypothetical 10,000-ton system with an annual utilization of 21 percent and an average cost of electricity of $.074 per kilowatt hour, the annual saving would be more than $400,000 per year, and more than 700 additional tons of capacity would be available to serve cooling demand due to the reduction of parasitic pumping loads.

In order for the facilities administrator to take full advantage of the potential cost savings that are present in many existing central cooling systems, it is imperative to utilize a systems engineering approach that will evaluate all components within the system and to clearly understand the interrelationships of each component. The system evaluation must focus simultaneously on the individual air handlers served by central chilled water, the buildings as a whole, the distribution system, and the central chilled water plant. Failure to carefully evaluate all components in the system will leave many cost reduction opportunities unrealized. If a specialized engineering consultant is used to perform the system analyses, all systems must be included in the scope of work for their services.

Other opportunities for operating cost reductions will present themselves as the full impact of the phaseout of CFCs are felt, as well as the changing regulatory climate and the move by utilities toward demand side management. The facilities administrator must be ever alert to the options and have in place plans that can utilize these external forces to the best advantage.

The following will briefly cover the three areas where performance improvements are likely to yield major reductions in operating cost: 1) the individual air handlers associated with the system, 2) the building interface with the central system, and 3) the central plant itself. Again, a systems engineering approach must be utilized in order to achieve the maximum potential of the opportunities. The omission of any component in the central cooling system may adversely impact the cost saving potential of the other elements.

Individual Air Handlers

There are two modifications that may be possible at the building chilled water coils: the removal of three-way control valves and the revision of coil control strategy.

In many older central chilled water systems, three-way control valves were utilized. Figure 1 shows this arrangement where the coil is at 50 percent load, with half of the water being directed *through* the coil and the other half being

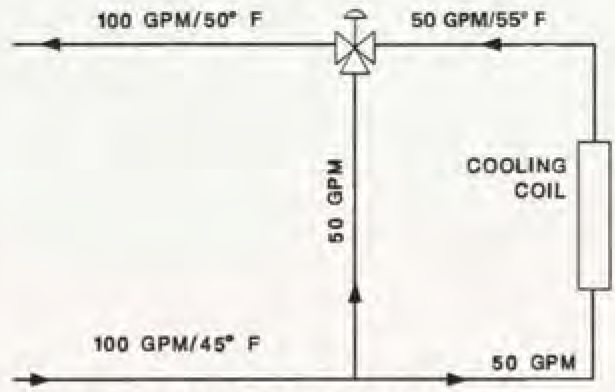

FIGURE 1 3-WAY CONTROL VALVE

bypassed *around* the coil. If the three-way valve is replaced with a two-way control valve, the flow through the coil will be cut in half, and the differential temperature will be doubled. In many instances it is not necessary to replace the valve; different internals can be purchased from the manufacturer, allowing the valve to be converted, in place, to two-way operation. System cooling coils will only be at full-load conditions from 1 to 3 percent of the time, and reduced flows are possible for all but a very few number of hours per year. In large systems, this simple, low-cost modification can substantially reduce pumping cost and parasitic loads on the central

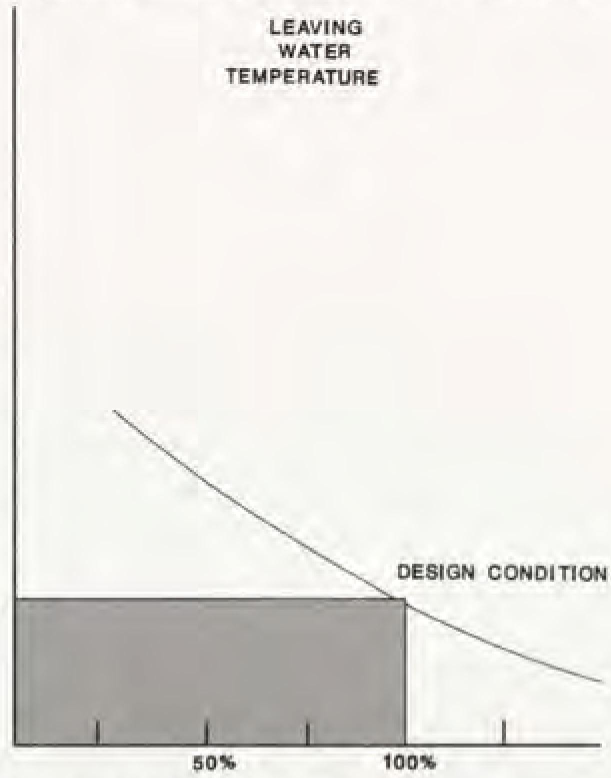

FIGURE 2 LEAVING WATER TEMPERATURE VS. LOAD

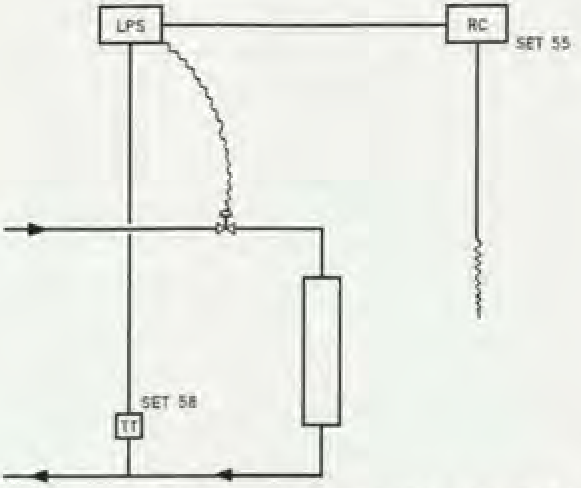

FIGURE 3 COIL CONTROL MODIFICATION

cooling equipment when the cube relationship of flow to the required pumping energy is considered.

Figure 2 illustrates the relationship between cooling coil load and chilled water leaving temperature. Leaving water temperature degrades rapidly once the design capacity of the coil is exceeded. With the load growth that has occurred in recent years due to the wide spread application of personal computers, this overload condition may be present in many older systems. In order to control this run away flow condition, which may starve buildings farthest from the central plant, many engineers and operating personnel have advocated the use of leaving chilled water temperature control. While the application of this control strategy will prevent the runaway flow condition it ignores the inherent advantages of increased leaving chilled water temperature and reduced flow during part-load conditions.

Figure 3 illustrates a control strategy that will both prevent the runaway flow conditions while capitalizing on the advantages of increased leaving water temperature during part-load conditions. This control modification is relatively low in cost and in most cases can be implemented by maintenance personnel and should not cost more than $500 per air handler.

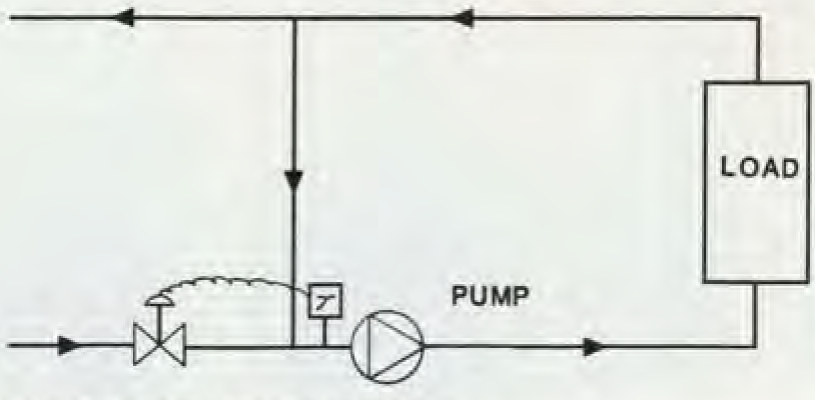

FIGURE 4 TYPICAL BUILDING

The Building Interface

While the arrangement of building interconnections to the central system will vary widely, a commonly applied primary-secondary interface is illustrated in Figure 4. In this case, all of the head pressure delivered by the central chilled water circulating pumps is throttled away across the primary control valve and the building supply temperature is maintained slightly above the supply temperature from the central system.

While this arrangement affords good control and assures that the building pumping system will not adversely affect the central system during changing load conditions, the practice of throttling away all of the hydraulic head pressure provided by the central circulating pumps is extremely wasteful as it increases pumping costs and parasitic load imposed on the central system. The requirement that building supply water temperature be maintained above that supplied by the central system also adds unnecessarily to system pumping cost and will be discussed later in more detail.

In many systems, the central circulating pumps often produce adequate head pressure to circulate chilled water through the building system, and the secondary pump can simply be eliminated and the interface converted to full primary. And now that full proportional-integral-derivative (PID) controls are widely available at a reasonable cost, it is technically and economically practical to compensate for the undesirable interaction that changing building loads will have on the central circulating loop.

In order to identify building interfaces that are candidates for conversion to full primary, it will be necessary to determine system pressure conditions across the full range of central system and building loading. This is now practical through the use of widely available hydraulic modeling programs that are available for personnel computers at a modest cost. Although the initial data gathering will be time consuming, the model will be useful far into the future with only minor revisions to reflect changes or additions to the system. Once the pressure conditions of the central system have been analyzed, it will most likely be found that a number of building loads can be supplied in the direct primary mode during part load conditions. Under higher load conditions, inadequate central system circulating head pressure will be available. This condition will most likely exist with buildings that are located somewhat distant from the central plant.

Figure 5 illustrates a hybrid arrangement that can take full advantage of a direct primary connection when central system head pressure is adequate to serve the building during part load conditions and will then revert to a primary secondary system during high load conditions when central system differential pressure is too low to circulate water in the building. During the analysis of the system pressures, particular attention must be paid to the differential pressure that will be available at the cooling coils in buildings converted to a direct primary arrangement.

It is not uncommon to discover that the differential pressures supplied by the central system will be quite high under certain load conditions.

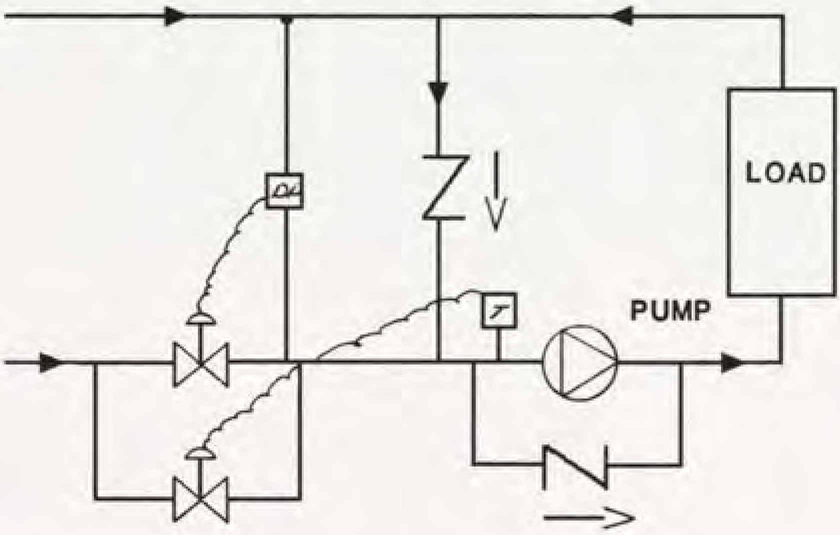

FIGURE 5 HYBRID BUILDING INTERFACE

As cooling coil control valves cannot effectively throttle against a differential pressures much over twenty pounds per square inch, conditions may exist at the control valve that will forced it open and excessive flow will occur. If these conditions are found to exist, it will be necessary to provide a means of limiting chilled water differential pressure supplied to the buildings that are converted to a direct primary arrangement.

This can be accomplished simply through the installation of a packaged fishtail butterfly control valve and differential pressure controller that are offered by a number of equipment manufacturers. In the case of the buildings converted to the hybrid arrangement, a separate differential pressure control

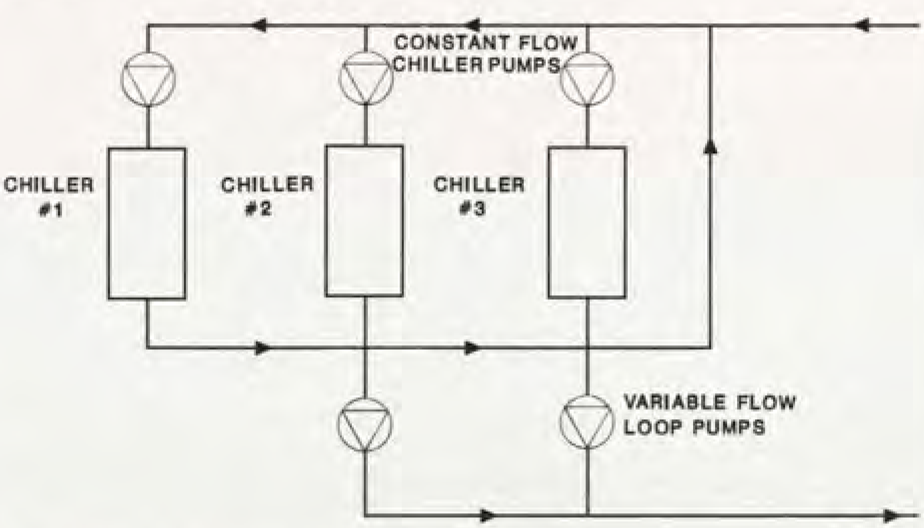

FIGURE 6 TYPICAL CENTRAL PLANT PRIMARY-SECONDARY ARRANGEMENT

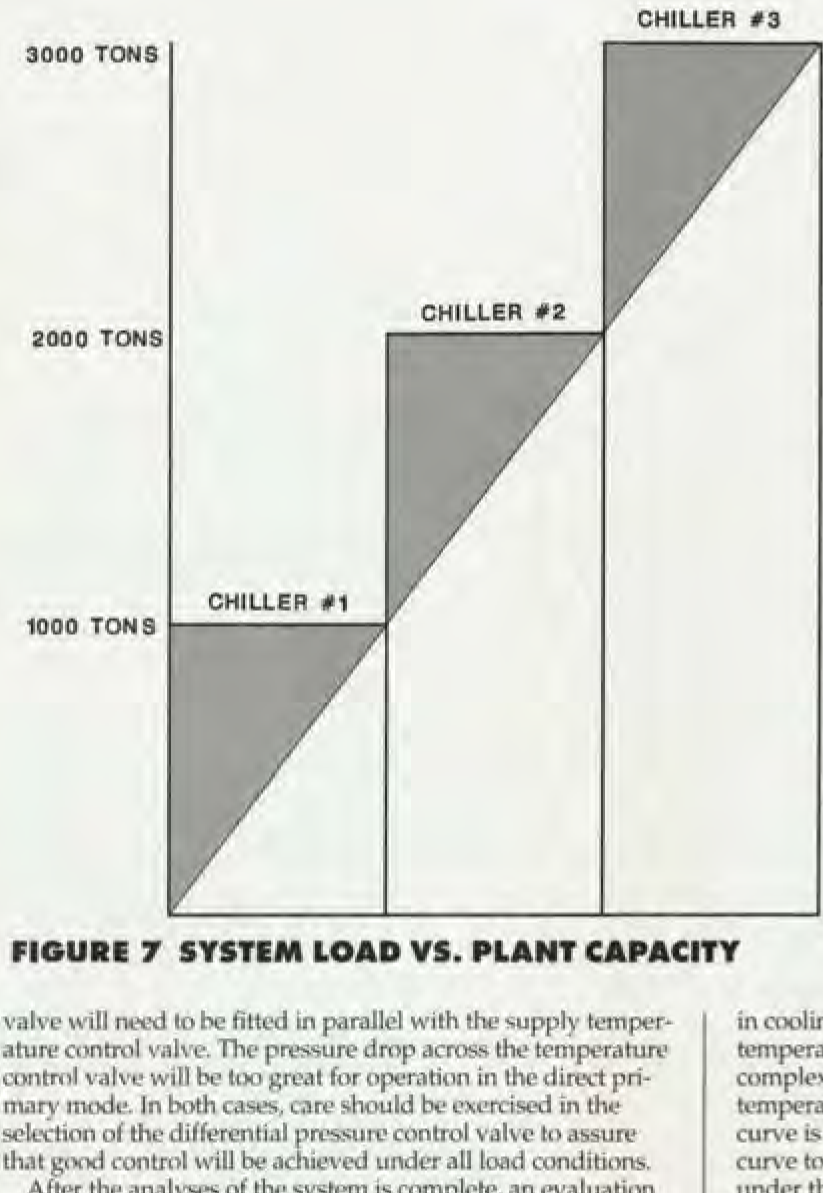

FIGURE 7 SYSTEM LOAD VS. PLANT CAPACITY

valve will need to be fitted in parallel with the supply temperature control valve. The pressure drop across the temperature control valve will be too great for operation in the direct primary mode. In both cases, care should be exercised in the selection of the differential pressure control valve to assure that good control will be achieved under all load conditions.

After the analyses of the system is complete, an evaluation of the economic benefits of modifying some or all of the buildings should be developed. It is quite likely that a combination of all three interface arrangements will be cost effective for many systems.

The Central Plant

The central plant also affords many opportunities to reduce operating costs through the reduction in pumping energy while potentially to increasing the load carrying capacity of the central distribution system. It can further reduce pumping costs through the application of variable flow through central plant chillers and a reduction in central plant send out temperature.

Figure 6 illustrates a typical primary-secondary arrangement for a central plant that utilizes constant flow through the chillers and variable flow through the central distribution system. In this illustration the water circulated through the central plant is 300 gallons per minute greater than that circulated through the central distribution system. If the flow through one of the chillers was reduced, the central plant flow could be matched to the flow of the central distribution system and unnecessary pumping cost would be avoided. Not only would these costs be reduced, but the two chillers that remain at full flow will be fully loaded and operating at their peak efficiency. In the constant chiller flow example, all three of the chillers are operating at reduced load and thus not producing chilled water at peak efficiencies.

Figure 7 illustrates the impact of constant flow through the chillers and shows that there are only three points on the load curve where the chillers are operating to peak, full-load efficiencies. If the flow is varied through one of the chillers, the remaining machines are able to operate at the more efficient full-load condition. This impact is far greater on systems with a large number of chillers installed in the central plant, and the savings potentials can be quite large.

In the past, chiller manufacturers would not warrant their equipment in variable flow applications for fear of compressor damage from a surge condition or chilled water freezeup caused by a rapid reduction in evaporator water flow. With the wide availability of full PID controllers, this is no longer the case. All three major chiller manufacturers now warrant their machines for variable flow applications—a common practice in modern installations.

Another cost saving modification to central plant operation is to reduce the plant leaving chilled water temperature. Figure 8 illustrates the change in cooling coil performance by reducing the supply water temperature. While heat transfer in cooling coils is extremely complex, this simplistic illustration shows that when supply temperature is reduced, the area under the right side of the curve is increased, causing the area under the left side of the curve to decrease correspondingly, so that the total area under the curve remains constant for both supply water temperature conditions.

As an extreme example assume an existing system with a design of ten degree chilled water differential temperature and a capacity of 10,000 tons. If the system differential temperature were to be increased to twenty degrees, the flow could be cut in half while still supplying the designed 10,000 tons. The same distribution system would be capable of distributing 20,000 tons without any capital investment in distribution piping. In existing systems, a reduction in plant send-out temperature can often solve current undersized piping problems at extremely low cost and avoid the disruption caused by modifications to existing piping. Reducing chilled water production temperatures will require the reduction of the chillers' capacity by approximately 10 percent if the same kW per ton is to be maintained. This loss in capacity is most often more than made up for by the reduction in parasitic

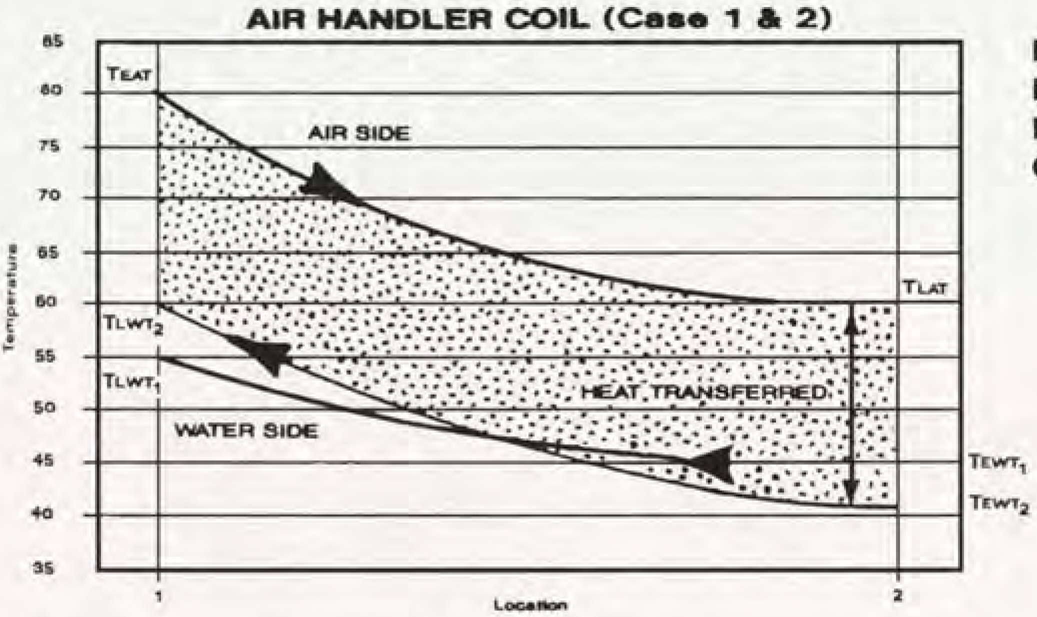

FIGURE 8 RELATIONSHIP BETWEEN EWT AND COIL △T

loads. Figure 9 illustrates the relationship between system differential temperature and water flow requirements, and shows that even modest increases in system differential temperature can dramatically reduce chilled water pumping requirements in large systems.

Other Opportunities

As current legislation accelerates the phaseout of CFC-based refrigerants, facilities administrators have been forced to develop conversion plans to move away from CFC-based cooling equipment. Many of these plans call for a phased replacement of cooling equipment, starting with the oldest machines. This equipment replacement represents an opportunity to improve efficiency and reduce operating costs. Many older chillers have kW per ton that can be in excess of .8 kW and will have extremely high water side pressure drops. With equipment available today, compressor kW per ton can be reduced below .55 kW per ton, and water side pressure drops can also be substantially reduced.

Another opportunity may also exist if cooling towers must be replaced or rebuilt in conjunction with chiller replacement. It may be possible to install a new or rebuilt cooling tower with a lower approach and reduce the kW per ton even further. Through careful selection of equipment, it is possible to return the investment of the replacement in less than five years. The selection may also qualify for a rebate from the local electric utility as demand side management programs become more widespread.

As has been discussed, there are many opportunities to reduce the operating costs of large central chilled water systems, but it must be restated that the system evaluation must utilize a systems engineering approach in order to maximize the improvement potentials. In addition, the same systems approach must also be utilized in the operation and maintenance of the chilled water system if peak efficiencies are to be maintained. ■

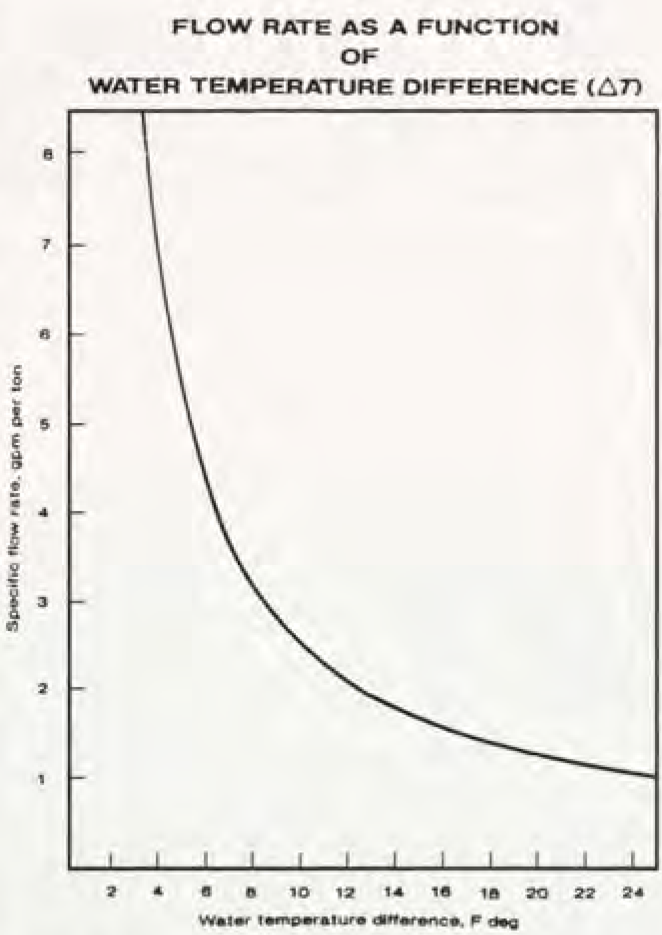

FIGURE 9 GPM PER TON VS. △T

Recharging Campus Energy Conserv

ESCOs and Demand Side Management at

This is the story of a good campus energy conservation program that is getting better. It's happening at the State University of New York (SUNY) at Buffalo, known locally as the University at Buffalo or UB. UB has two campuses with more than 8 million gross square feet in eighty campus buildings. Our annual energy bills are $19 million.

Over the years we've done a lot of energy conservation. Our project log identifies more than 300 energy conservation projects resulting in total annual energy savings or "cost avoidance" of more than $3.5 million. We are now immersed in a large energy conservation project with the potential to shave an additional $2 million to $2.5 million off our energy bills each year.

As at other schools, however, progress in the energy area has not been steady. There have been slow times when this campus energy officer despaired. In fact, it was only a few short years ago when our forward momentum seemed to actually stop.

Walter Simpson is energy conservation officer for the State University of New York campus in Buffalo. He is the author of Recipe for an Effective Campus Energy Conservation Program.

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SUNY Buffalo

by Walter Simpson

Tighter SUNY budgets resulted in less campus money for everything, including energy conservation projects. Conservation efforts also suffered because of a statewide utility budgeting mechanism that discouraged conservation by not allowing individual SUNY campuses to keep the savings they produced through conservation.

New York's governor, Mario Cuomo, issued an executive order calling on state facilities to reduce energy consumption by 20 percent by the year 2000. But there seemed to be no way for us to get from here to there. Now, thanks to a number of recent developments, UB's energy conservation program has bounced back.

UB Joins the Negawatt Revolution

A watt saved is a watt earned. Energy analyst Amory Lovins called it a "negawatt." Years ago he began preaching that it makes more sense—economically and environmentally—to save energy than to produce it. This simple insight sparked an energy revolution nationwide, now evident in the demand side management (DSM) programs encouraged by state utility commissions and being conducted by numerous electric power utilities.

The demand side management program of our local utility, Niagara Mohawk Power Corporation (NiMo), has come to UB, and none too soon. It was just what the doctor ordered.

NiMo's program offered us two DSM options: 1) conventional and custom equipment rebates, and 2) an incentive program administered through CES/Way International, an energy service company (ESCO) under contract with NiMo to reduce the utility's demand by approximately 8 megawatts.

We opted to work with CES/Way and primarily utilize NiMo's incentive program, which offers substantial subsidies per kW of reduced demand (in excess of $1,000/kW). To obtain these subsidies, the ESCO and its clients must guarantee that all energy conservation measures (ECMs) financed through the program will stay in place for a minimum of fifteen years (a provision acceptable to UB).

It is important to avoid "cream-skimming," the practice of doing only easy, quick payback measures. Our ESCO's agreement with NiMo stipulates that a "comprehensive approach" to energy conservation must be taken, using quick payback measures to leverage the longer payback ones—so more gets done. This approach is "win-win," benefiting not only UB, but also the utility, the ESCO, the general public, and the environment.

We are now at the end of the detailed engineering analysis stage of a project on our North Campus. The current scope projects capital improvements of approximately $12 million, and $2 million to $2.5 million in annual energy savings for UB. Approximately $4 million of the project cost will be covered by incentive funds from our utility, bringing the overall payback of the project into the three-to-four-year range.

Why Work with an ESCO

A good energy service company can quickly study a campus and identify many cost-effective conservation measures. It can also package these measures into a larger project, then serve as the design consultant and general contractor to see a project through to completion. In addition to technical skills and knowledge of the energy field, an ESCO can offer colleges and universities attractive financing alternatives, often including DSM incentives.

ESCOs have found their niche by providing whatever is needed to make energy conservation projects happen. Thus, they provide an important service, but at a cost. The value of this service to a college or university can be measured by the savings benefit an ESCO produces for that institution, minus

> Our collaboration (with an ESCO) will enable us to do as much in a few years as we might be able to do in 10 or 15 years on our own.

the fee it charges for the service. Time frame is also a factor.

While our initial contact with ESCOs left us skeptical, our experience with CES/Way International has been a positive one. Even for a university center with as much in-house technical capability as we have, working with an ESCO can make a lot of sense. Our collaboration will enable us to take a giant leap forward and do as much in a few years as we might be able to do in ten or fifteen years if we tried to go it alone.

This opportunity is so extraordinary that it has served as a catalyst to begin resolving our system-wide budgetary incentive problem. UB will keep the savings generated by this project, and a substantial positive cash flow is expected as soon as construction is complete.

A variety of ECMs are contemplated, including lighting modifications (T-8 lamps, electronic ballasts, and reflectors in some applications), installation of high efficiency motors and variable frequency drives, energy management system improvements, HVAC measures (night setback, heat recovery, etc.), and gas conversion of space and/or water heating systems in some of our electrically heated buildings.

Our ESCO's contract with our utility permits the ESCO to include gas conversion ECMs in their projects (although the utility will not provide DSM incentive funding for this type of ECM). This flexibility is valuable to UB since many of the buildings on our North Campus are all-electric.

Better Lighting at Half the Cost

Lighting technology has come a long way in the last few years. While compact fluorescent lights may have received most public attention, the real story is the T-8 lamp coupled with electronic ballasts and reflectors. T-8 lamps have a higher color rendering index (CRI) than T-12 lamps, making colors look more natural and vibrant. We expect to maintain existing light levels throughout our North Campus, while reducing lighting wattage by 30 to 50 percent.

In order to evaluate the performance of reflectors, our staff is working with our ESCO to conduct tests in ten different campus buildings. So far we have found that we are about 10 percent shy of obtaining equivalent light from reflectorized two-tube T-8 fixtures when compared to our existing conventional four-tube T-12 fixtures with energy saver 34-watt tubes. While a 10 percent footcandle reduction is acceptable for most corridor applications, it may not be for our offices and labs. Hence, we are looking for a little more light either through better designed reflectors, the use of higher output electronic ballasts, or less delamping (e.g., going from four tubes to three tubes).

As many as 50,000 light fixtures may be retrofitted. To minimize disruption of campus business activities, we may specify that much of the work needs to be done during the second or third shift or on weekends.

A lighting project this size is going to create a lot of solid waste. To minimize this waste we have asked our ESCO to avoid wholesale replacement of fixtures. We would like to keep the existing fixtures and just change their "guts," i.e., lamps and ballasts. As a matter of environmental responsibility, we are also investigating recycling options. Of course, PCB-containing ballasts will require special handling.

Variable Frequency Drives and IAQ

Our ESCO has identified 200 possible variable frequency drive (VFD) applications. Some of these involve using VFDs to operate our variable air volume (VAV) fan systems, instead of relying on fan inlet vanes. But the larger savings come from retrofitting constant volume fan systems with VFDs to reduce air flow seasonally and during times of the day when occupancy is low.

The fan law—which says that energy is saved in proportion to the cube of fan speed reduction—guarantees huge savings from even small reductions in fan speed and air flow. A 20 percent reduction in air flow can result in nearly a 50 percent reduction in fan horsepower. This is the basis of most VFD savings.

One potential pitfall associated with converting constant volume buildings to VAV is the possible reduction of outside air, which could result in an indoor air quality problem. To address this concern, we plan to install air quality sensors in the affected fan systems. These will modulate building outside air dampers and guarantee sufficient outside air when the VFDs slow down building fans.

A Creative Solution to Our Worst Energy Problem

Laboratory buildings with high ventilation requirements are our biggest energy consumers. UB's worst are Cooke and Hochstetter Halls, two connected lab buildings with numerous fume hoods and a continuous ventilation rate of 300,000 cfm of outside air. This facility consumes $1.8 million worth of electricity a year. By working closely with our ESCO's engineers, we have been able to develop an ECM that will reduce this amount by $650,000 a year.

Generally speaking, we found strategies for reducing energy costs associated with lab ventilation systems: air flow reduction, heat recovery, and fuel switching. After many months of analysis and discussion, we decided to use all three methods!

We plan to install a glycol "run around" loop heat recovery system on Cooke-Hochstetter's exhaust and supply air systems, which will eliminate substantial amounts of electric preheat. Additional "free heating" will be provided by heat extracted from water circulated in our underground campus chilled water loop; this loop is warm enough (55-60 degrees) in the winter to heat outside air when circulated through fan cooling coils. Our ESCO's design will enable us to add supplemental gas heat from a process steam boiler when necessary. We are also investigating sash stops as a way of reducing air flow through the fume hoods while maintaining safe face velocities.

Good News For South Campus

While the CES/Way DSM project may reduce UB's North Campus energy consumption by 25 million kilowatt-hours or more, our South Campus may soon be the beneficiary of energy improvements from another source: cogeneration.

Guidelines for a Successful ESCO Project

1. Select an energy service company (ESCO) the same way you would professional services, not like a low-bid contractor. Choose a company that has a good track record, is able to effectively employ utility DSM financing, and offers a comprehensive (non-cream-skimming) approach to campus energy savings.
2. Negotiate a contract that reasonably limits ESCO profit-making and establishes a win-win arrangement. Carefully weigh the pros and cons of performance contracting and shared savings versus fees for services and other alternative contractual arrangements.
3. Work with your ESCO to secure top-level administrative support by clearly demonstrating your project's potential short- and long-term financial benefits. Remember to consider non-energy savings, e.g., maintenance savings and avoided capital improvements.
4. While contract negotiations are by their nature adversarial, once the work has commenced it is essential that both facilities and ESCO staff work as partners in a collaborative process.
5. Organize an in-house facilities project team to work with the ESCO to mutually develop ECM proposals, prepare bid specs, prequalify prospective bidders, etc.
6. Work with the ESCO to conduct tests of questionable technologies in order to determine their performance and applicability and to maximize available benefits while avoiding costly mistakes.
7. Ask your ESCO to incorporate extended product warranties and expanded personnel training into your bid specs as price alternates. If your project is sizable, ask the ESCO to use your buying power to obtain these extras at no additional cost to you.
8. Consult with faculty and other building occupants and modify ECMs accordingly.
9. Design the project and coordinate construction in a way that minimizes disruption of campus academic and business functions.
10. Catalog both energy and non-energy benefits of your project and be prepared to "sell" it to the campus community.

—W.S.

For more than sixty years our South Campus has been heated by steam produced by our MacKay Power Plant, a coal, gas, and oil burner with five large boilers and a reliable heating capacity of 140,000 pounds of steam per hour. This venerable plant has seen better days and is in need of replacement.

We looked at a variety of options and decided that our best bet was a dual-fuel (gas and oil) cogeneration plant in the 8 MW range. We considered third party development but, after considerable analysis, determined that it was advantageous for the State of New York to construct the power plant itself. Since our summer heating load is not very large, the plant's generators need to be sized with flexible, load-matching operation in mind.

Through cogeneration we expect to lower South Campus total energy costs significantly. The new plant should also produce significant environmental benefits because it will be much more energy efficient than the MacKay Plant and utilize cleaner fuels. Of course, the cogeneration plant will not make South Campus buildings any more efficient. That will be a future priority on our conservation agenda.

Campus Energy Awareness: An Essential Ingredient

No campus energy conservation program will last long if the campus community becomes complacent and takes campus energy use for granted. Through the use of various media (posters, brochures, newspaper articles, classroom lectures, special campus-wide events, etc.), the magnitude of campus energy use must be conveyed.

At UB we have signs in each building that tell how many energy dollars each building costs the university annually. These enlighten (and often shock) building occupants.

We have also developed some interesting statistics to convey the environmental impact of campus energy use. For example, UB energy use is responsible for pumping 250,000 tons of carbon dioxide, a greenhouse gas, into the atmosphere each year. One of our faculty members calculated that we would have to plant fifty-four square miles of trees to remove that amount of carbon dioxide from the atmosphere. Luckily, campus energy conservation efforts are a more practical remedy and have already reduced our annual carbon dioxide emissions by 50,000 tons—no small amount!

TQM should mean doing a better job implementing energy policies (not abandoning them).

An effective energy awareness program must target and reach different campus constituencies, especially the top-level administration and the maintenance staff. It is equally important to address the wider campus community and suggest practical steps that students, faculty, and staff can take to help the conservation effort. Computers are a case in point.

There are nearly 10,000 personal computers at UB. At about 150 watts each, they consume approximately $200,000 worth of electricity per year. We are now in the process of developing an energy awareness campaign specifically directed at the problem of energy waste and PC use. Our goal is to convince campus computer users to keep their computers and peripherals off when not in use and to buy energy efficient computer equipment when they purchase new equipment. A successful campaign could easily save UB more than $20,000 in annual energy costs in the short term. As more efficient computers are phased in, much larger savings can be achieved.

Purchasing efficient equipment will become easier as the federal government's "Energy Star" computer program kicks in, prompting major computer manufacturers to offer desktop PCs with "sleeping modes" and other energy saving features.

Moving Toward a Green Campus

Our energy awareness program indirectly received a boost by the formation of a university environmental task force (ETF) by UB's president. The ETF has thirty-five student, faculty, and staff members, with significant representation from our facilities division. The task force is charged with the responsibility of investigating how UB affects the natural environment and developing programs and policies to minimize those impacts.

During the 1993-94 academic year, UB's ETF will be organizing a building conservation coordinator (BCC) network to promote environmental awareness and compliance with university environmental policies in each of our eighty buildings. These key individuals, or BCCs, will also be in a position to encourage participation in our recycling and energy conservation programs, which should help both programs considerably. At a university our size, a network like this is probably the most effective outreach mechanism.

Energy Conservation is TQM

Total quality management (TQM) has become increasingly popular on campus these days, and for good reason; we can always improve what we are doing. But a tension could exist between TQM and campus energy conservation.

In a facilities setting, TQM means, in part, providing quality service to customers with resultant customer satisfaction and an absence of complaints. Once this goal becomes part of the facilities department's TQM philosophy, efforts to conserve energy through restrictive operational measures such as temperature control and fan scheduling could be in danger. TQM could be misconstrued to mean giving the customer whatever he or she wants, even if unreasonable. Here are several ways to resolve this potential conflict and allow the power of TQM to benefit campus energy conservation.

First, energy conservation should be explicitly included in your TQM program. Applying TQM to energy conservation means improving and strengthening the conservation program, moving toward energy excellence and a less wasteful, more efficient campus. We have recognized this principle at UB by incorporating resource efficiency in our facilities mission and vision statement.

Second, the TQM process should lead to the development of official temperature and fan operation policies that are reasonable and endorsed by campus top-level administration. If you already have these energy policies, it is essential—in light of TQM—that your campus recommit to them. TQM should mean doing a progressively better job implementing energy policies (not abandoning them).

Good communication is fundamental to TQM. Campus energy policies and the good reasons for them should be effectively communicated to the campus community via top-level memoranda as well as by your energy awareness program.

Finally, it is essential that TQM be defined broadly in terms of public service and environmental responsibility.

Our TQM philosophy has definitely made our facilities operation more customer-oriented. But who are facilities' customers? Are they just our colleagues? The faculty? The current enrollment of students? Or are they also members of the wider community, including our children and the next generations? And what does it mean to provide quality service?

In order for TQM to really inspire, it must be expansive in its ethical commitments and be ultimately rooted in public service and concern for the wider community—for the future and for the earth itself. Once TQM obtains that kind of depth and maturity, it will bolster campus energy conservation, not threaten it.

Campus energy conservation is one of the most important things a school can do to meet its environmental obligations. Energy production and consumption do so much harm: polluting air and water, contributing to acid rain and global warming, causing the destruction of wilderness areas, and even leading to energy wars that nobody wants to fight. Conserving energy not only mitigates those problems, but also saves money. It is time to take campus energy conservation off the back burner and get serious again. ■

1993 Index

Facilities Manager, Volume 9

by Steve Glazner

Steve Glazner is APPA's director of communications and editor of Facilities Manager.

Articles by Subject

Authors

Alenco wrote the book

to help with your planning

Alenco's 1994 product selection guide comes in a four-color booklet full of information you can use immediately in planning that new construction or the renovation project.

There are photographs and product details of various Alenco Commercial windows including single-hung, double-hung, horizontal sliders, projected, casement, and fixed. Examples of specific completed projects are shown.

This booklet also contains sections on Alenco Commercial's installation accessories and replacement window systems as well as a two-page spread sheet that answers 22 key design and engineering questions concerning each series of Alenco Commercial's windows.

Alenco Commercial is a division of Redman Building Products, Inc., one of the largest manufacturers of aluminum windows in America. Aluminum windows were an innovation of Alenco in the early 1950s, and architects and builders across the United States have been served by Alenco for more than 40 years.

Alenco Commercial provides many services to help you with your project from concept through completion, and you can find out more by requesting our 1994 product selection booklet.

Ask for your copy.

ALENCO
A DIVISION OF REDMAN BUILDING PRODUCTS

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A division of Redman Building Products, Inc.
201 North FM 2818
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APPA Answers

Experience Exchange Update

Maxine Mauldin

The International Experience Exchange database has been a free service to the APPA members since 1989. During this time the original six-page survey has been revised twice, resulting in the expanded eight-page survey currently used. The survey is reviewed yearly by the APPA staff and the Information Services Committee. It is evaluated based on its content and the demand on issues concerning facilities management. During this review period, sections of information no longer pertinent to members' needs are deleted and new information and questions are added.

The Information Services Committee determined that the Comparative Costs and Staffing Report survey and the International Experience Exchange survey will be mailed out for updating in alternate years. Members will have the opportunity to list the topics on which they would like to see APPA collet data. If we see that more members are interested in a certain subject, we will include it on the next survey.

The new International Experience Exchange survey will be mailed soon to all Institutional and Affiliate members. This information will be mailed to you on a diskette, as it was with the 1991-92 Comparative Costs and Staffing Report.

This new way of processing information from our computer to your computer has provided us with a lot more flexibility as well as greater accuracy. By using the diskette, we can send you a copy of the current survey we have on our system for your institution. Once we receive your completed diskette, we will be able to update your information within seconds. Your data is ready to be used immediately with other entries for reports and statistical information used by APPA members.

On October 20, 1993, the International Experience Exchange and the APPA membership databases were merged together on the APPA local area network. The merging of the two departments will allow much greater interaction of information. There is information on the membership records that is useful to the Experience Exchange printouts, such as the updated names, addresses, and phone numbers of APPA's members. Because the International Experience Exchange survey is updated biannually, the facilities staff may change. But the APPA membership database is updated weekly.

Now that the two databases are merged, information is keyed in one time, and both are updated, thus offering a more comprehensive database for members to use. For more information, call the APPA Hotline at 703-684-4338 ■

Maxine Mauldin is APPA's information services manager.

Global Exchange

University of Canterbury

Donald Gunn

Donald Gunn is buildings registrar at the University of Canterbury in Christchurch, New Zealand.

The University of Canterbury traces its origins back to 1873, at which time Canterbury College, as it was known, was established on the old town site in Christchurch. During the 1940s, overcrowding and lack of land within the city onto which we could expand led to a decision in 1949 to purchase property and move the university beyond the city limits. This was done in 1951 with the acquisition of 126 acres of land at the present site of Ilam.

The first department to move out to Ilam was geology as the result of a fire in 1953 that destroyed a large part of the town site. The department moved into the old homestead building that occupied the site. Fine arts took over this building in 1955 after geology moved back into town. The old homestead building still stands, at an age of 114 years, at the rear of the Registry Building and houses the continuing education department.

In 1957, tenders were let for the school of engineering, and in 1960 work had progressed enough to allow staff and students to move in and use lecture space. For a duration of twenty years (1955-75) the university was divided between the two sites, which made life difficult for all. At last in 1975, all departments were united at the present Ilam site.

This however, was at the expense of our library. An eleven-floor building had been constructed, with the library occupying the bottom five floors. The top six floors were occupied (temporarily) by arts departments and the faculties of law and commerce. It was envisaged that by 1980 these departments could move into their own new buildings to allow the library to expand. The construction of these buildings has been slow. The arts departments have been housed elsewhere and the school of law has been in its new building for a year. It is

The 114-year-old Okeover House was the first building occupied on the new campus.

hoped that commerce will be housed in their new building in 1996.

At present, departments in the original Ilam buildings are requiring more accommodation, and we are presently investigating the amount of additional accommodation that will be needed.

Further land acquisition since the first land purchase has enlarged the campus to seventy-two hectares.

Climate

The climate in Canterbury could be termed temperate, with average summer temperature in the low to mid-20s (centigrade), and the maximum temperature (only rarely) reaching 33.5°C. Winter daytime averages would be 9°C to 12.5°C, with night temperatures going down to -6.5°C. Our average rainfall is in the region of 40 square meters per annum. The greatest problem caused by weather conditions is moss growth on the shady side of buildings.

Funding

All universities in New Zealand are government funded. Canterbury has various private investments through bequests that supplement the government grant. Industry also contributes a limited source of research money mainly to individuals.

The Registry Building Quadrangle includes the Admin and Between Library.

Staff/Students

In 1993, the Canterbury roll numbers 10,903 students. This is composed of undergraduate and postgraduate subjects covering most topics except medicine, dentistry, and architecture. Faculties consist of arts, law, commerce, music and fine arts, and engineering. Four hundred fifty academic staff are employed full time. Seven hundred fifty nonacademic staff make up the balance of a total full-time staff of 1,200.

The campus' tallest building, the James Hight Library.

Buildings

There are forty major buildings on site, the tallest being eleven stories high. Most buildings average six stories. Construction is mainly of reinforced concrete in the government architect utility design. Heating is provided by steam recirculated around the campus with a computer controlled energy management system. This accounts for about half the energy bill of NZ$1 million per annum. Electricity makes up the rest. The new building recently constructed for our school of law has a granite cladding, which blends well with other buildings. Interior fittings, furniture, window coverings, and floor coverings for all our buildings are all of a standard make.

Works and Service Department

The works and services department is structured with an administrative section in the registry consisting of a staff of six plus two support personnel. The head of this section reports directly to both the registrar and the vice-chancellor. This section oversees the "nuts and bolts" departments, including a workshop employing forty-six trades people, with an engineer in charge, assistant engineer, two trade supervisors, and one office support staff. Other areas controlled from the administration department include the custodial section with seven custodians and 120 cleaners, parking with two traffic controllers (car parks for 2,406 cars), telephones with four operators, mail room with four mailpersons, the administration of thirty-four transit houses as well as safety, emergency services, security, energy conservation, lecture room bookings, and warehouse.

The annual sum spent on works and services including energy, runs at about NZ$4.8 million at present. ■

Database Update

Howard Millman

Remote Monitoring Systems: The Ultimate Tattletales?

The better you do your job, the less likely you will ever be noticed. Just let one thing go wrong and suddenly everybody knows your name. Well, maybe you'd rather get noticed less, at least for disasters.

Disasters lurk everywhere. Looking back on memorable events in my career, I still ask how was I supposed to know that in a distant machine room a pressure regulator valve's diaphragm cracked and domestic water pressure soared to 120 psi?

When did I find out? When a pipe exploded. On the ninth floor. On Sunday night. That's when I decided it was time to install an energy management system. The system monitored pressures and rang an audible alarm if they exceeded a preset point.

You can't be everywhere, and even if your personnel checks all the equipment when they say they will (and I believe in Santa Claus too), it has become an inefficient use of a mechanic's time to constantly check on all that stuff. And besides, who really has that kind of slack in their staffing levels these days?

Technology offers a better way. Monitor the machinery electronically and remotely. Agreed, this is no great leap forward in technology, since every facility already has monitoring equipment in place. Whether it is simple boiler controls or sophisticated pneumatic panels with dozens of dials, most of these systems require you to go to them.

Information, however, has value only when it's in the hands of the people who need it. Newer monitoring systems, fortunately, will minimize that problem by transmitting the data to a central point, displaying and logging it. If you have a compatible computerized maintenance management system, you can automate the generation of a work order (more about this later). Your benefit is empowerment. Monitoring systems empower you to avoid, or certainly minimize, mini to major disasters.

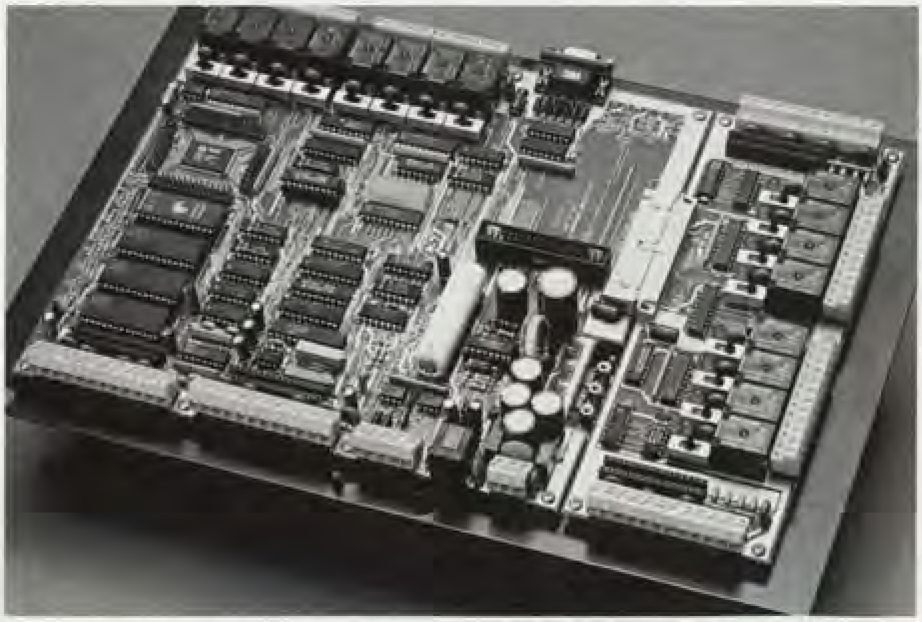
Several quality vendors provide monitoring systems. Most of you know Johnson Controls. Johnson, who now provides advanced remote management and monitoring systems, is the venerable pioneer of control systems.

There's another quality firm you may not know about: Control Systems International. Like Johnson, they provide a variety of sensors to monitor pressures, temperatures, lighting, and humidity. In addition to monitoring, the system will launch a preprogrammed response when certain conditions are met. CSI provides polar (on/off) and proportional controllers to initiate demand load shedding, load cycling, and night setbacks. When the system senses an emergency, it can call your home phone and play a prerecorded message. I'm not sure, however, how highly you will cherish this feature.

Security monitoring features include door access and control, plus fire and other alarms. For the many ways that CSI is similar to Johnson Controls, it differs in at least one respect. CSI's controllers are independently intelligent and will continue to operate even if the main communication network fails.

CSI's flagship product is their I/NET 7700 Distributed LAN system. The specific benefit of this system is its ability to communicate over an existing Ethernet local area network. CSI's system communicates at Ethernet's standard data transfer speed of ten megabits per second. It supports up to sixty-three concurrent stations and monitors as many as 6,400 points.

I/NET works with the two major network transport software, Novell and Banyan Vines. It also works with Artisoft's Lantastic, a competent and economical peer-to-peer networking technology. CSI uses a distributed data architecture. That means that each computer accessing the CSI system contains a percentage of the total data and, likewise, a similar percentage of the program's instructions. It also means that the system does not require a server.



CSI links to the Ethernet LAN as a node. That means the LAN sees the whole CSI system as a device, like any computer or printer. One advantage of this design is the low cost and simplicity of connecting the LAN to the CSI

Howard Millman is a systems integrator with twenty-five years of experience in facilities management. His firm, Data Systems Services, is based in Croton, New York.

system. One disadvantage is that the CSI system requires its own local cabling; CSI calls it a Controller LAN,

to maintain communication between its sensors and controllers. A Controller LAN can use low-cost twisted pair wire up to a total run of 25,000 feet.

One of the maxims in computer software is that the simpler it is to use something, the harder someone worked to make it simple. The I/NET 7700 system uses an object-oriented technology, a comparatively new programming method that generally results in improved performance and easier-to-use software. CSI says its users can command its system without knowing how to read!

Through a combination of hardware and software, CSI's system offers context sensitive help screens, full graphics support, and a Windows-like graphic-user interface. Through an RS-232 serial interface, it will communicate with some maintenance management software, for example, Maintenance Automation's Chief 2000.

An RS-232 link enables the CSI system to upload its data directly into a compatible CMMS database and generate a work order when a preset number of run hours are clocked, airflow drops below a preset point, or any of a dozen other conditions exist. If you deal with critical equipment, machinery that absolutely has to run without fail, investigate this RS-232 link to preserve your sanity and maybe more. There will be times when you will want a bulletproof record of the maintenance you provided for key equipment.

Some of I/NET's add-in modules include a distributed lighting control unit (that courteously winks the lights before shutting them down), a remote access module to override HVAC and lighting programs (from your home or car phone), stand-alone entry access control units, and a fiber optic interface to connect to a fiber optic backbone.

CSI estimates the cost per installed point will range from $200 to $400, depending on the total number of points, ease of access, distances, and a host of other factors. They predict payback in under three years.

To find out more about how this kind of disaster prevention insurance might help you, contact Control Systems International in Carrolton, Texas at 214-323-1111, or fax 214-242-0026. ■

The Bookshelf

Leadership and Customer Service

How To Win Customers and Keep Them for Life, by Michael LeBoeuf, Ph.D. New York: The Berkeley Publishing Group, 1989. 183 pp. $6.95, softcover.

I received this book as a present, and I just recently got around to reading it. I have previously digested the Tom Peters "excellence" books, and this short, succinct paperback contains the best philosophy I've found for providing superlative customer service.

You may look at the title and think, "What's all this about winning and keeping customers? We're the only store in town. We have a captive market." You know that, the rest of the university knows it, and they know that you know it. Think, then, of how delighted they'll be if you and your people begin to behave as if you were in competition for their business! What a great way to improve your image, even if it's already good.

Part one of the book, entitled "The Basics," outlines in nine chapters covering seventy-eight pages the philosophy required of a business that really emphasizes customer service. The author points out that winning and keeping customers depends on rewarding people for being customers. He goes on to say that if we concentrate more on helping people and less on just selling or providing a service, then we'll feel better about what we do and so will our customers. We are told that the greatest customer we'll ever win is ourselves. If we have sold ourselves a commitment to helping people, then it will be obvious to them as they interact with us.

Good Service or Good Feelings?

In this book, LeBoeuf asserts that "Customers don't buy what your company sells. They buy what those goods and services do for them. Customers will exchange their hard-earned money for only two things_good feelings and solutions to problems." To illustrate his point, LeBoeuf offers a "plea from an anonymous customer." In it, the customer pleads, "Don't sell me clothes. Sell me a sharp appearance, style, and attractiveness." Also, "Don't sell me books. Sell me pleasant hours and the profits of knowledge." There are other similar statements.

As I considered LeBoeuf's proposition, it occurred to me that we in the university facilities business might apply the same rationale to our services. Thus, the following.

Plea From an Anonymous University Faculty/Staff Member

Don't give me trash collection, dusting, floor care, and window washing_give me a place that uplifts and inspires me by its cleanliness.

Don't give me plumbing repairs, electrical maintenance, and carpentry service_give me the peace of mind that comes from knowing that everything works, all the time.

Don't give me heating and air conditioning_give me, my students, my visitors, freedom from the distraction of uncomfortable temperature and humidity.

Don't give me lawn mowing, edging, planting, and litter pickup_give me the serenity of enjoying a beautiful campus and the pride of showing it to others.

In short, don't give me maintenance services_give me the satisfaction of knowing that the university values me and my efforts enough to assure me a clean, safe, comfortable, and beautiful place to practice my profession.

I find this a powerful concept for focusing on what we're really all about in the facilities management business.

Later in part one, the author suggests the two "platinum" questions. (The golden question has already been asked and you'll have to read the book to find out what it is.) The platinum questions are: "How are we doing?" and "How can we get better?" Do you regularly ask the university community these questions? If not, how do you identify improvement goals. Do you have improvement goals?

Finally, at the end of part one, LeBoeuf suggests that the five ways to keep customers coming back (or in our case, continue to be delighted with us) are to "be reliable, be credible, be attractive, be responsive, and be empathetic." Ideas we've all long known, but they're presented in a new and refreshing style.

In part two, "Managing the Moments of Truth: Ten Action-Ready Strategies," the author offers suggestions for dealing with ten specific situations associated with closing a sale. While not directly applicable to our environment, there is still plenty of food for thought. For example, LeBoeuf suggests that if you have for some reason created a situation that will cause your customer to be disappointed (his example is a garage not delivering a repaired auto when promised), then give the customer a positive perk (such as a loaner car).

I couldn't help but think of our school of business administration, where the brick facade had been partially removed for several months. We'd had to correct a problem with the waterproofing membrane behind the brick, and the brickyard searched for months to find and deliver a brick that closely matched the existing facade. I put the positive perk idea to work by having a vase of cut flowers delivered to the business school dean the day after the masons cleaned up and left. Enclosed was a card that thanked him for his patience during the repairs. This gesture earned a return note from him expressing his thanks for both the flowers and our perseverance in repairing his building. We both had a good taste in our mouths.

Finally, in part three, LeBoeuf gives us the payoff. Here we find his action plan for instilling in our work force the mindset to provide this customer-winning and customer-keeping service. He calls it "The Triple-Win Reward System." In the introduction he tips his hand by quoting J.W. Marriott Jr. of the Marriott Corporation (also mentioned prominently in *A Passion For Excellence*). Marriott says, "Motivate them, train them, care about them and make winners out of them.... We know that if we treat our employees correctly, they'll treat the customers right. And if customers are treated right, they'll come back."

I've ordered a copy of this book for each of my supervisors. Our next annual planning retreat will be built around implementing the strategies it contains. I have three sons and a daughter-in-law, all involved in retail sales. I've given them each a copy and think that if they'll cultivate in themselves the attitude and traits offered by LeBoeuf, they can be the best at what they do. I recommend it to any facilities administrator who's serious about providing superlative customer service to her or his captive market.

This book is available from G.B. Putnam's Sons, Berkeley Books, 200 Madison Avenue, New York, NY 10016.

— **Charles W. Jenkins**
Facilities Administrator
St. Mary's University
San Antonio, Texas

The Leadership Faith

The Seven Habits of Highly Effective People, by Stephen R. Covey. New York: Simon & Schuster, Inc., 1989. 334 pp. $12, softcover.

Suppose you're having trouble with your eyes and you decide to go to an optometrist for help. After briefly listening to your complaint, he takes off his glasses and hands them to you.

"Wear these. They've been great for me

for the past ten years. I have an extra pair at home. Go ahead and use them." So you put them on. But your vision is even worse.

"This is terrible! I can't see a thing!"

"Well, what's wrong?" he asks. "They work great for me. Try harder."

"I am trying," you insist. "Everything is a blur."

"Well, what's the matter with you? Think positively."

"Okay, I positively can't see a thing."

"Boy, are you ungrateful!" he chides. "And after all I've done to help you!"

This creative little vignette opens Stephen R. Covey's chapter, Seek First to Understand, Then to Be Understood—Principles of Empathic Communication. This is but one of the habits he explores in his book, *The Seven Habits of Highly Effective People*.

Having completed reading this book, I expect fully to utilize it as a sort of manual or guide for action in both my private and public life. Much of Stephen Covey's material clearly appears to come from his study of the Bible. The parallels with Jesus' teachings are too frequent to be coincidental. One effective way to use this book would be to have it open on one hand, and a Bible open on the other for reference to the "correct principles" Covey points to as being central.

"Seek first to understand" is a deep shift in our paradigm. We typically seek first to be understood. Our mental motor is running, ready to pounce in to share our own autobiography rather than to seek first to really understand.

Because we listen too biographically, we tend to respond in one of four ways. We evaluate, we probe, we advise, or we interpret.

I think of the rich young ruler who came to Jesus and stated his case. Jesus asked a question that revealed the ruler's adherence to the letter but not to the spirit of the law. Jesus offered his prescription, and the ruler went away sorrowful. Jesus listened with empathy and deep understanding, and then was clearly understood.

If we don't have confidence in the diagnosis, we won't have confidence in the prescription.

The physician who treats my wife and me spends three hours the first time he meets with a patient listening and seeking to understand. Based upon this extensive history and physical, blood, and other tests, he is finally in a position to diagnose and to prescribe. This diagnostic process takes an additional period of time away from the patient. The next day the diagnosis and prescription are presented to the patient.

Among the elements the doctor determines are the dominance/weakness of the autonomic nervous system_is the sympathetic or parasympathetic system dominant, or are they balanced? Then through the use of nutrition, vitamins, minerals, and enzymes he helps the person's body toward balance biochemically.

Now the doctor was trained as a physician and in all the related biochemistry to believe that regardless of what a person might think, he could provide the correct biochemistry and healing would occur. He's found, as have other physicians, that no amount of therapy will help the person who has no faith get well. "Seek first to understand" is a correct principle evident in all areas of life. But it has its greatest power in the area of interpersonal relations.

As we learn to listen deeply to other people, we will discover tremendous differences in perception. We can also begin to appreciate the impact that these differences can have as people try to work together in interdependent situations.

Probably for most of us, our home life and our work life fill our days. Stephen Covey recognizes that in both we are interdependent. He brings many effective illustrations out of his relationship with his wife and children, and applies them to both home and work.

How many of us enter a situation wearing the optometrist's eyeglasses? Our perceptions can be vastly different. Yet we both have taken our autobiographical thinking for "fact" for all these years, and we have really questioned the character or the mental competence of anyone who can't "see the facts" as we see them.

The principal shift that occurs with seeking first to understand is a refreshing breath of fresh air in our perceptions and in our thinking. This is all deliciously dangerous stuff that Covey proposes, shares, develops, and illustrates.

I recommend the book to you for your enhanced effectiveness in all the important areas of life.

This book is available from Simon & Schuster, Inc., Simon & Schuster Building, Rockefeller Center, 1230 Avenue of the Americas, New York, NY 10020.

—**John Holmes**
Director of Physical Plant
Messiah College
Grantham, Pennsylvania

Track and Field Construction

Track Construction Manual, second edition. Baltimore, Maryland: U.S. Tennis Court and Track Builders Association, 1992. 103 pp. $12, softcover.

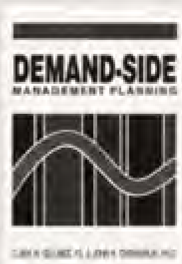
The *Track Construction Manual* is exactly what you would expect: a guide for planning, design, layout, construction, and maintenance of track and field facilities. The manual discusses general considerations such as siting, site development, subsurface work, drainage, fencing, and spectator facilities in addition to providing comprehensive coverage of the running track and of each field event. Comparative discussion of the various track surfacing systems is included, along with step-by-step methods for calibration, marking, and certification of the track. Special sections are provided for indoor facilities and for con-

In Brief

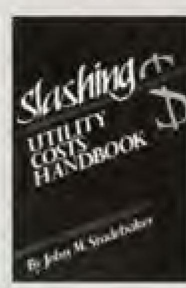
Fairmont Press has published a number of publications dealing with energy and utilities. *Software Applications and Directory for Energy Analysis* is a guide to analytical software programs for both end-users and utilities for assessing the efficiencies of DSM-related technologies and in strategic planning for customer load controls. This book is 285 pages and costs $64.

Power Generation, Energy Management & Environmental Sourcebook is the proceedings of the 14th World Energy Engineering Congress/1991 Environmental Engineering Congress. This book is softcover, 625 pages, and costs $75.

Other books available are *Energy Management Handbook, Performance Contracting for Energy and Environmental Systems, Demand-Side Management Planning, Slashing Utility Costs Handbook, Waste Heat Boiler Deskbook, Innovative Energy Design for the '90s*, and *Introduction to Efficient Electrical Systems Design*. They are all hardcover books and about 350-400 pages long each.



For more information on any of the above books, contact Fairmont Press, Inc., 700 Indian Trail, Lilburn, GA 30247; 404-925-9388.



version of 440-yard to 400-meter tracks.

This manual is directed toward interscholastic competition facilities, based on the National Federation of State High School Association's track and field rules. However, specifications are included for the other three rules and standards bodies: National Collegiate Athletic Association, International Amateur Athletic Federation, and The Athletic Congress of the USA. The user is cautioned to obtain rules and regulations from the governing body for use in conjunction with the manual, and the contact addresses and telephone numbers are included.

Excellent layout sketches with dimensions are available for every track and field event, clearly marked as high school or NCAA where differences exist. A glossary of terms peculiar to track and field construction is found in the appendix. A qualified facilities manager, engineer, coach, or athletic director could use the manual alone to develop an adequate facility. However, a final chapter of the manual discusses the advantages of engaging a professional consultant and describes methodology for using a consultant.

The goal of the authors of this manual is to inform and educate people involved in construction, physical layout, surface selection, maintenance, and marking of track and field facilities. The expected result is improved facilities for recreation, training, and competition. The book is well-organized in a logical, sequential fashion, and the material is extremely well-defined in a table of contents that allows quick reference for specific questions. Tables and figures can be comprehended at a glance, and all details and dimensions are clear.

This manual is a good primer for anyone contemplating involvement with track and field facilities. A new school board member could get up to speed on the subject with thirty minutes of reading. A coach or facilities manager could use it for ready reference. A facilities construction and maintenance manager could use it as a design guide or as a planning and estimating tool. A professional consultant could use it to educate clients. The one precaution associated with using the manual is clearly stated in the manual itself: get the current rules and other facilities guidance from your governing body (NCAA, IAAF, TAC, or NFSHSA) to use along with this book.

The *Track Construction Manual* has taken its place on my shelf of ready references, and I expect it to be used often by both my staff and myself. It would be of similar value to anyone involved with track and field facilities.

This book is available from the U.S. Tennis Court and Track Builders Association, Inc., 720 Light Street, Baltimore, MD 21230-3816.

—Joe Cannon
Associate Vice Chancellor for Facilities Management
University of North Carolina
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APPA Events

Contact the APPA Educational Programs Department at 703-684-1446.

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Mar. 18-19—**Building Commissioning: Save Money and Improve Performance.** Denver, CO.

Mar. 25-26—**Custodial Staffing Guidelines Seminar.** Minneapolis, MN.

Apr. 10-15—**Executive Development Institute.** Notre Dame, IN.

Jul. 10-13—**Deep in the Heart of Service: 1994 Educational Conference & 81st Annual Meeting.** San Antonio, TX.

Aug. 21-26—**Institute for Facilities Management.** Denver, CO.

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