SECURE RELIABLE UTILITIES:

More than Meets the Eye

by Tony R. Litton, P.E.

The untrained eye journeys through a campus with little understanding of the utility infrastructure that supports their activities. The complexity that surrounds even the simplest of those activities—turning on a light, working or studying in a climate controlled environment, sending and receiving e-mails upon demand—escapes most. Many walk over the miles of buried pipe and electrical lines and other utilities that serve their beck and call without any consideration of how many things have to be carefully orchestrated for these systems to work properly.

On the other hand, the facilities staff is unable to make a trip across the campus without worrying about the condition of that 20-year-old air handler with the patched coils, or the 35-year-old boiler that now requires the extra attention to keep it limping along, or the 40-year-old steam lines that are corroding.

The facility staff has the prominent middle position in the transfer, conversion, and delivery of energy and resources from primary utility providers to end-users or customers. The successful team commands an understanding of the needs of their customers and the capabilities and limitation of their systems as well as those of their suppliers. This understanding also requires a special vision of how dynamic influences such as energy availability, political policy, and regulation may have an impact on their ability to provide secure, reliable, and cost-effective utilities. Events over the last decade have compounded the challenges of delivering reliable utilities to the campus. Hazards have increased in number and complexity via intentional acts to disrupt service, whether from a computer virus or other acts of destruction. Further demands are placed on utility systems from indirect pressures such as aging infrastructure, difficulties in obtaining capital, uncertain regulations, unfunded mandates, and constrained supplies failing to meet rising demand. Natural hazards continue to wreak havoc even though advances have been made in mitigating the severity of the damage.

Needs and desires of the customer are becoming more complex. We are faced with providing both traditional as well as new utilities to support increasingly sophisticated facilities where loss of service can be extremely costly. Clear goals and objectives need to be established so that prioritization of utility needs can be established. For example, it may be prudent to segregate loads in a building where research labs, teaching labs, classrooms, and offices are combined within a single building. Too often entire buildings or even clusters of buildings are classified as "load critical," yet insufficient and

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unfocused resources are made available to protect and serve the aggregate load. Often there is not time or resources to make the necessary assessments to prioritize which loads should be served during times of crises when only limited service is available. This is a highly technical and political process that if not addressed may have significant financial impact.

The ability of a campus to provide utility service to its customers can be compromised anywhere along the energy supply chain. Identification and understanding of a supplier's weakness is an important part of assessing vulnerability. For example, during the August 2003 blackout in the Northeast U.S. and parts of Canada, the unanticipated failure of a number of municipal water supply systems occurred because the municipal onsite electrical backup systems did not function. An institution equipped to generate its own electricity may be unable to do so due to a requirement for makeup water in a cooling system that is dependent on that municipal water supply.

The United States' energy infrastructure is extremely complex and wrought with interdependencies. Energy infrastructure is inextricably interconnected with other critical infrastructures such as transportation, information technology, and water delivery systems. This interconnection of dependency is articulated in an article titled "Studying the Chain Reaction" by James P. Peerenboom, Ronald E. Fisher, Steven M. Rinaldi, and Terrance K. Kelly, published by Edison Electric Institute. The article is available at www.eei.org/magazine/ editorial_content/nonav_stories/2002-01-01-chain.htm.

Environmental regulations influence the way a campus converts energy and delivers utilities to its customers. On January 13, 2003, the Environmental Protection Agency (EPA) published proposed National Emission Standards for Hazardous Air Pollutants (NESHAPs) for Industrial/Commercial/Institutional Boilers and Process Heaters, 40 CFR 63 Subpart DDDDD. NESHAPs are more commonly referred to as Maximum Achievable Control Technology (MACT) Standards, and this one has been dubbed "Boiler MACT." At a minimum, the MACT standard will require a higher level of testing and monitoring of industrial, commercial, and institutional boilers and heaters. The implementation of Boiler MACT may require fuel switching or costly equipment retrofits resulting in a major financial impact on the institution. As written, this regulation also applies to backup fuel systems. This could cause a facility to become deficient of firm capacity due to its inability to operate older noncompliant equipment even during emergency conditions. The anticipated promulgation date for this rule is February 2004. Rule and implementation information for this pending regulation can be found at www.epa.gov/ttn/atw/boiler/boilerpg.html.

Recent Disasters and Universities

In July 1999, a heat wave resulted in a sustained power outage in New York City. The electricity went out at Columbia University and was not completely restored for 2-3 days. In the intervening time, researchers at Columbia's College of Physicians and Surgeons lost irreplaceable research materials–human tissue, enzymes, and cells–because there were not sufficient backup generators to keep freezers or incubators running. Damages to the $200-million research program were calculated at many millions of dollars.

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Campuses must determine how they are going to manage their energy resources. A good resource management plan will address issues such as fuel flexibility, sustainable design practice, energy conservation, and alternative energy use. Those that are more adept at managing their resources will be in a better position to serve the next generation of students.

While implementing a project, the entire life-cycle energy impact of the project and its components should be considered, as well as the economic and environmental impact and performance. Design and construction practices that significantly reduce or eliminate the negative impact on the environment should be encouraged. A focus on efficient systems and energy conservation will result in reduced loads and may relieve the stress on existing infrastructure. Managing the use of energy is encouraged in part due to the fact that the easiest and most secure utility load there is to serve is the one that does not exist.

Regardless of the countless "what-if " scenarios or contingencies set in place to circumvent a utility outage, there are bound to be interruptions. However, the impacts associated with an interruption can be substantially reduced with proper planning. The Federal Emergency Management Agency (FEMA) has released a document entitled *Building a Disaster-Resistant University*. This document walks the reader through a four-phase process:

- Organize Resources
- Hazard Identification and Risk Assessment
- Develop the Mitigation Plan
- Adoption and Implementation.

This is a valuable resource that lays out a systematic approach to reducing vulnerabilities. It is available at www.fema.gov/fima/dru.shtm.

Delivering secure and reliable utilities is one of the major missions for facilities staff. It is a complex act of planning and implementation that is put to test everyday. Delivering on this mission requires balancing the needs of customers with meeting the goals and objectives of the institution. It requires continuous reassessment of the multitude of factors that have the potential to influence operations. It means developing an energy plan that addresses many of the same challenging aspects surrounding the development of our national energy policy. It means planning for hazards, whether created or natural, and enacting plans to protect life and property when these hazards occur. To the untrained eye, an "invisible" utility infrastructure is a routine expectation. To the facility professional it means so much more.

Useful Web Sites

For Easy Reference visit APPA *Facilities Manager* online and open this article for access to the hyper links

APPA	www.appa.org
APPA's *Facilities Manager*	www.appa.org/facilitiesmanager/
American Coal Council	www.americancoalcouncil.org
American Gas Association (AGA)	www.aga.org
American Petroleum Institute (API)	www.api.org
Council of Industrial Boiler Owners (CIBO)	www.cibo.org/
Edison Electric Institute—Studying the Chain Reaction	www.eei.org/magazine/editorial_content/nonav_stories/2002-01-01-chain.htm
Edison Electric Institute (EEI)	www.eei.org
Energy Central	www.energycentral.com/
Energy Information Administration	www.eia.doe.gov
Energy News	www.energyinfosource.com
Environmental Protection Agency (EPA)	www.epa.gov
EPA—Proposed rule for Industrial/Commercial/Institutional Boilers and Process Heaters:	www.epa.gov/ttn/atw/boiler/boilerpg.html
EPA Colleges & Universities Sector Initiative Work Groups	www.epa.gov/sectors/colleges/index.html
Federal Emergency Management Agency (FEMA)—Building a Disaster Resistant University	www.fema.gov/fima/dru.shtm
Federal Energy Regulatory Commission (FERC)	www.ferc.gov
National Association of Regulatory Utility Commissioners (NARUC)	www.naruc.org/
New York Mercantile Exchange (NYMEX)	www.nymex.com
U.S. Department of Energy—Energy Efficiency and Renewable Energy	www.eren.doe.gov
U.S. Department of Energy—Office of Electric Transmission and Distribution	www.electricity.doe.gov/index.cfm
U.S. Geological Survey	www.usgs.gov
U.S. Green Building Council	www.usgbc.org
U.S. Senate Committee on Energy and Natural Resources	www.energy.senate.gov/index2.cfm
Whole Building Design Guide	www.wbdg.org