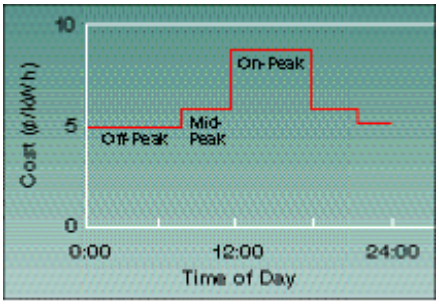
ELECTRICAL LOAD MANAGEMENT



Typical Time-of-Use Rate Schedule

Electrical energy consumption at water and wastewater treatment plants is increasing because of more stringent regulation and customer concerns about water quality. As a result, more facility managers are turning to energy management to reduce operating costs. Reducing energy consumption, however, is only part of the equation.

Electricity is typically billed in two ways: by the quantity of **energy** used over a period of time, measured in kilowatt-hours; and by **demand**, the rate of flow of energy, measured in kilowatts. By choosing when and where to use electricity, facilities can often save as much (or more) money as they could by reducing energy consumption.

RATE SCHEDULES

Because it is costly for electric utilities to provide generating capacity for use during periods of peak electrical demand, they often structure rates to encourage customers to minimize demand during peak periods. That's why plants should investigate the variety of rate schedules offered by electric utilities. They may achieve substantial savings simply by selecting a rate schedule that better fits their pattern of electricity use.

- **Time-of-Use Rates**

In most areas of the country time-of-use rates, which favor off-peak electrical use, are available. Under time-of-use rates, energy and demand charges vary during different block periods of the day. For example, energy charges in the summer may be only five cents per kilowatt-hour with no demand charge between 9:30 p.m. and 8:30 a.m., but increase to nine cents per kilowatt-hour with a demand charge of $10 per kilowatt between noon and 6:00 p.m. The monthly demand charge is often based upon the highest 15-minute average demand for the month.

- **Interruptible Rates**

Interruptible rates offer users discounts in exchange for a user commitment to reduce demand on request. On the rare occasions when a plant receives such a request, it can run standby power generators.

- **Power Factor Charges**

Power factor, also known as "reactive power" or "kVAR," reflects the extent that current and voltage cycle in phase. Low power factor, such as that caused by a partly loaded motor, results in excessive current flow. Many electric utilities charge extra for low power factor because of the cost of providing the extra current.

- **Future Pricing Options**

As the electrical industry is deregulated, many new pricing options will be offered. **Real-time pricing**, where pricing varies continuously based on regional demand, and **block power**, or electricity priced in low-cost, constant-load increments, are only two of the many rate structures that may be available. Facilities that know how and when they use energy and have identified flexible electric loads can select a rate structure that offers the highest economy, while meeting their energy needs.

DEMAND MANAGEMENT STRATEGIES

- **Conduct an Energy Survey**

The first step to an effective energy management program for your facility is to learn how and when each piece of equipment uses energy. Calculate the demand and monthly energy consumption for the largest motors in your plant. Staff may be surprised at the results—a 100 horsepower motor may cost over $4,500 per month if run continuously.

The rate at which energy is used will vary throughout the day, depending upon factors such as the demand from the distribution system and reservoir and well levels for water systems or influent flows and biological oxygen demand loading for wastewater systems. Plot daily electrical load as a function of time for different plant loading conditions and note which large equipment can be operated off-peak. Examine all available rate schedules to determine which can provide the lowest cost in conjunction with appropriate operational changes.

- **Reduce Peak Demand**

Look for opportunities to improve the efficiency of equipment that must run during the peak period, such as improving pump efficiency or upgrading a wastewater plant's aeration system. During on-peak periods, avoid using large equipment simultaneously: two 25-kilowatt pumps that run only two hours each day can contribute 50-kilowatts to the demand if run at the same time.

- **Shift Load to Off-Peak**

Many large loads can be scheduled for off-peak operation. For example, plants can use system storage to ride out periods of highest load rather than operating pumps. Avoid running large intermittent pumps when operating the main pumps.

- **Improve Power Factor**

Low power factor is frequently caused by motors that run less than fully loaded. This also wastes energy because motor efficiency drops off below full load. Examine motor systems to determine if the motor should be resized or if a smaller motor can be added to handle lower loads. Power factor can also be corrected by installing a capacitor in parallel with the offending equipment.

DEMONSTRATED SUCCESS

Encina Wastewater Authority reduced its demand charges $50,000 per year by manually shutting down select high-demand equipment on-peak. Moulton Niguel Water District eliminated on-peak pumping at several large pumping stations by utilizing gravity flow from storage reservoirs, reducing demand charges by $320,000 per year. The City of Woodland Water Department

reduced its energy costs $125,000 per year simply by changing to a time-of-use rate schedule and modifying operating practices to lower its peak demand.

REFERENCES

Electric Power Research Institute, *Reduce Costs by Understanding Your Electric Bill*, BR-103303, 1993.

Electric Power Research Institute, *Energy Efficiency in Wastewater Treatment*, TechCommentary Vol.1, No. 3, May 1993.