District Heating & Cooling

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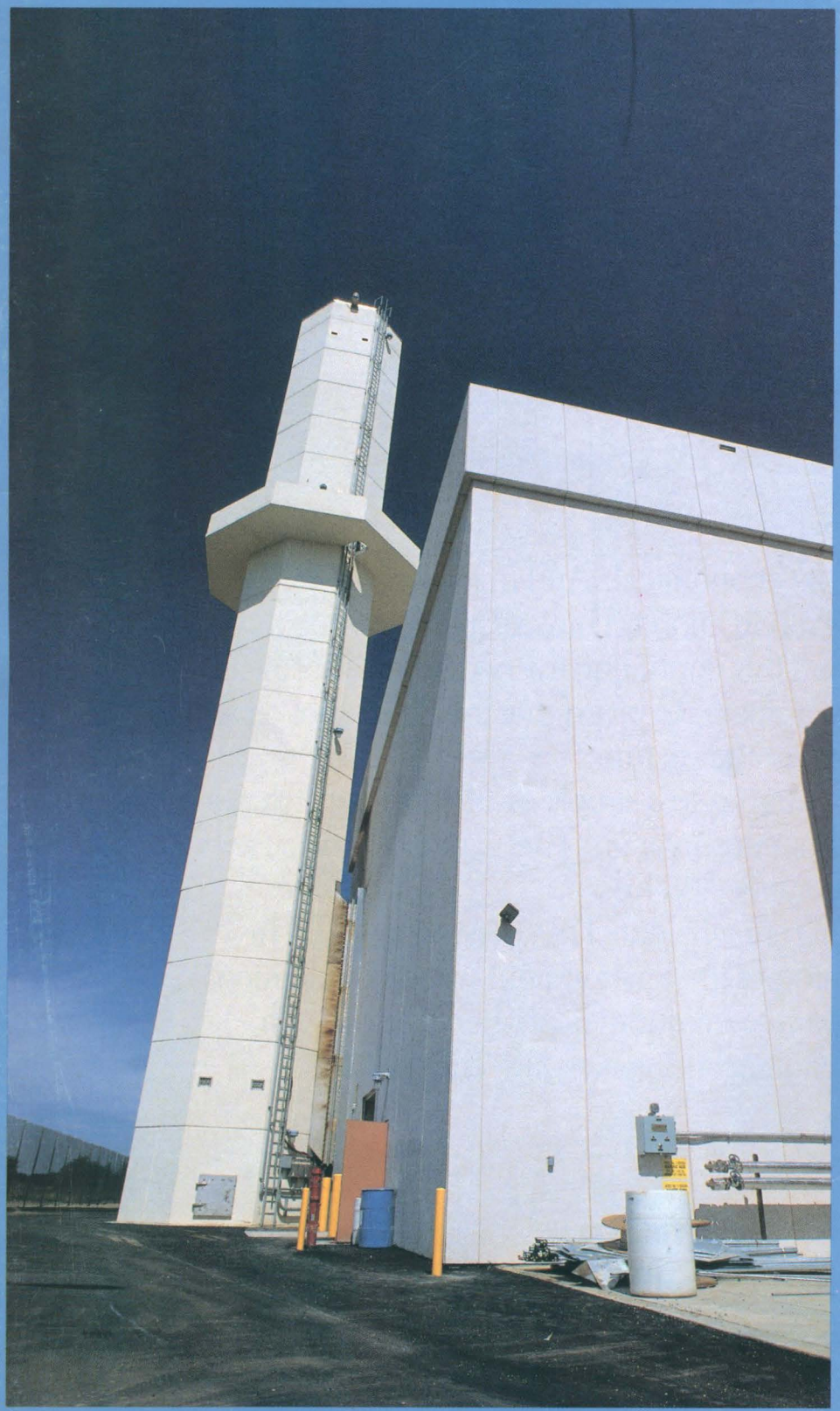

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Iola Powerhouse:

Monroe County Optimizes Fuel-Use Strategies

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Monroe County's Iola Powerhouse supplies high-pressure steam to six major governmental buildings and building complexes on the southern edge of Rochester, New York. The steam is used for heating, driving absorption chillers and other facility operations. The recently renovated boilers and control systems permit efficient, environmentally sound, and cost-effective operations, enhancing the benefits from the central steam generation plant and distribution system. These benefits include more reliable, lower-cost heating and cooling, increased building space available for the users' services and savings on system operating and maintenance costs. The fuel-source flexibility of the plant buffers the users from the fluctuations in fuel cost and availability, caused by such crises as the recent Middle East conflicts, strikes, natural disasters, etc.

This article reviews the Iola Powerhouse steam generation plant and distribution system, production control and fuel-cost optimization strategies, and central steam district benefits which accrue to users of the system.

Iola Powerhouse — A Steam and Hot Water Source

The Iola Powerhouse, located on the Monroe County government's Iola Campus at 350 East Henrietta Road, provides high-pressure steam (120 psig), low-pressure steam (8 psig), and hot water to the following nearby County buildings: Monroe Community College, Monroe Community Hospital, Monroe County Health and Social Services Building, Monroe County Correctional Center, Children's Detention Center and the Iola Complex buildings.

Steam Generation

The Iola Powerhouse generates 120 psig steam from four boilers. Boilers No. 1 and 4 are fired by oil and natural gas, Boiler No. 3 by coal, and Boiler No. 2 by coal with a 20,000 lb./hr. oil-fired side burner. All boilers were installed in the 1960s. Each is rated at a generating capacity of 40,000 lb./hr. at 200 psig saturated steam. Because of their age, the boilers are not presently operating beyond 35,000 lb./hr. at 120 psig each. Steam production records indicate that the maximum observed production load for all four boilers during winter months has approached 80,000 lb./hr. The maximum observed summer load was 60,000 lb./hr. Fuels for firing the boilers are selected on the basis of plant load and current fuel costs.

Steam Distribution

The high-pressure distribution system transports 120 psig steam to each of the users who reduce the pressure as needed within their facilities. At Monroe Community Hospital laundry, 120 psig steam is used for various pieces of equipment. The college and the health and social services building use low-pressure steam to drive absorption-type chillers which supply chilled water for the building cooling system. An additional line from the powerhouse delivers low-pressure steam to the hospital for heating. Domestic hot water is supplied to the hospital and the Iola Complex buildings from steam-to-hot-water heat exchangers located in the powerhouse.

Coal and Ash Handling

The coal-handling equipment consists of a bucket elevator that lifts crushed bituminous coal from the dump grate chute in the basement of the powerhouse to a conveyor system overhead. The conveyor system evenly distributes the coal in the overhead storage bin. The coal is then fed by gravity into the boiler hoppers.

The ash-handling system consists of a cyclone-type collector on the south side of the powerhouse which collects all boiler bottom and fly ash. The ash is hand-raked to the vacuum system intake ports. An ash storage containment area is located to the south of the building.

Renovations and Controls

The boilers and control systems were renovated in several stages from 1985 to 1988 to reduce air contaminant emissions and operation control problems. A complete new motor control center has been installed in the engineers' equipment room. Coal handling, conveyor and other controls have been upgraded and a graphic display of the system operations has been added. Sensor data is fed to a programmable logic controller, as well as the display devices, for computerized process control.

A view of the Iola Powerhouse.
Courtesy of the Monroe County, Communication Department

Iola Powerhouse *Continued from page 23*

This computer allows operators to view trends of important factors such as individual cost-center steam usage or boiler operation variables. New sensors, such as flue-gas analyzers, present real-time data on operating conditions and the effects of system regulation actions. Process data are logged and periodically reported, allowing operators to more precisely regulate the plant. The renovations have enabled both the plant operators and plant equipment to function more effectively, and to efficiently and reliably provide steam to users.

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The County is currently studying plans for further modifications, among them the possibilities of cogeneration. The objectives are to maintain or lower the already-low cost of steam while improving overall plant efficiency, safety, and reliability, and reducing air contaminant emissions.

Cost Optimization Strategies Focus on Selection and Control

During calendar year 1989, the average annual cost of Iola steam was $9.38 per Mlb., counting both fuel and operating costs. The flexibility afforded by the powerhouse's multiple boilers, the ability to use several fuels plus the equipment in place at user facilities have allowed Monroe County to pursue several strategies for steam production cost containment. These generally involve fuel selection and steam demand strategies.

Fuel Selection

The plant's ability to use several fuels — coal, oil, and natural gas — has permitted the County to employ a least-cost fuel-use strategy. Demand is sufficient to allow the County to enter a natural gas supply contract with a regional distributor at a long-term fixed price. Fuel can be selected based on known demand factors and relative costs of utility or distributor-supplied gas versus oil or coal. The accompanying charts shows cost curves for the different fuel based on a range of prices. Currently, the lowest-price fuel is direct-supplied natural gas. Fuel prices are monitored carefully, however, to ensure that the lowest cost fuel is used. Coal may only be used between November 1 and April 15, per the County's New York State Department of Environmental Conservation (DEC) permit, provided that 25,000 lb./hr. of steam is produced. This ensures a proper fuel-air ratio and a flue-gas opacity of less than 20 percent.

Demand Control

Fuel selection is obviously also influenced by the demand load. Demand strategies have also been developed to facilitate optimal fuel selection. It is advantageous that the college, hospital, and the health and social services building use steam for absorption chillers as well as heating. This provides demand that may justify coal use during the warmer months. Monroe County is planning to apply to DEC to authorize an extension of the coal-firing period into the summer and fall months when demand is sufficient. Other strategies include helping users identify cost-saving opportunities from use of steam as an energy source when future equipment purchases or replacements are considered. Iola-supplied steam was chosen for heating the recently constructed correctional facility. These strategies yield cost avoidance or savings to the powerhouse by helping optimize use of equipment and plant staff.

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Users Benefit From Central System

The Iola Powerhouse and its users and distribution network comprise a district heating and cooling system which affords system users many advantages. Users only need heat exchangers, absorption chillers, and internal distribution systems in their facilities. They do not need to purchase or devote precious space to primary and backup furnaces or boilers; fuel handling and storage equipment; or chimneys, waste handling, and pollution control facilities. They also don't need to maintain and equip a staff of operating personnel to operate such equipment.

Continued on page 26

Iola Powerhouse *Continued from page 24*

The central DHC plant provides users cost advantages from economies of scale in equipment, fuel, staffing, pollution control equipment and practices, insurance, etc. And the professional power plant managers, not the users, are responsible for dealing with the increasingly complicated concerns of heating plant management, pollution control and operations safety. As a result, the users can commit more of their time to their own clients and services.

The college, hospital, and health and human services building use Iola steam to drive absorption chillers for facility cooling. Using lithium bromide as a refrigerant, these chillers avoid CFC contamination for the atmosphere. They do not face the potentially high-cost retrofit of CFC-based centrifugal chillers. The chillers also provide a summer load to the plant, allowing efficient year-round operation and a resulting lower cost per Mlb. of steam to the users.

Middle East Instability Affects Fuel Pricing

Like other power utilities, the Iola Powerhouse has been affected by oil price changes resulting from instability in the Middle East. In early August 1990 the price of oil jumped from $21.54 to $40.00 per barrel, then back to $33.00. The ability to use both natural gas and coal at the powerhouse buffered the plant and its customers from the oil price changes no matter what happened. The plant was able to use natural gas through this period, supplied under contract at a stable price. Increasing demand may, however, affect long-term availability. Natural gas users are looking to increases in the capacity of pipelines delivering Canadian gas to offset potential supply and pricing problems.

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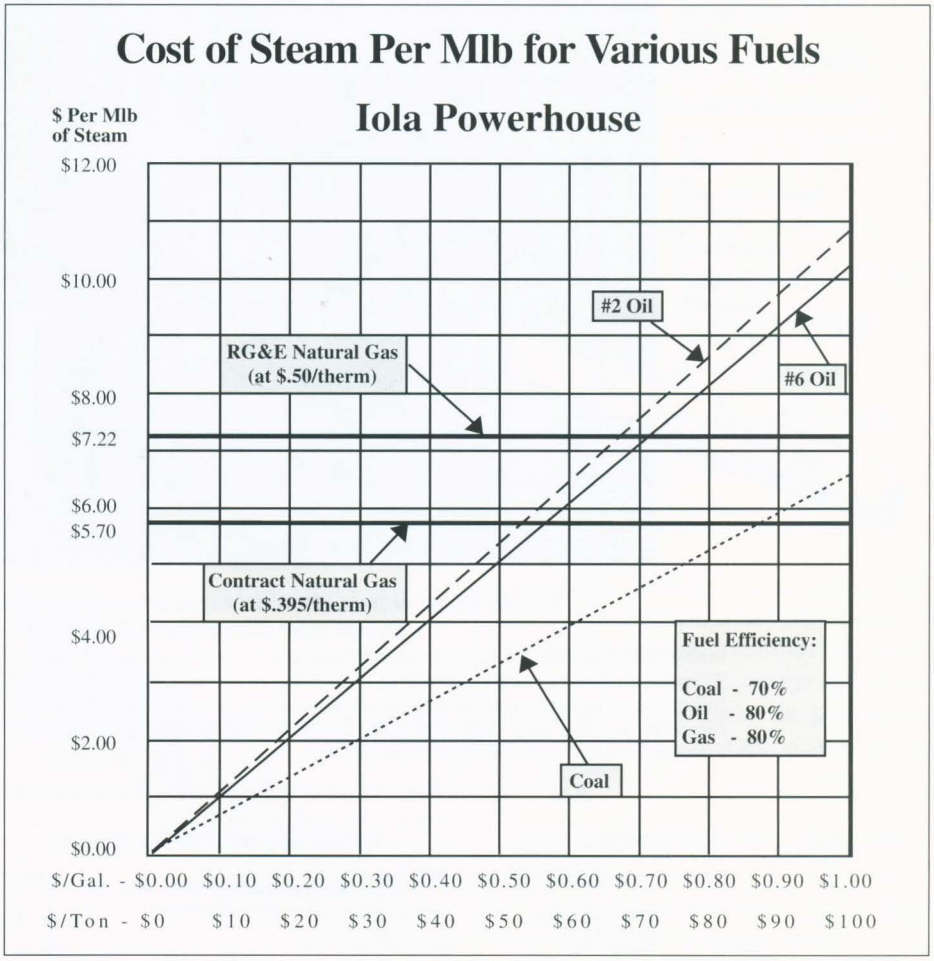
The Iola Powerhouse is the heart of a major district heating and cooling system serving important institutional users. Its state-of-the-art equipment and operating practices enable it to reliably and efficiently serve its users at as low a cost as possible. This is important to the Monroe County government in its efforts to provide cost-effective services for our community, control taxes and foster economic development.

Please contact Henry Manczyk, Monroe County administrator of building operations, (716) 274-7986, for further information.

Henry Manczyk in front of the control board of Boiler No. 1.
Courtesy of Monroe County, Communication Department



Cost-effective fuel selection is an important part of the success of the Iola Powerhouse and its district heating and cooling system.
Courtesy of Henry Manczyk, Monroe County

The above chart is based upon the following formula:

$$Cm = \frac{1}{Be}\left[\frac{(Qs \times 1000)}{Qf} \times Cf\right]$$

WHERE:

Cm = Cost of steam per Mlb.
Be = Boiler fuel efficiency
Qs = Btus/lb. of steam - 1,193 at 120 psi
Qf = Btus per unit of fuel
Cf = Cost of fuel per unit of fuel
Mlb.= 1000 lb. of steam at 120 psi

Boiler fuel efficiency is 80% burning oil or gas fuel.
Boiler fuel efficiency is 70% burning coal fuel.
Powerhouse steam is 120 psi (1,193,000 Btus/Mlb.).

Ratings of fuels:
Natural gas - 103,000 Btus/Therm,
Coal - 26,000,000 Btus/Ton (avg.),
#2 Oil - 138,000 Btus/Gallon
And #6 Oil - 146,000 Btus/Gallon.