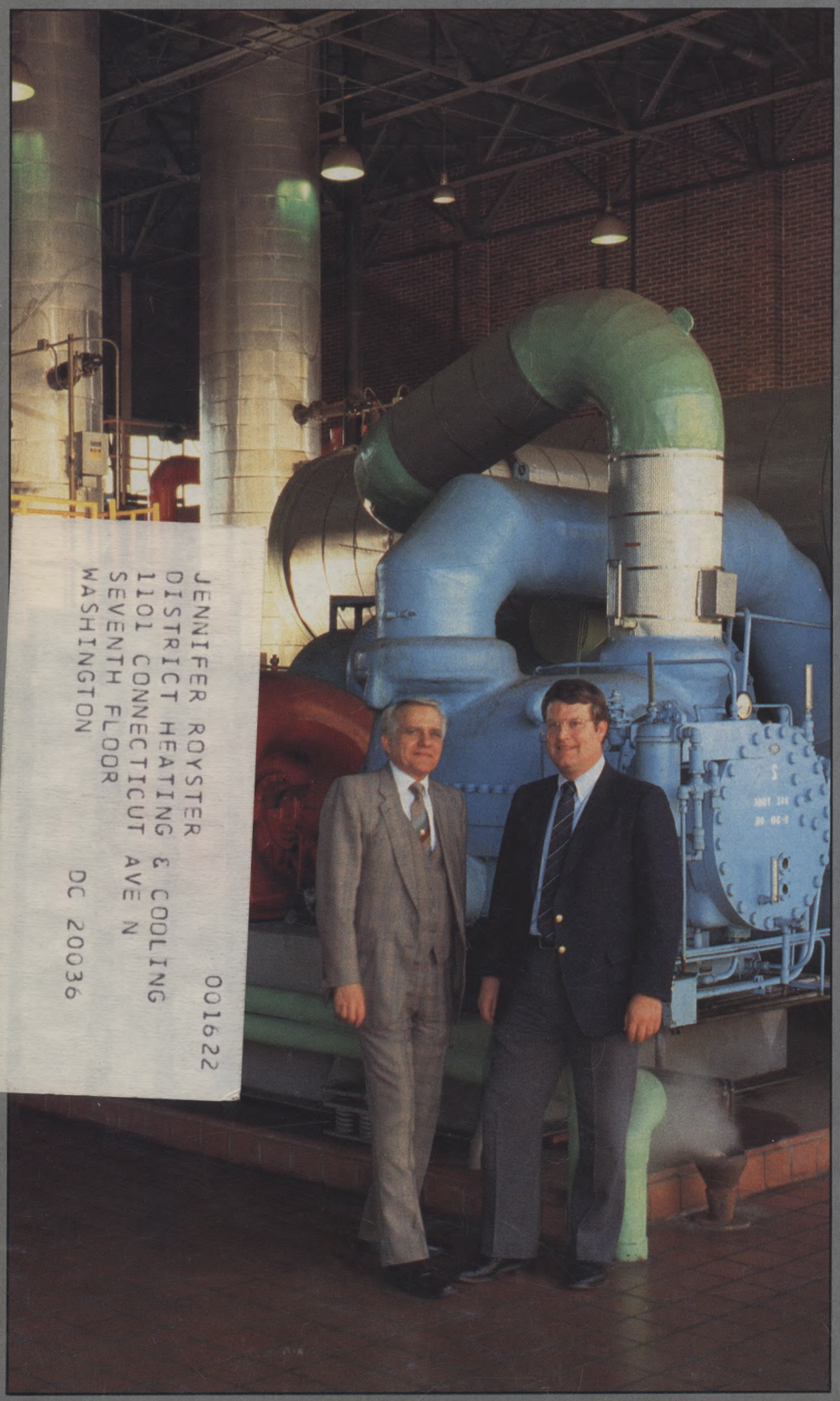
District Heating & Cooling

Volume 73 Number 2 Fourth Quarter 1987



DHC in Pennsylvania

With Reports On . . .

Harrisburg
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SPECIAL REPORT—
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Table III
Approximate friction factors for turbulent fluid flow through smooth pipe

Nominal pipe dia., in.	Friction factor, *f*
3	0.0175
4	0.0162
6	0.0150
8	0.0140
10	0.0135
12	0.0130
14	0.0128
16	0.0123
18	0.0120
20	0.0118
24	0.0150

Table IV
Pipe loop vs. expansion joint—an annual cost comparison

Cost item	Loop	Expansion Joint
Cost of expansion joint, $*	—	4,200
Material and labor for loop, $	2,833	—
Material and labor for loop support structure, $†	500	—
Total initial investment	3,333	4,200
Minimum rate of return, plus taxes and insurance, %	20	20
Annual investment charge	667	840
Annual cost of pumping water through the loop	633	—
Total annual cost	1,300	840

*Expansion joints are normally custom engineered for each specific installation. Because no two systems are alike, cost factors cannot be tabulated for general application. For an economic determination, actual costs should be obtained from a manufacturer.

†The cost of erecting a pipe-loop support structure is usually estimated on the basis of dollars per pound. Because this cost factor can vary considerably, accurate values should be obtained from a contractor for the area where the system is to be installed.

fully turbulent liquid flow through smooth pipe are listed in Table III); L = equivalent length, ft (determined by means of the equations previously provided); u = utilization factor, % (i.e., the percentage of time that the system will be in operating during a year); c = average cost of electricity, $/kWh; e = pump and motor efficiency, % (normally 70–75%); p = density of the pumped fluid, lb/ft^3; and d = pipe I.D., in.

Sample problem—pipe loop vs. expansion joint

A decision on whether to install a pipe loop or an expansion joint can be resolved on the basis of economics. Hot water at 150 psig and 300°F is to be distributed at a flow-rate of 1,459,000 lb/h through nominal 12-in.-dia. standard-weight A106B pipe. The loop would be a short-radius U-bend having a width of 12 ft (i.e., h = 12 ft). Both the pipe run and loop would be horizontal.

An externally pressurized single-bellows expansion joint would cost $4,200. The cost of electricity averages $0.06/kWh. The system is expected to be in operation an average of 16 h/d. The loop supporting structure would cost $500. The minimum rate of return, plus taxes and insurance, is 20%. Determine the most economical approach to provide the needed pipe-system flexibility.

As previously calculated, the piping material and labor costs for the loop add up to $2,833. The loop support costs an additional $500. The equivalent length of the U-bends is 2(12) + 116(1) = 140 ft. Via the pumping-cost equation, the annual cost of pumping hot water through the loop would be: $(1{,}459{,}000)^3(0.013)/(140)/(0.67(0.06)$ / $(627{,}300)(0.70)(57.3)^2(12)^5$, or $633/yr.

The tabulation in Table IV shows that, while on the basis of purchase costs the expansion joint is more expensive, it is 35% less expensive based on total annual costs.

References

1. "Design of Piping Systems," The M. W. Kellogg Co., Wiley, New York, 1956, p. 230.
2. Weaver, R., "The Piper's Pocket Handbook," Gulf Publishing Co., Houston, 1979.
3. "Flow Of Fluids Through Valves, Fittings, and Pipe," The Crane Co., New York, 1979.
4. Crocker, S., "Piping Handbook," ed. R. C. King, McGraw-Hill, New York, 5th ed., 1973.

The author

Robert K. Broyles is manager of engineering at Pathway Bellows, Inc. (P.O. Box 1525, El Cajon, CA 92022), an expansion-joint manufacturer that serves the chemical process industries, as well as many other markets. A member of Pathways' engineering group since 1976, he was previously chief engineer with Barron Fabricators, Inc. A recipient of a B.S.I.E. from California State Polytechnic University and an M.S.I.E. from Georgia Institute of Technology, he is a registered engineer in the state of California and a patent-holding inventor. He has frequently been a guest speaker at meetings of the American Soc. of Mechanical Engineers and of other professional organizations.

The Future of DHC in Kansas City:

Boom or Bust?

By Kathi Ann Brown

The year: 1888. The place: Kansas City, Missouri. Steam from the Kansas City Electric Light Company's electric generation plant courses through a new underground piping system, carrying with it a cheap and convenient source of heat for the city's bustling downtown. The future of DHC looks expansive and secure.

The year: 1987. Kansas City Power & Light, KCEL's successor, petitions the Missouri Public Service Commission to discontinue service and abandon the city's DHC system by the end of 1990, citing loss of customers, aging equipment, and lack of profitability. The end of an era appears to be at hand.

In recent years, this too-familiar scenario has been played out in a number of cities across the American power landscape. The recipe? A city with a downtown in flux. A DHC system that's seen better days. And a utility that wants out of the steam business—period.

But Kansas City's system may soon get a new lease on life, if the Missouri Public Service Commission has anything to say about the matter. And the Commission had plenty to say on October 7, 1987, in its 25-page ruling on KCP&L's request to phase out service and abandon the system's pipes and plants at the turn of the decade.

The Kansas City system, admittedly, is one that has seen better days. By the late 1920's the city's electric company had purchased the large Grand Avenue power station from the Kansas City Rapid Transit Company and had built three plants of its own. In 1927, one of the three KCEL stations was converted to a pressure reduction plant and connected to the Grand Avenue stop with a new high pressure (185 PSI) main.

The staff recommended that KCP&L be obliged to rehabilitate the system, attempt to sell it, and stop offering conversion equipment.

The next three decades saw a few changes, including the abandonment of Heating Station #2. But the system basically flourished until the 1970's, having grown over the years into a complex distribution network of high and low pressure piping that reached almost 300 customers. By 1982, the original piping had more than doubled to 61,000 feet, much of it to supplement the low pressure piping installed by KCEL in 1905.

By the close of the 1970's, changes in the downtown area began to take their toll on the system. Between 1982 and 1986, 84 customers left the system, some converting to other energy sources, many because

buildings were razed or abandoned. Over five thousand feet of pipe was disconnected. The older sections of the system needed a program of maintenance and replacement. Despite rate increases over the period 1977-1982, the company could not cover its costs. And for the first time, Kansas City Power & Light began to take a long, hard look at the future of its steam business.

In the late 1970's, KCP&L initiated two studies. The results of the first study appeared in 1981. General in nature and focus, the report included among its suggested options that KCP&L consider selling the system and getting out of the steam business entirely. A second, long-range study which appeared the next year echoed the earlier report, recommending that if no large customers were added to the system by 1985, KCP&L should begin to phase out its service and promote customer conversion to electric heat.

In 1983, a new and large customer appeared on the horizon. Corn Products Corporation signed on to the system, a contract which promised to triple KCP&L's steam load. For two years, the system turned a profit. Then CPC sold its facilities to National Starch, whose steam needs were only one-fourth of CPC's. In light of the change, KCP&L pulled together a proposal to phase out its service once and for all by 1990. It was this proposal that the Missouri Public Service Commission reviewed and ruled on in October of this year.

KCP&L wanted approval from the Commission on several fronts. First and foremost, the company hoped to discontinue its major steam service by December 31, 1990, when its contract with National Starch expired. Using an 11-phase plan based on customers' geographical proximity to KCP&L's power centers, all users would be systematically disconnected from the system by dates established by KCP&L.

Secondly, KCP&L proposed to offer each customer on-site electric heating equipment, with various advantageous ownership and maintenance options.

Thirdly, KCP&L applied for revised tariffs representing a 120% percent increase on an annual basis, or a total of $5.8 million.

The staff of the Missouri Public Service Commission reviewed KCP&L's conversion proposal and offered a number of recommendations for action to the full Commission.

The staff's sharpest aim was directed at KCP&L's apparent lack of enthusiasm for selling the system. Citing internal memos and less-than-aggressive attempts to market the system, the Commission staff indirectly charged that KCP&L was essentially biding its time until it could abandon the system, without investing more money and effort in its management and upkeep. By abandoning the system and at the same time offering to clients bargains in electrical heating equipment, KCP&L could get out of the steam business while retaining some of its customer base by helping them to convert to electrical power. The staff felt that KCP&L's offer of equipment violated the state's Promotional Practices Rule and masked "the true cost of conversion to electric heat." The staff recommended that KCP&L be obliged to rehabilitate the system, attempt to sell it, and stop offering conversion equipment.

No fewer than five concerns have already expressed interest in purchasing the Kansas City system.

Although the Commissioners did not take as dim a view of KCP&L's motives as their staff, they essentially agreed that the utility was doing questionable justice to their customers by so readily consigning the steam system to the dust heap and offering to help with the switch to electrical. Noting that KCP&L—or any owner of the system—would have to increase its customer load to make a go of it, the Commission agreed to let the company abandon the system on December 31, 1990, but only after a "good-faith effort" to sell it. In the interim, rates would remain frozen to avoid losing more customers and enhance saleability. KCP&L would have to stop offering electrical equipment and customers who had taken advantage of the offer to date would have to reconnect to steam or buy the bargain equipment at standard market rates. KCP&L would be required to solicit detailed proposals from potential purchasers and report to the Commission by January 1, 1989 on the status of the system's sale.

Reaction to the Commission's decision was predictably mixed. Looking for a silver lining, KCP&L's spokesman, David Martin, pointed out that "KCP&L takes note that the PSC is in basic agreement with the company, in that the Downtown central steam system as now constituted is not viable." Spokespeople for others interested in seeing alternatives to abandonment explored were pleased that some time has been bought to look around at different options.

Among those happiest with the Commission's order to explore sale of the system is Joe Gentile, Assistant Manager, Solid Waste Division in the public works department. Gentile praised the Commission's ruling, but hopes that pressure on KCP&L to make a concerted effort to sell the system can be sustained. He noted that a timetable of "interim checkpoints" has been proposed by the Commission to monitor KCP&L's progress in soliciting proposals from interested parties.

Gentile is perhaps most concerned about the image of the system that KCP&L has portrayed to the public.

"The system is not in as bad shape as the utility has been saying. Sure, there's going to be some rehabilitation in order and, of course, maintenance, but KCP&L itself has been replacing some of the worst sections of the system in recent years. It's in better shape than it was only three years ago. The fellows who work most closely with the system have said that leakage has been reduced from 40% to around 20%, average for many systems."

"Customer confidence is critical to the success of the system," continued Gentile. "Right now, we've got customers who would prefer to stay with or come back to the steam system, but who are confused about what's going to happen in the future. We've been trying, through workshops and meetings, to explain the state of things and map out for them as best we can what lies ahead. Just giving them examples of how similar situations with DHC systems in other cities have worked out—successfully—builds their confidence in the concept."

No fewer than five concerns have already expressed interest in purchasing the Kansas City system, a sign that Gentile thinks bodes well for the future.

"It's really a great opportunity for someone," says Gentile. "There are at least 20 million square feet of office and retail space in the minds and on the drawing boards of people involved in the revitalization of the downtown area. Those buildings will need heat. If someone gets in there and markets aggressively, there's no reason why we here in Kansas City can't repeat the successes of our sister systems in Baltimore, Rochester and other cities across the country." IDHCA