

District Heating & Cooling

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DHC in Pennsylvania

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The EQUITABLE GAS-ENERGY SYSTEM *Pittsburgh, Pennsylvania*

Over two decades ago the Equitable Gas-

*By David W. Wade, P.E., Walter E. Beck, P.E., Karen Herring
Resource Development Associates, Inc.*

Allegheny Center has enjoyed reliable district heating

Energy Company was conceived and built to supply The Allegheny Center urban renewal project with heating and cooling energy from a central gas fired energy plant. The concept of utility supplied chilled water, steam and hot water was advanced at that time as being simple and low cost for customers and cost effective for the central utility supplier due to customer diversity and economy of scale. In the intensely competitive environment of electric versus gas utilities during the 1960's, the Allegheny Center presented an excellent opportunity for the Equitable Gas Company to serve a cooling energy market, typically dominated by electric driven refrigeration, thus supplying year round heating and cooling from a natural gas fuel source. Operation of the plant began in 1966 with the initial construction phases of the urban renewal project.

and cooling service for over twenty years provided by the Equitable Gas-Energy Company. Gas-Energy is a wholly owned subsidiary of the Equitable Resources, Inc. of Pittsburgh, Pennsylvania and is regulated by the Pennsylvania Public Utilities Commission on a "cost of service" basis. Throughout its service life, the Gas-Energy system has been operated to service the customers heating and cooling requirements in a reliable and cost effective manner. Expansions to the plant and distribution system have been undertaken as the Allegheny Center community has grown. Current plans include offering chilled water and steam service to other office and institutional buildings in the immediate vicinity. Equitable Gas-Energy's service area is shown in Figure 1.

In 1986, Equitable retained Resource Development Associates, Inc. to review operating prac-

tices, facilities and future potential of the system. With this review in hand, Gas-Energy management has adopted new business practices in moving toward continued viability of chilled water and steam service to the Allegheny Center community.

Description of Physical Plant

The Gas-Energy system was designed circa 1964 by the engineering firm of Ford, Bacon & Davis. The original design included two identical boilers and three identical turbine-driven centrifugal water chillers with an installed steam generation capacity of 140,000 LBS/HR and a refrigeration capacity of 6000 tons. Increases in heating and cooling demands dictated installation of additional capacity beyond that provided in the original design. A third boiler rated 100,000 LBS/HR was added in 1972 and a fourth turbine driven centrifugal chiller rated 4000 tons was added in 1975. Figure 2 schematically depicts the existing system.

All three boilers are of the packaged type manufactured by Babcock and Wilcox. Saturated steam generated at 235 psi is delivered to the chiller turbines, auxiliary turbines and the distribution system. Natural gas is utilized as the primary fuel with standby capability to fire No. 2 fuel oil in the event of a natural gas curtailment. The major refrigeration equipment is manufactured by York and is designed for a chilled water send out temperature of 40°F.

Chilled water pumps recirculate water through the chillers, the chilled water supply distribution pipes, through the buildings, and returns it to the central plant. An evaporative cooling tower is used to dissipate heat from the chillers and turbine condensers. The physical plant is laid out in two floors—the operating floor and the ground floor. Major items of equipment—boilers, chillers, deaerator, and switchgear are installed on the operating floor along with offices and the control room.

All auxiliaries including the electrical substation, pumps, fans, air compressors, emergency generators, water treatment equipment, and other minor auxiliaries are located on the ground floor. This layout results in an uncluttered and aesthetically appealing building interior. The architectural design of the building exterior is more typical of a commercial office building than a physical plant.

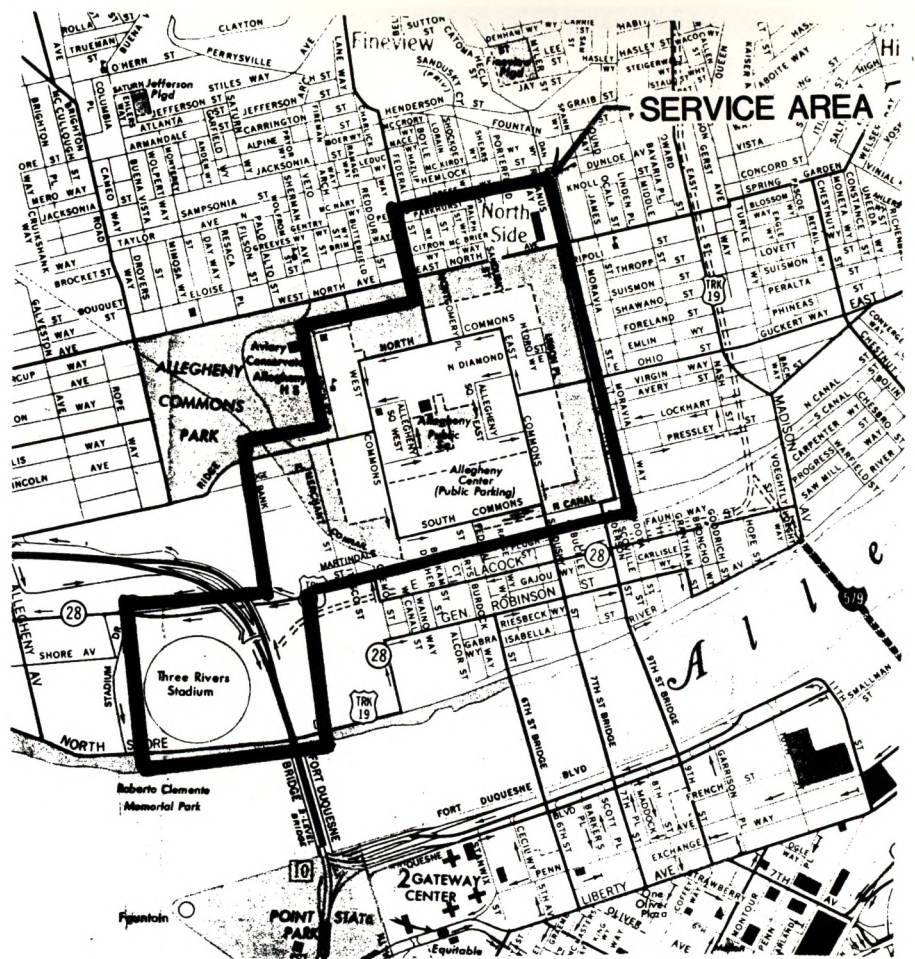


Figure 1
Service Area

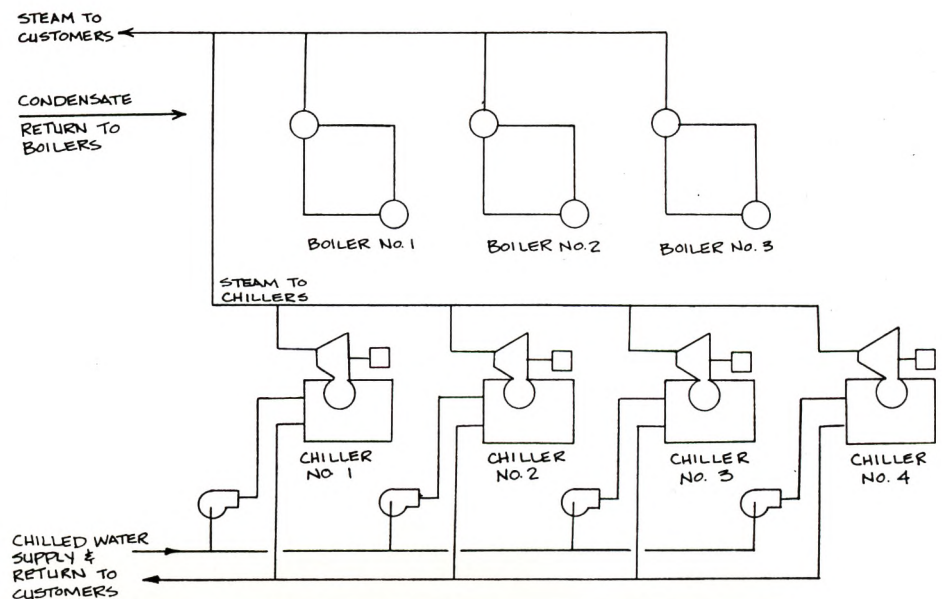


Figure 2
Equitable Gas Energy Plant Schematic

Description of Distribution System

The distribution system is depicted in Figure 3. Pipe sizes utilized and associated lengths are shown in Table 1. The steam supply and condensate return piping are encased within a common concrete envelope. Concrete pits are installed at varying intervals and house valves, traps and expansion joints. The chilled water system consists of supply and return lines running parallel to the steam and condensate lines. These lines are coated and wrapped, and the supply line is insulated. Both supply and return lines are direct buried without a concrete envelope. The four pipes are arranged across the trench in order of decreasing temperature—steam, condensate, chilled water return, and chilled water supply so as to minimize heat transfer between pipes.

In addition to steam and chilled water, the system also supplies 180°F hot water to townhouses located adjacent to Allegheny Center. District steam is supplied to hot water converters in the center of each group, and hot water is pumped to each townhouse.

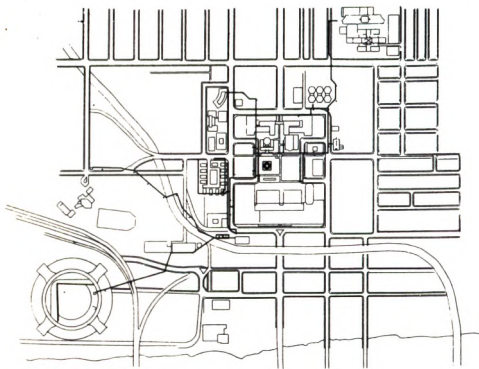


Figure 3
Distribution System

Customers

The Equitable Gas-Energy System is unique in that it provides complete "climate control" to its customers on the same basis as a public utility. Central heating and cooling services are charged on a demand and usage basis.

The system serves eighteen customers and was one of the first of its kind to serve a diverse group of customers with both heating and cooling services. Nine of the system's customers are a part of the successful redevelopment project in the Old Allegheny sector of Pittsburgh. Known as Allegheny Center, this 79-acre complex is occupied by

Table I
Equitable Gas-Energy Company
Distribution System
(Approximate Lengths)

CHILLED WATER (Supply & Return)		STEAM PIPING		CONDENSATE PIPING	
Pipe Dia.	Length (FT)	Pipe Dia.	Length (FT)	Pipe Dia.	Length (FT)
30"	1872	12"	1725	8"	630
26"	1578	10"	814	6"	1909
24"	1628	8"	1470	4"	3039
20"	1770	6"	2663	3"	1094
16"	1780	4"	153	2"	298
12"	1538	3"	145		
8"	3394				
6"	380				
Total	13940	Total	6970	Total	6970

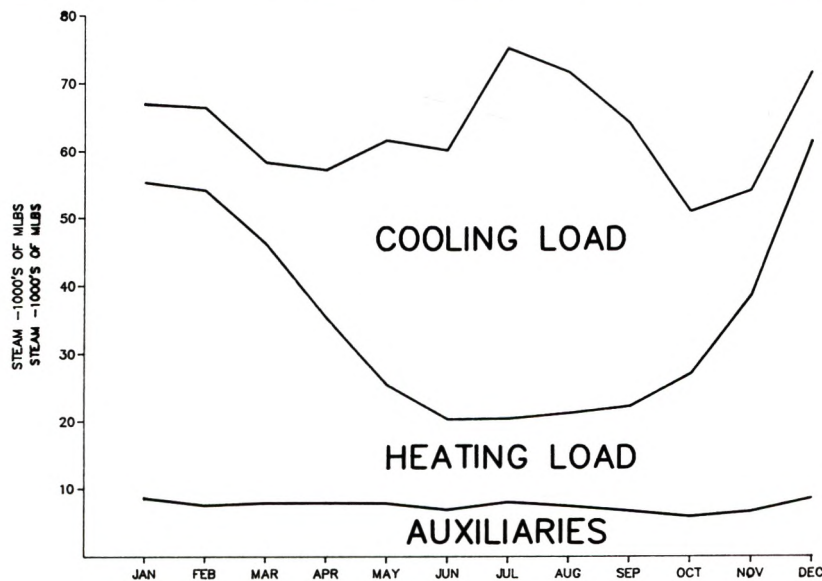


Figure 4
Steam Load Profile

a shopping center which includes 750,000 sq. ft. of commercial space, three office buildings including the IBM office tower, four apartment buildings with a total of 1350 living units, and a group of townhouses.

The other nine customers are located in close proximity to Allegheny Center. These customers include the Allegheny General Hospital, Allegheny Professional Buildings, Divine Providence Hospital, Allegheny Community College, Sears Roebuck & Co., Carnegie Library, Christian Mission Church, and an elementary school. The customer heating and cooling demand loads total 180,000 lbs of steam per hour and 10,900 tons of refrigeration respectively. This centralized heating and cooling system has been noted as one of the largest in the world. Figure 4 illustrates the system's high annual load factor.

Potential customer additions in the near future include a new science center, several office buildings planned for the north side of Pittsburgh, a warehouse renovation project and high-rise additions at the Allegheny General Hospital.

Future Plans

The changing energy climate of the 70's and 80's has not promoted positive responses by energy system customers.

To address customer concerns, Equitable retained Resource Development Associates, Inc. (RDA) to evaluate the Gas-Energy System and make recommendations for operational and management changes aimed at improving the plant's efficiency and business operations. Some of the changes currently being considered are modified operating procedures which will reduce system "unaccounted for" statistics, incorporation of boiler economizers and a program of "energy audits" for system customers. Gas-Energy has also retained RDA as an independent on-site management team to improve business operations, customer relations and marketing to new customers.

David Wade, Walter Beck and Karen Herring are members of Resource Development Associates, Inc. Atlanta Office providing management services to the Equitable Gas-Energy Company of Pittsburgh.

