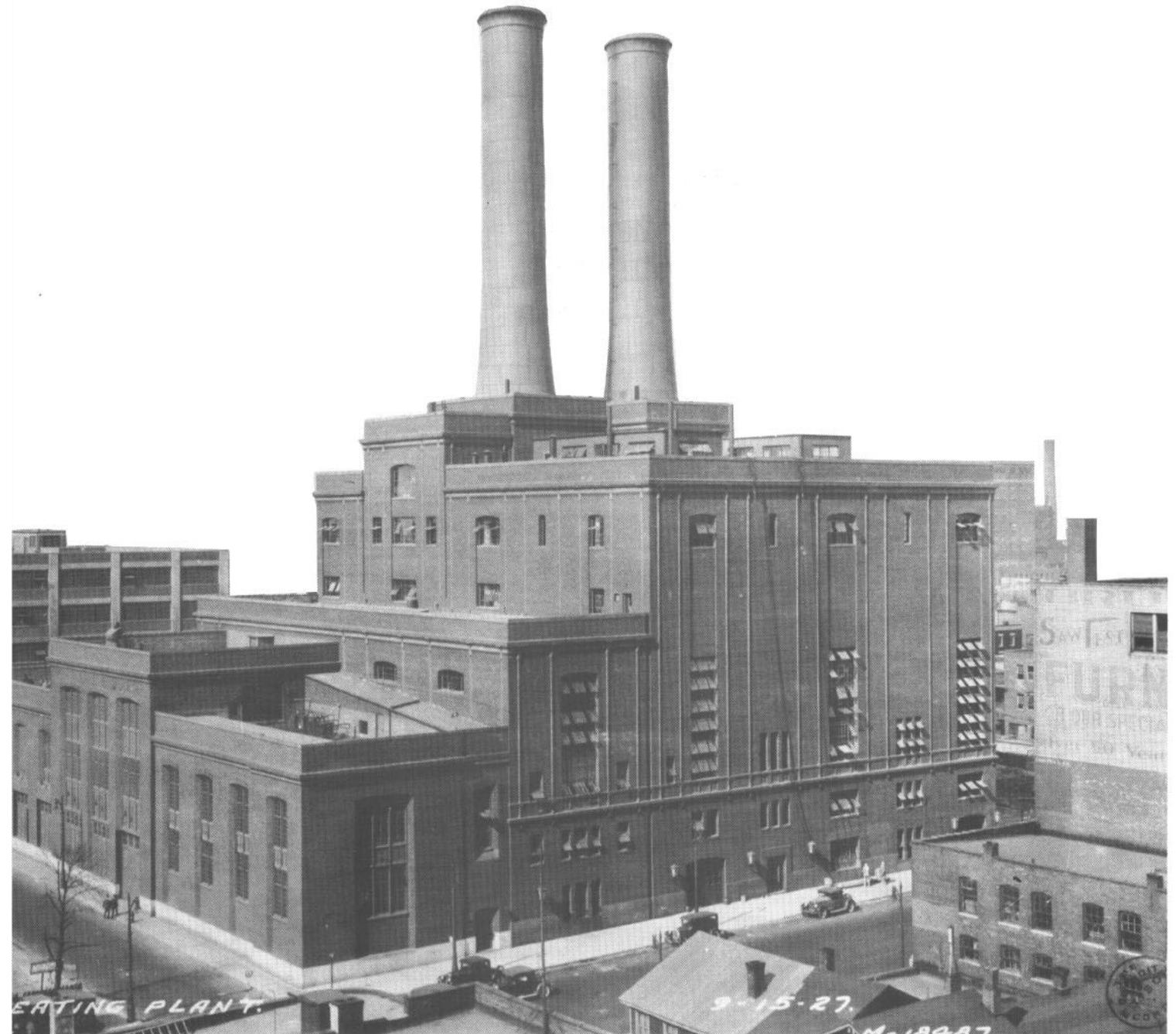


Detroit Edison's District
Heating System (1903)
Beacon Street Plant

National Historic
Mechanical Engineering
Landmark
May 22, 1985

The American Society of
Mechanical Engineers



Introduction

In an effort to cut energy costs and attract business back to downtown districts, many cities are now returning to an old method of energy distribution known as district heating and cooling. This method provides energy to customers in the form of steam, hot water or chilled water.

These products are produced from energy sources such as steam turbine exhaust from electrical generating plants, or from dedicated boilers, which can use refuse-derived fuels, as well as conventional fuels like coal, gas and oil. The products are generally distributed from one or more central plants through underground pipe to a relatively concentrated area of businesses and homes in the downtown district to satisfy their heating, cooling and process needs.

Historical Background

In 1877, Birdsill Holly at Lockport, New York, introduced district heating, showing how a single large steam plant could operate at higher overall thermal efficiency than a series of small isolated boilers, especially in the commercial districts of cities.

In 1903 officials of the newly formed Detroit Edison Company in Michigan, made the decision to establish the wholly-owned Edison Illuminating Company's Willis Avenue generating station as a district heating source. The exhaust from its steam engines would be used to heat buildings in the neighborhood, to improve thermal efficiency.

Originally, a separate corporation (named the Central Heating Company) was formed to own and operate the heating system, using exhaust steam purchased from the Detroit Edison Illuminating Company. Its franchise with

the city allowed it to install distribution mains in streets and alleys. When Central Heating Company began operation, it served 12 customers. Today, the system is greatly enlarged and operates under Detroit Edison's District Heating Management Organization.

Steam was chosen over hot water as the distribution medium for several reasons. Over time, these reasons have been validated and the method continues. For example:

1. A steam line is cheaper to install as it uses only a single pipe.
2. No circulating pumps are required.
3. Steam can be adapted to buildings piped for hot water.
4. Steam can be metered easily with a condensate meter.
5. Unlike hot water, steam will circulate to any elevation, thereby better serving tall buildings.

One of the turbine rooms at the Beacon Street Plant, 1927. After steam is used to turn the generator, it is exhausted from the turbine into the district heating system.



6. The customer can control his own heat supply with steam, while hot-water service must be regulated from a central station.
7. Equipping a building for steam is cheaper.
8. Cooking apparatus and water heaters can use steam, but not hot water.

Operations Expanded

With 3000 feet of mains and 12 customers, the company began operation on December 10, 1903. During the next year expansion began. That summer, 9,865 feet of mains were added, and the company began increasing its heating system by building the Farmer Street plant, which operated until 1926. It was replaced by an electrical substation and its capacity transferred to newer heating plants.

A plant was built at Park Place in 1912 which operated only until 1927, because nearby tall buildings extended above its

stacks. Its steam capacity also was transferred to other plants.

In June, 1914, Detroit Edison bought the Murphy Power Company which had been supplying steam heat in the southern part of the central business district.

Then, on July 1, 1915, all the plants and business of the Central Heating Company were bought by the Detroit Edison Company, and since then the steam heating business has been carried on directly by Detroit Edison. This combined the city's district heating system into a single administration.

Increasing steam demand led, in 1916, to the first reconstruction of the Willis Avenue Plant. The engine-driven generators were replaced by a separate converting substation. This district thereafter, was supplied with live steam from a boiler plant devoted exclusively to this purpose. (In 1927, Willis Avenue was linked to the larger Beacon Street plant which can pro-

vide Willis with an enlarged volume of steam when called upon.)

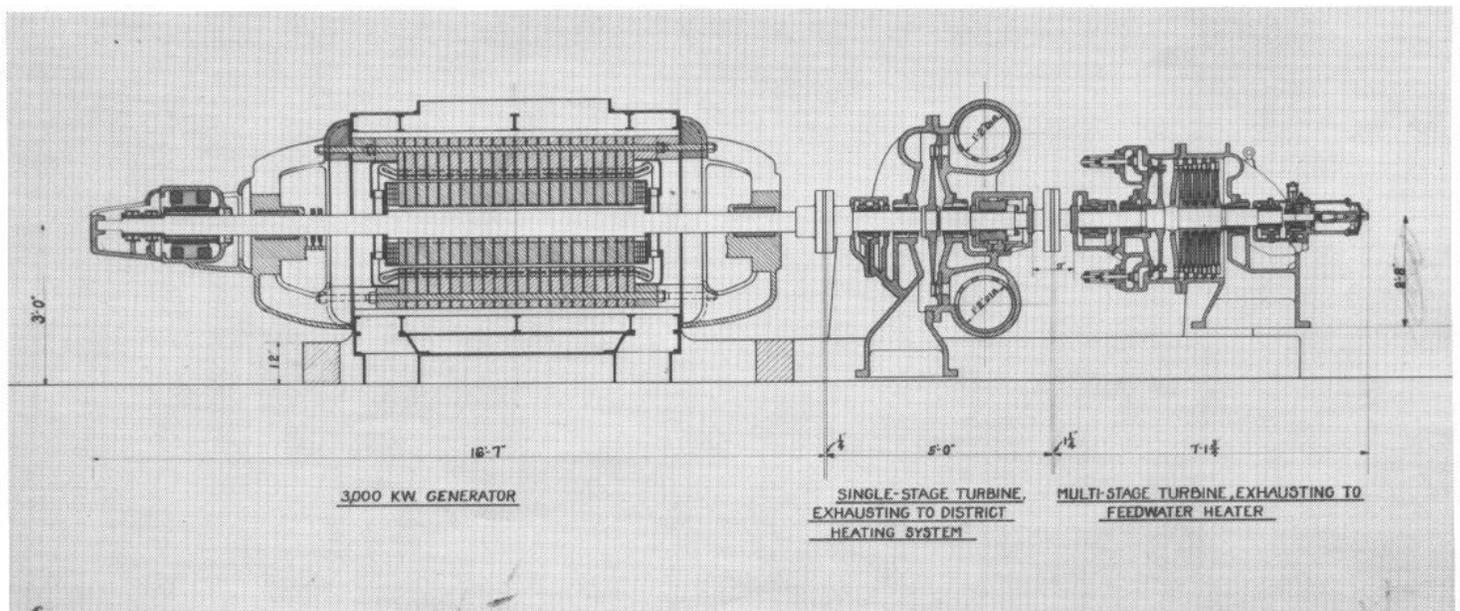
In 1917 the first boiler units were installed in a new plant at Congress Street and Cass Avenue. Other boilers were added and, in 1923, the final unit was installed. Its capacity was slightly greater than that of the Willis Avenue Plant.

Beacon Street Plant

Meanwhile, the downtown area demanded increasing steam heating capacity. In 1926 the Beacon Street Plant, the largest facility, was put into service with two boilers. A third boiler was added in 1927 and a fourth in 1929. The Beacon Street Plant was designed to handle large increases in the downtown steam requirements for some time to come.

Detroit Edison's next acquisition was the boiler plant supplying heat to the large General Motors Corporation headquarters building and the New Center district.

Cross section of the 3,000 kilowatt turbine generator at the Beacon Street Plant.



In 1948, the Willis Avenue Plant installed yet another boiler to assist in serving Wayne State University and the Grand Boulevard area.

As the Willis Avenue Plant expanded to its present seven boilers, equipment was added that included new water walls, an economizer, and a dust collector.

As equipment in the Congress Street Plant became obsolete, it was decided to plan for its retirement. An alternate steam source was needed, however, to maintain continued reliable service to its customers. To meet that objective, a new boiler and turbine generator were installed in 1959 at the Beacon Street Plant, along with a 24-inch main steam line running from the plant to the area served by the soon-to-be retired Congress Street Plant. The new boiler was of huge proportions and still is the largest in the central heating system. It produces up to 500,000 pounds of steam per hour flow at 900 pounds per

square inch and 700 degrees F. The steam was used to produce up to 19.5 megawatts of electricity through the new turbine generator before being exhausted into the steam mains for customer use. This type of "co-generation" results in high thermal efficiency.

In addition to serving the Congress Street Plant area, the increased steam capacity at Beacon Street also provided steam to customers in the north area during cold weather when the Willis and Boulevard plants were operating near full capacity.

Prior to 1972, all boilers in the Central Heating System were coal-fired, with underfed-type stokers. But with more stringent, state-mandated pollution-control standards being implemented, a decision was made to convert the Beacon Street boilers to natural gas as the primary fuel, and No. 2 fuel oil for back-up.

Conversion work began in 1972. It was

completed in 1975, and in the same year Willis' No. 5 boiler was converted from coal to No. 2 fuel oil, and a new No. 2 oil-fired package boiler, No. 7, was also installed. Both oil-fired boilers at Willis still are used primarily for emergency back-up.

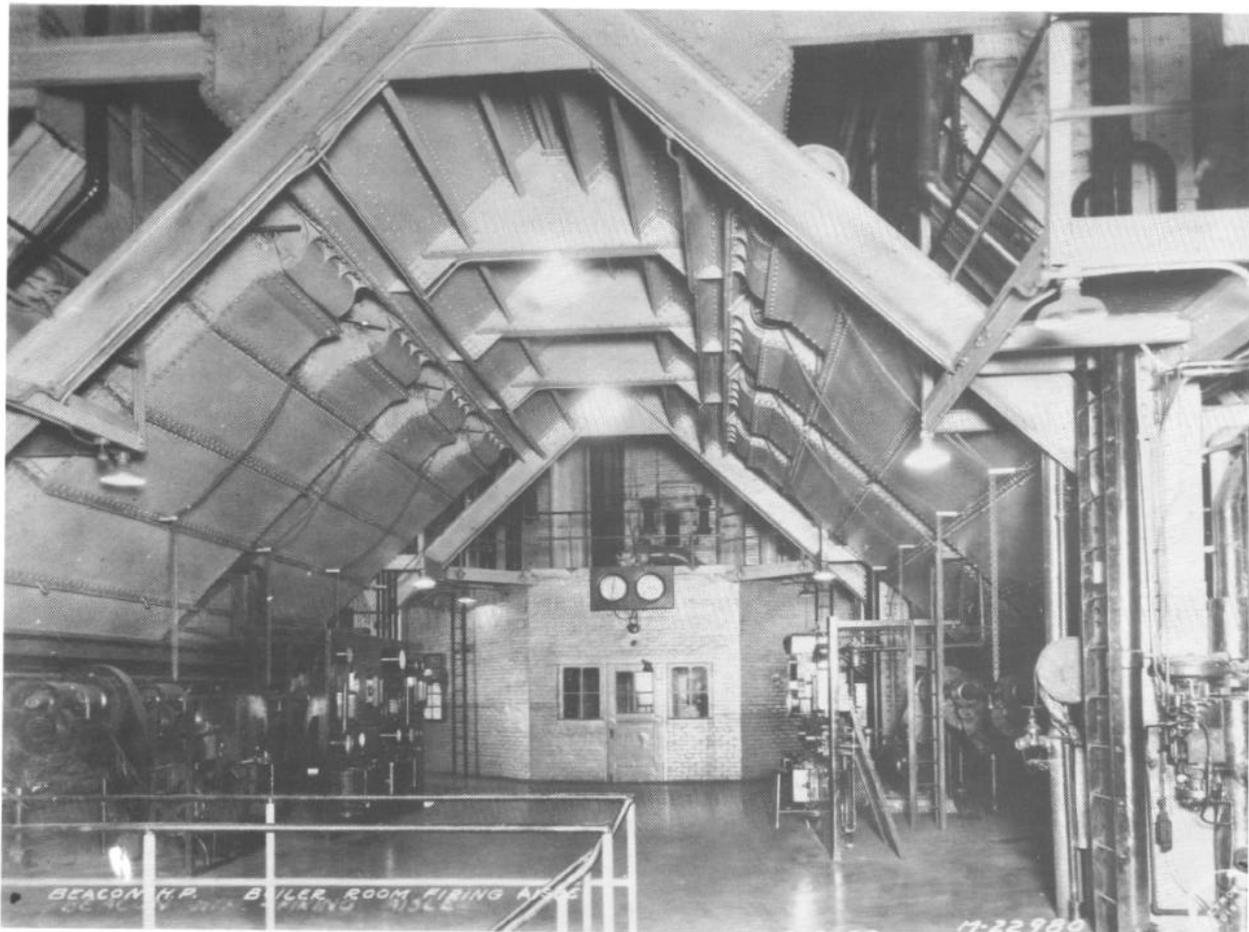
Current Operations

Three plants serve the central heating system: Beacon at the south end; Willis north of Beacon; and Boulevard at the extreme north end. Maximum boiler steaming capacities are: 2,400; 645; and 96 mlbs/hr (mlbs is equal to 1,000 lbs).

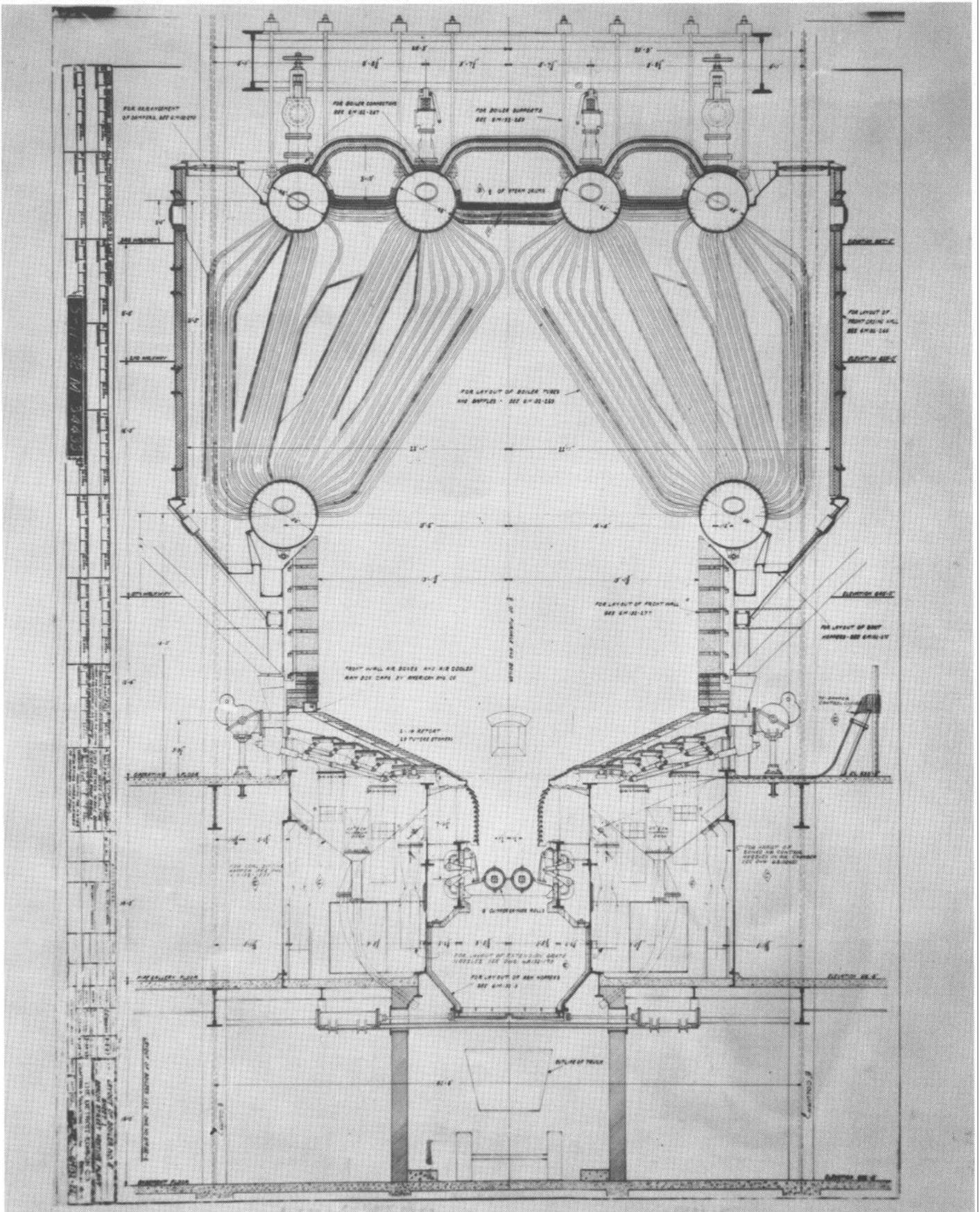
The plants supply steam to the distribution system through 53.6 miles of mains, carrying from 30 to 135 pounds per square inch pressure depending on customer requirements.

It is interesting to note that since less than five percent of the steam is returned to the plant in the form of condensate,

The operating floor or "boiler room firing aisle" of the Beacon Street Plant, 1929. The ceiling contains coal hoppers for boilers one and two. The stokers are at floor level.



Layout of boiler No. 5 at the Beacon Street Plant. The boiler stands nearly 40 feet tall from the center of the boiler drums at the top to the operating floor below.



approximately 240,000 gallons of water per hour are needed from the city water system for steam production.

The Southeastern Michigan Section of the American Society of Mechanical Engineers gratefully acknowledges the efforts of all who cooperated on the Landmark designation of the Detroit Edison District Heating System as a National Historic Mechanical Engineering Landmark, particularly the staff at the Detroit Edison Company.

The Detroit Edison District Heating System is the 77th National Historic Mechanical Engineering Landmark to be designated since the program began in 1973. Since then 18 International and 8 Regional Landmarks have also been recognized by the American Society of Mechanical Engineers. Each represents a progressive step in the evolution of mechanical engineering, and each reflects an influence on society.

The Landmarks program illuminates our technological heritage and serves to

encourage the preservation of the physical remains of historically important works. It provides an annotated roster for engineers, students, educators, historians, and travelers, and helps establish persistent reminders of where we have been, where we are, and where we are going along the divergent paths of discovery.

For further information contact the American Society of Mechanical Engineers, Public Information, 345 East 47th Street, New York, N.Y. 10017, 212-705-7740.

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