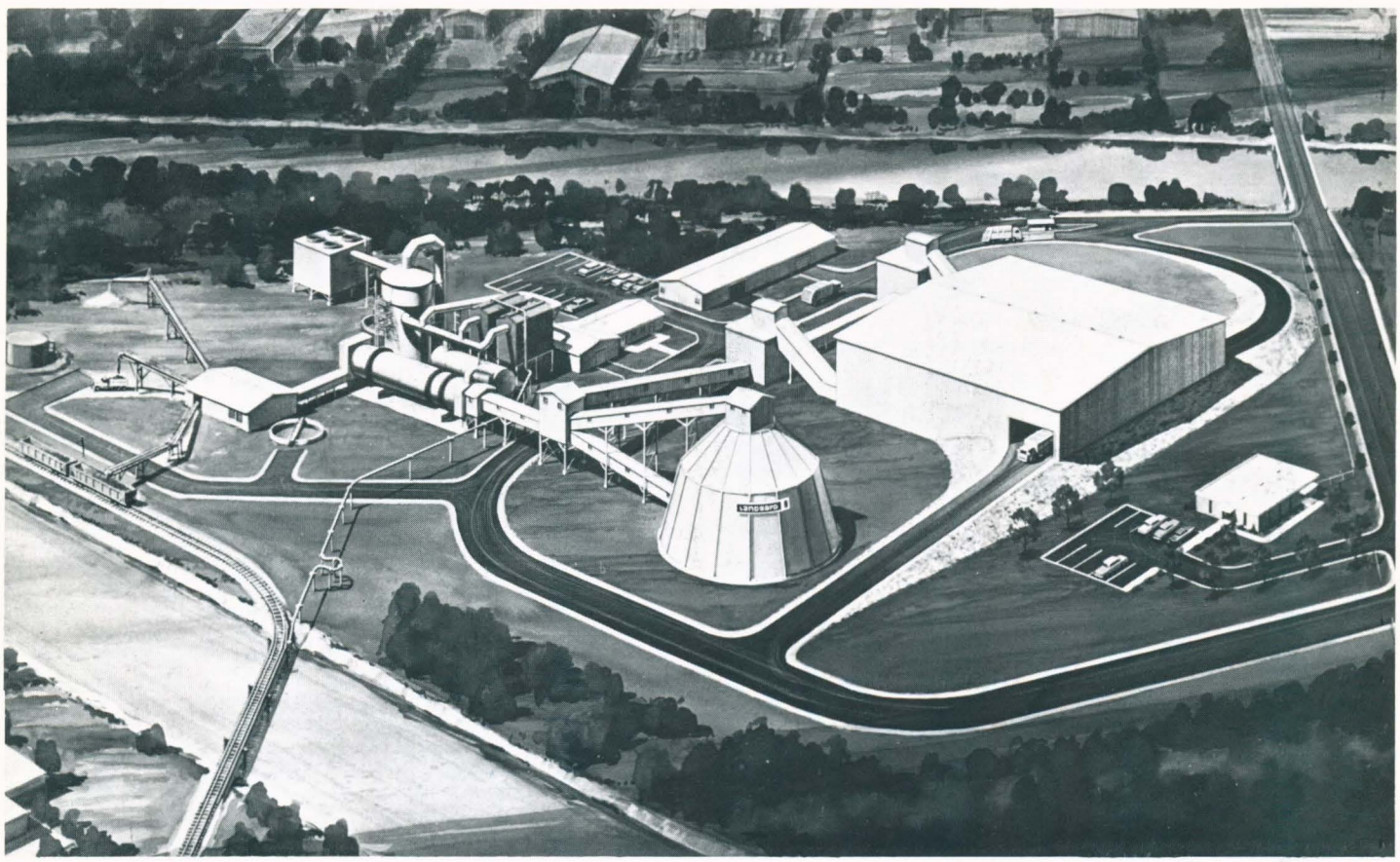
DISTRICT HEATING

JANUARY-FEBRUARY 1974



BALTIMORE'S RESOURCE RECOVERY CENTRE
The World's First Pyrolysis Solid Waste System

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The Story of Franklin Station Rochester, Minn.

by **William D. Latham**
Superintendent

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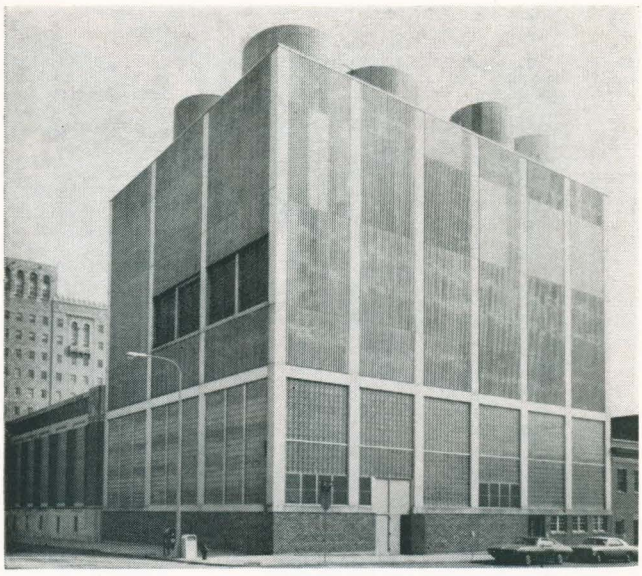

Fig. 1 — View of the Franklin Station. Taller portion in foreground is refrigeration section and cooling towers. Lower portion in background is electric generation area.

Franklin Station, a facility for centralized production of steam and electricity, owned jointly by Mayo and Kahler Corporation, was built in 1926. Prior to this time buildings owned by Mayo and Kahler each had their own heating plant, and power to meet electrical requirements was purchased from the City of Rochester, which had its own municipal power plant. During this period, there were no power ties between power companies as there are today.

The original Franklin Board, as now, consisted of two representatives from Mayo and two from Kahler. They recognized the desirability of owning a reliable source of power, and at the same time maintaining a tie with the city. This has proved a very successful arrangement over the years.

The original name was Franklin Heating Station because of the emphasis on heating. As pointed out later in this article, many other services were added, and hence the name was changed to its present form. The name recalls that in early Rochester, Second Avenue, on which Franklin Station is located, was named Franklin Street.

The original plant had three 35,000 lb per hr boilers at 250 psi. With these, there were two 1000 kw steam turbine generators. In addition to steam and electricity, Franklin Station provided cold water from two wells located in the plant, and hot soft water heated by heat from the condensers. The wells are still in operation today and provide much of the present water requirements.

New boilers, at the original pressure, were added to the system in 1932 and 1941. The original boilers were coal fired, but in 1931 Franklin became the first plant in Minnesota to use natural gas as its prime fuel.

The first major expansion occurred in the early 1950's, after World War II, when two 2500 kw turbine generators were installed which had a combined capacity of 160,000 lb per hr, with 400 psi boilers. At this time Franklin also entered the air conditioning field and installed three 1000 ton refrigeration machines. These machines supplied chilled water for the new Mayo Clinic building and an expansion of the Kahler Hotel.

In 1966, with announcement by both Mayo and Kahler of new building programs, Franklin again had to review its ability to adequately serve its customers. An expansion program was undertaken and completed in 1969. Obsolete boilers and generators were removed and replaced with new units with greatly increased capacity. In 1970, it was felt that the plant was in a position of possessing enough refrigeration machines, surplus steam and electricity generation capacity, for well into the foreseeable future.

But, in early 1972, Mayo Foundation announced plans for new construction in the block just west of Franklin Station: the 11-story Murry and Leonie Guggenheim Building for Research and Education in the Life Sciences, and the 10-story Conrad N. Hilton Building for Laboratory Medicine and Center for Research in Human Behavior. They are being constructed at a cost of more than $20 million. The two linked structures, scheduled for completion in the summer of 1974, will add nearly one-half million sq ft of space to the 2.5 million sq ft in the 10-building complex now heated and cooled by Franklin Station.

This called for additional expansion which is now underway, and at year-end will add about 50 per cent to Franklin's capacity to serve the air condition-

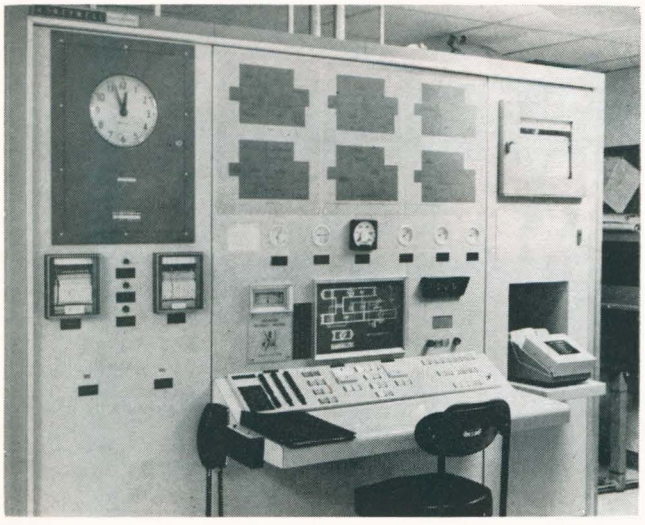

Fig. 2 — Mechanical equipment monitoring panel in Rochester Methodist Hospital which monitors all air handling equipment (heating, air conditioning, ventilation); provides start-stop of equipment; monitors vacuum pumps, compressed air, and reheat of the interior system. Should a problem occur, the operator can ring up the schematic of the equipment being monitored, and provide all pertinent information, and it will provide an automatic printout of the fault.

ing requirements of the expanded facilities of the medical and hotel owned complex.

In addition to Mayo expansion, Kahler is remodeling parts of the Kahler Hotel (the largest transient hotel in Minnesota), and increasing requirements for air conditioning in its Zumbro Hotel.

Franklin also provides to Rochester Methodist Hospital: heating and cooling, plus high-pressure steam for sterilization and process work; compressed air; some cold water; hot softened water; and presently a stand-by source of power for emergencies for the hospital. This hospital which at present has 640 beds and 30 operating rooms, is adding four floors to its building.

Presently, the plant has one 6375 kw turbine generator at 850 psi and 900 F, and two 2500 kw turbine generators at 400 psi. In addition, there is a tie with the city on the 13.8 kv bus with capacity of 8000 kw. Electricity is distributed at both 2400 and 13,800 volts.

The steam capability is 400,000 lb per hr with two 120,000 lb per hr boilers at 850 psi; and two 80,000 lb per hr boilers at 400 psi. In normal operation, this steam is delivered to the high-pressure turbine at 850 psi; and with the turbine on back pressure control, delivers up to the full capacity of the 240,000 lb of 400 psi steam when conditions permit. Some of this steam then goes to the 400 lb header and then to the two 2500 kw machines or the 3000 ton refrigeration machine. About 70,000 lb are extracted on the low-pressure end of the turbine at 10 lb. Normally, it will be extracted from the two 2500 kw machines at 10 lb.

The refrigeration section totals 7300 tons, producing chilled water at 40 F, with capacity of about 14,000 gpm circulating to the various buildings. To meet the expansion of the two new buildings, we have on order a new 3500 ton refrigeration machine, an addition to the cooling tower located on top of the

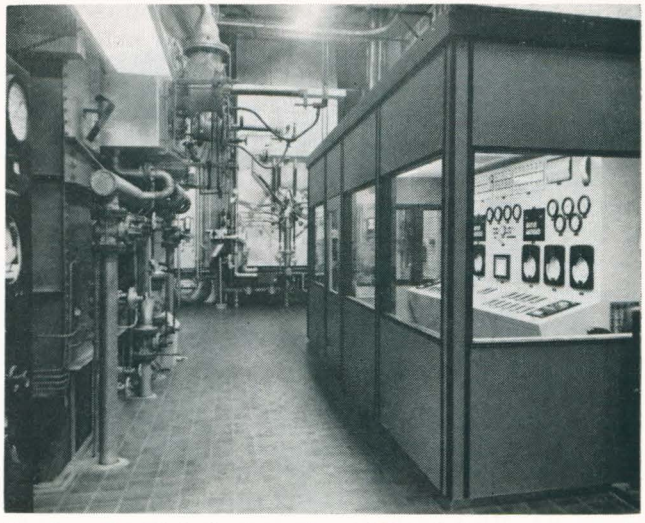

Fig. 3 — On left is the front of one 400 lb boiler. In center is the front of an 850 lb boiler showing dual fuel firing equipment. To the right is the fireman's control room with controls for the two higher pressure boilers.

plant; and we have just installed another air compressor with a capacity of about 700 cfm.

The entire distribution system is paralleled to prevent any extended outages. There are high-pressure steam lines to most buildings, with PRV's to allow for equipment failure or maintenance. The chilled water lines are looped, for the most part, to provide continuity of service. All utilities are underground, mostly in service tunnels. The entire complex is provided with pedestrian subways, so that no one need be exposed to the outside weather conditions.

The Mayo Complex automation system control center is located in the facilities engineering office area of the Mayo Building. The heart of the 5000 point system is the console which is equipped with automatic scanning of alarms, as well as on-off status of all remote systems; and a push button feature to enable us to initiate an alarm summary scan, run

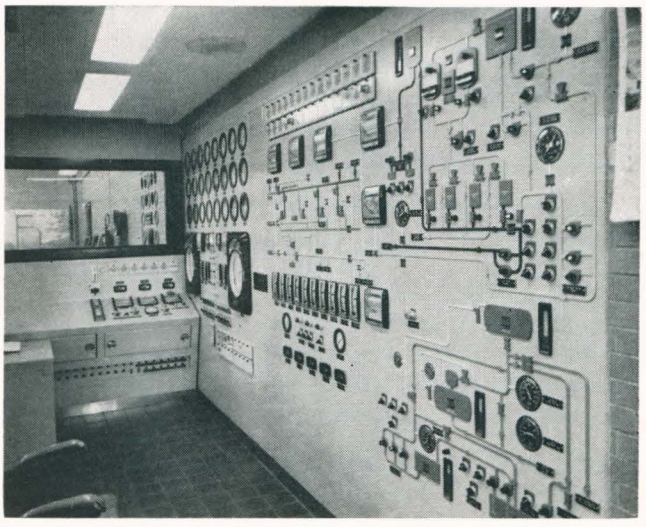

Fig. 4 — Console at far end of room (facing camera) and left side of main panel, control the three turbine generators. Center part of panel controls steam from the 850-400 lb, 400-125 lb, and 400-10 or 30 lb generators which are the main export steam pressures for heating. Air compressor controls are in lower center. On upper right are the water system controls; and on lower right, the condensate controls.

status, summary, a return to normal summary, and temperature indications. There is also a manual access to memory feature made especially for the system to allow easily changed start-stop programming and alarm limit ranges.

Our control center has proven to be most valuable, and especially so during the energy crisis, because of its easy access to program changing. Without it, we would be involved in many hours a month of overtime help.

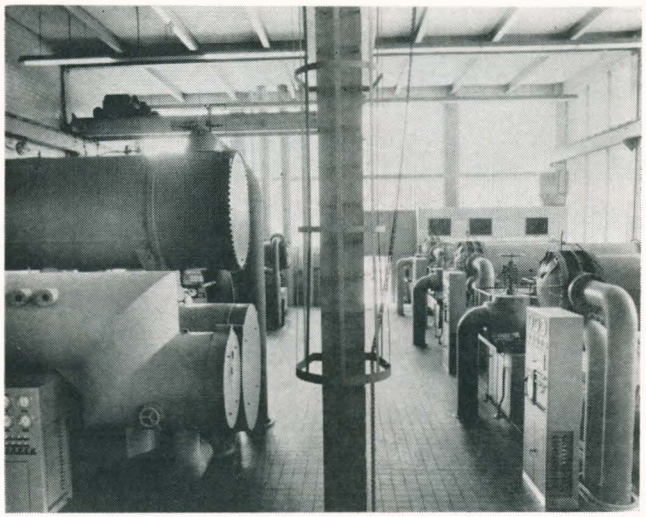

Fig. 5 — On the right are three 1000 ton refrigeration machines, and one in the rear. In foreground at left is a 3000 ton unit and a partial view of its control panel. A sixth steam turbine-driven centrifugal water chiller has been installed to supplement these five Carrier machines, increasing the plant's cooling capacity from 7300 to 10,800 tons.

Franklin Station has always been concerned about air pollution. All boilers are dual-fired natural gas or oil. Franklin has a commitment for natural gas to be supplied on a firm basis of 1.5 million cu ft per day. Gas needed in excess of this amount is furnished on an interruptible basis. When directed, oil is used to carry a portion of the load. With this arrangement of burning both fuels, the regulations of the State Pollution Control Agency covering sulfur dioxide and particulate matter are easily met. A supply of low sulfur oil is maintained should the Air Quality Index indicate any problems. Normally, oil is burned in conjunction with gas, when dual-firing.

The customers undertook a very extensive conservation program during the fourth quarter of 1973. This included such measures as reducing building temperature and excessive ventilation, removing unnecessary lighting, and reducing levels of lighting. At the time of this writing, no exact measure of the conservation can be stated but best estimates would indicate it to be in excess of the President's requests.

You may wonder about the economics and the justification for this utility operation. Through the years, the owners have experienced reasonable rates, excellent continuity of service, and have had complete control of the operations. The central utility is much more efficient than to duplicate boilers, refrigeration machines, cooling towers, etc. for each building, plus realizing some diversity in loads. It is obvious, on the other hand, that the Franklin is not as efficient as a large generating plant. However, with this operation, only about seven per cent of the total investment is tied up in distribution, whereas the large utility may have a major share of its investment in transmission and distribution costs. The initial investment per unit of installed capacity is greater, but the end result is competitive because of lesser costs for distribution and the efficient use of the steam for electric generation, turbine drive for refrigeration compressors, exhaust steam for heating, and condenser heat for heating water.

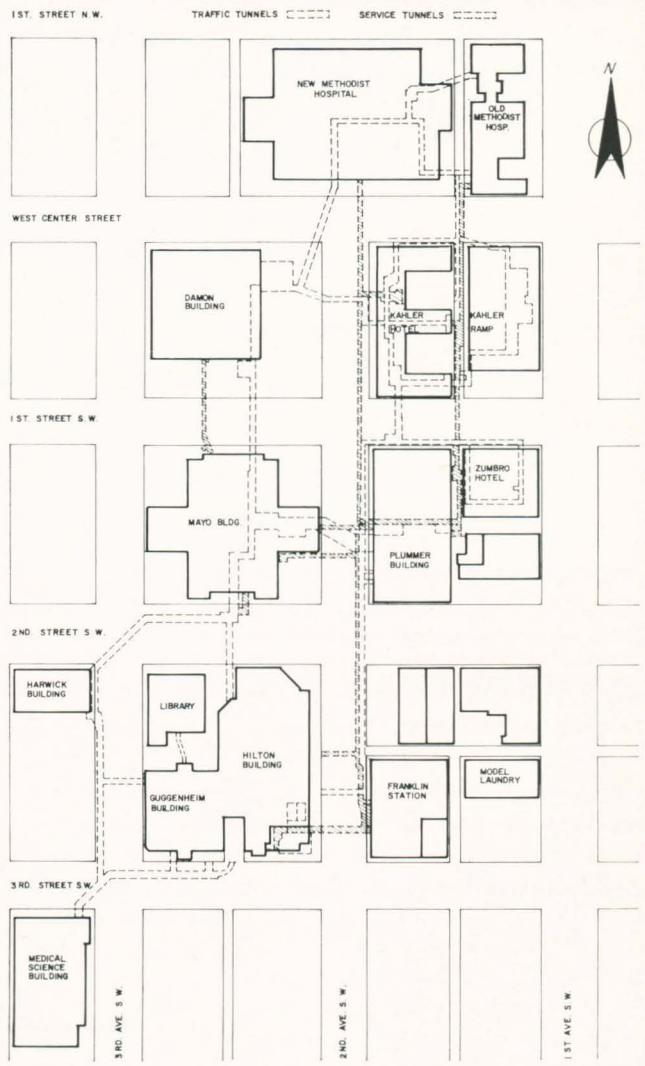

Fig. 6 — Mayo Clinic tunnels. Pedestrian tunnels provide patients with sheltered access to all buildings. Separate tunnels are used for utilities. (Schematic courtesy of ELLERBE Architects and Engineers)

The three customers (two of them the co-owners) Mayo, Kahler and Rochester Methodist Hospital, purchase some or all of their requirements from the Franklin Station, according to their needs, and pay for them at the same rate.

Overall, the Franklin Station is an efficient plant that makes the best possible utilization of fuel. It is proof of the good judgment of those who, in 1926, conceived the plan to pioneer the development in this region of a central power station. Δ