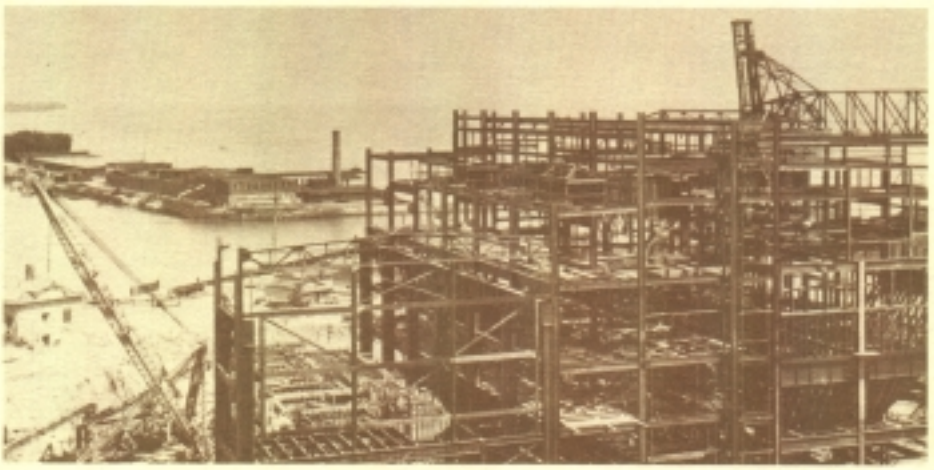
Port Washington Power Plant: A National Historic Mechanical Engineering Landmark

In the beginning . . .



Construction of the first unit at Port Washington Power Plant began in 1930 and lasted until 1935, creating work for hundreds of persons during the Great Depression.

The year was 1929. The Milwaukee Electric Railway and Light Company (TMER&L) was operating the Commerce, Oneida Street (East Wells) and Lakeside power plants, in addition to several other small power plants in the Milwaukee area.

East Wells was the site of the first successful experiments of burning pulverized coal to produce electricity. The East Wells innovations were incorporated into the Lakeside Power Plant, located in St. Francis, Wis. Lakeside was the world's first plant built to burn pulverized coal exclusively, and the first to incorporate radiant superheating into its furnaces.

The demand for electricity on the company's system was increasing, as was the number of customers. Studies were begun to determine what type of power plant would be needed to meet those increasing demands.

With a load growth rate of approximately 40,000 kilowatts per year, the company decided to build several 80,000-kilowatt coal-fired units.

The decision of where to build the units still needed to be made. The major portion of the generating capacity for the Milwaukee area was concentrated at Lakeside, located south of Milwaukee. It was decided that a new plant should be built at a point north of Milwaukee. This would permit feeding energy into the Milwaukee area from another source.

The most logical site was at Port Washington, a city with harbor facilities for lake boats bearing coal and other supplies. Port Washington also had good railroad connections and an ample supply of cold condensing water (Lake Michigan) and it was located about the same distance as Lakeside from the company's main bulk substation on Milwaukee's northwest side.

The stage was set for the construction of the newest jewel among TMER&L's pioneering power plants.

Innovator, pioneer, pacesetter . . .

Charles S. McNeer
President/Chief Executive Officer
Wisconsin Electric Power Company

Innovator, pioneer, pacesetter. All of these characterize Wisconsin Electric and the engineering accomplishments its employes have brought about during the company's long history.

From the early years of The Milwaukee Electric Railway and Light Co. to the present, Wisconsin Electric has encouraged employe creativity in finding better ways to provide customers with reliable electric service at a reasonable cost.

Wisconsin Electric takes pride in Port Washington Power Plant and its past and present employes as the plant joins two other company facilities as national historic mechanical engineering landmarks.

The construction and operation of Vulcan Street Power Plant in Appleton, Wis., in 1882 marked the first Edison hydroelectric central station to operate in North America. That plant received landmark status from the American Society of Mechanical Engineers (ASME), American Society of Civil Engineers and the Institute of Electrical and Electronics Engineers in 1977.

East Wells Power Plant in downtown Milwaukee was the site of the first time pulverized coal was burned successfully in furnaces of stationary steam boilers. East Wells received landmark status from ASME earlier this year.

Port Washington was the world's most efficient power plant between 1935 and 1948, and is further evidence of the company's innovative approach to problem solving. Today, we're still finding solutions. In an era when electricity is more valuable than ever before, we're developing new ways to use it more efficiently.

Our mission today, as in the past, is to provide customers with an adequate supply of reasonably priced energy. That will require new approaches, open minds, creativity and determination. It will require continued application of the sound business and engineering practices which have served our company well.

In the past 100 years, the electric utility industry has built an impressive record of achievements. The people who built Wisconsin Electric—from our founders to those who operate our company today—always have risen to the challenge, and have developed a tradition of finding new and better ways to supply our customers' energy needs.

It is not a tradition we take lightly.

Earth-moving equipment scooped 275,000 cubic yards of dirt out of a bluff on the Lake Michigan shoreline to make room for the plant. The dirt was used to form the fill for the plant's 1,000-foot-long coal dock.

The best of times, the worst of times . . .

The construction of Port Washington Power Plant came at the best and worst of times for TMER&L.

The company knew it had the expertise to build the plant. It had a team of steam and electrical engineers whose skill and expertise in power plant design was unexcelled. Only John Anderson was missing from the original team that pioneered in the use of pulverized fuel at East Wells and Lakeside.

But the year 1929 also brought the Great Depression. The New York Stock Exchange had just experienced its earth-shattering crash. Millions of people across the country either lost, or would lose, their jobs. Money was tight.

The demand for electricity on TMER&L's system began to slow down. But the company proceeded with plans to build the plant, confident that a return of more nearly normal conditions would justify its need.

As the late S. B. Way, then president of TMER&L, remarked: "While our business is subject to serious reverses during hard times, the general trend is toward greater use of electricity, and it is necessary to plan well in advance so that extension of facilities can proceed in an orderly and sound manner."

The company saw the situation also as a means of helping the people it served. Continuing work through the Depression years would "provide employment for hundreds on the job itself . . . and probably several thousand others in the mills and shops that fabricate the building materials, boiler, generator and other equipment," Way said.

Groundbreaking ceremonies for the plant project were held May 26, 1930, as Port Washington Mayor August F. Kruke manned the steam shovel.

Construction begins . . .

Construction began on Port Washington Power Plant on May 26, 1930.

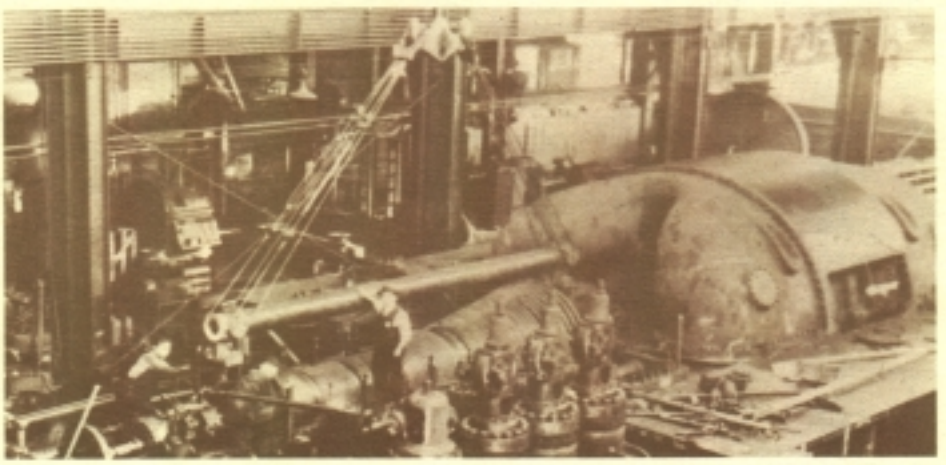
Equipment manufactured in Milwaukee, Port Washington and the surrounding communities was used wherever possible to keep the money in the company's service area.

The design of the plant was based on the design and operating experiences at Lakeside. Lakeside already had built a world-wide reputation, and had pioneered more significant and important developments than any other power plant.

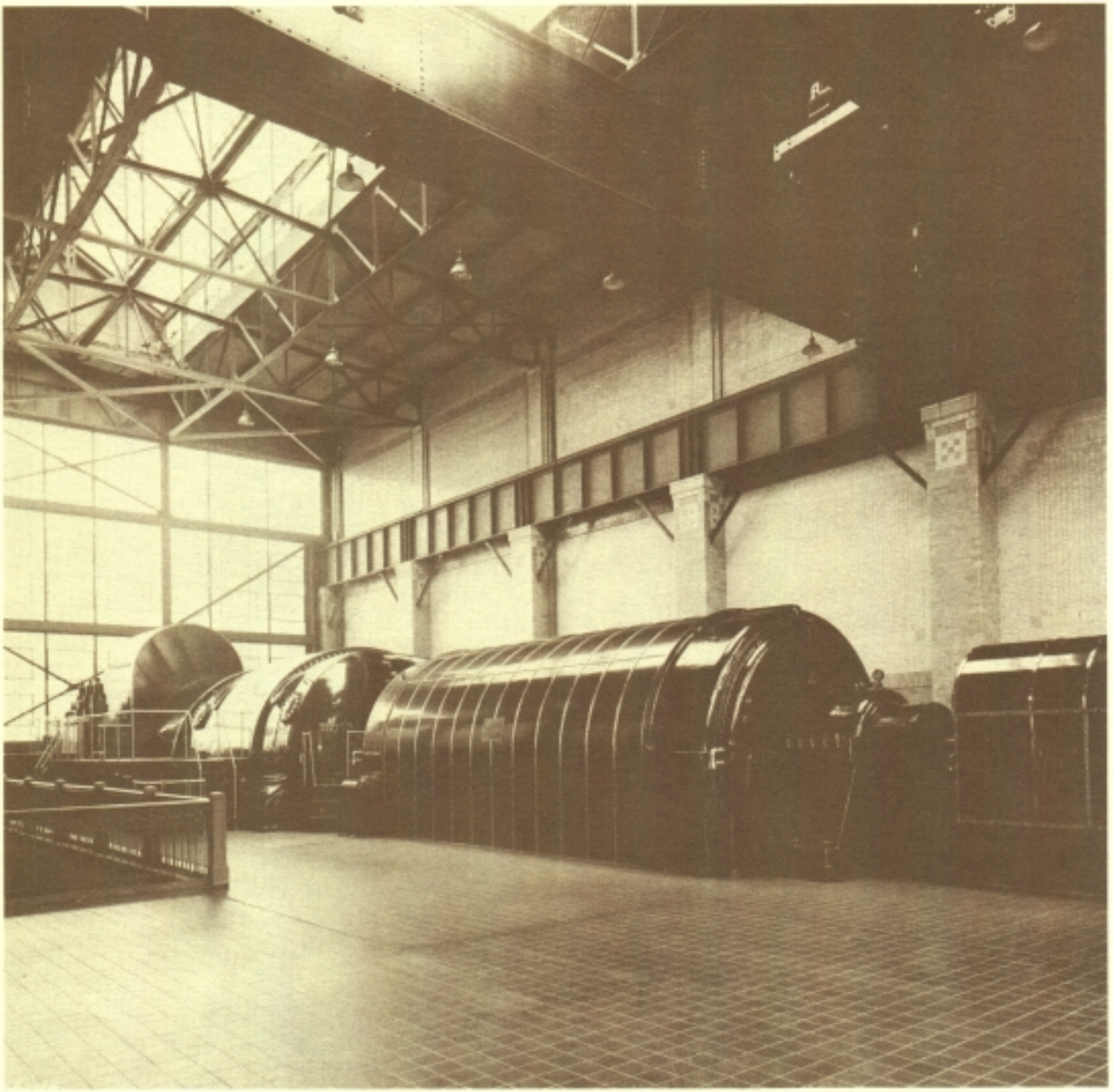
Some of the more notable achievements incorporated into the Port Washington plant design included the burning of pulverized coal, the successful use of 1,200-pound-pressure steam and the introduction of radiant superheating surfaces into the furnace.

While Lakeside was noted for pioneering achievements, there still were many improvements to be made on those achievements in the Port Washington design. One of the most important was the design of the unit itself. There was only one boiler for the single turbine-generator. There was one set of transformers, one 132,000-volt transmission line and one set of auxiliaries. The plant designers determined that simplification of the plant's design would simplify its operation.

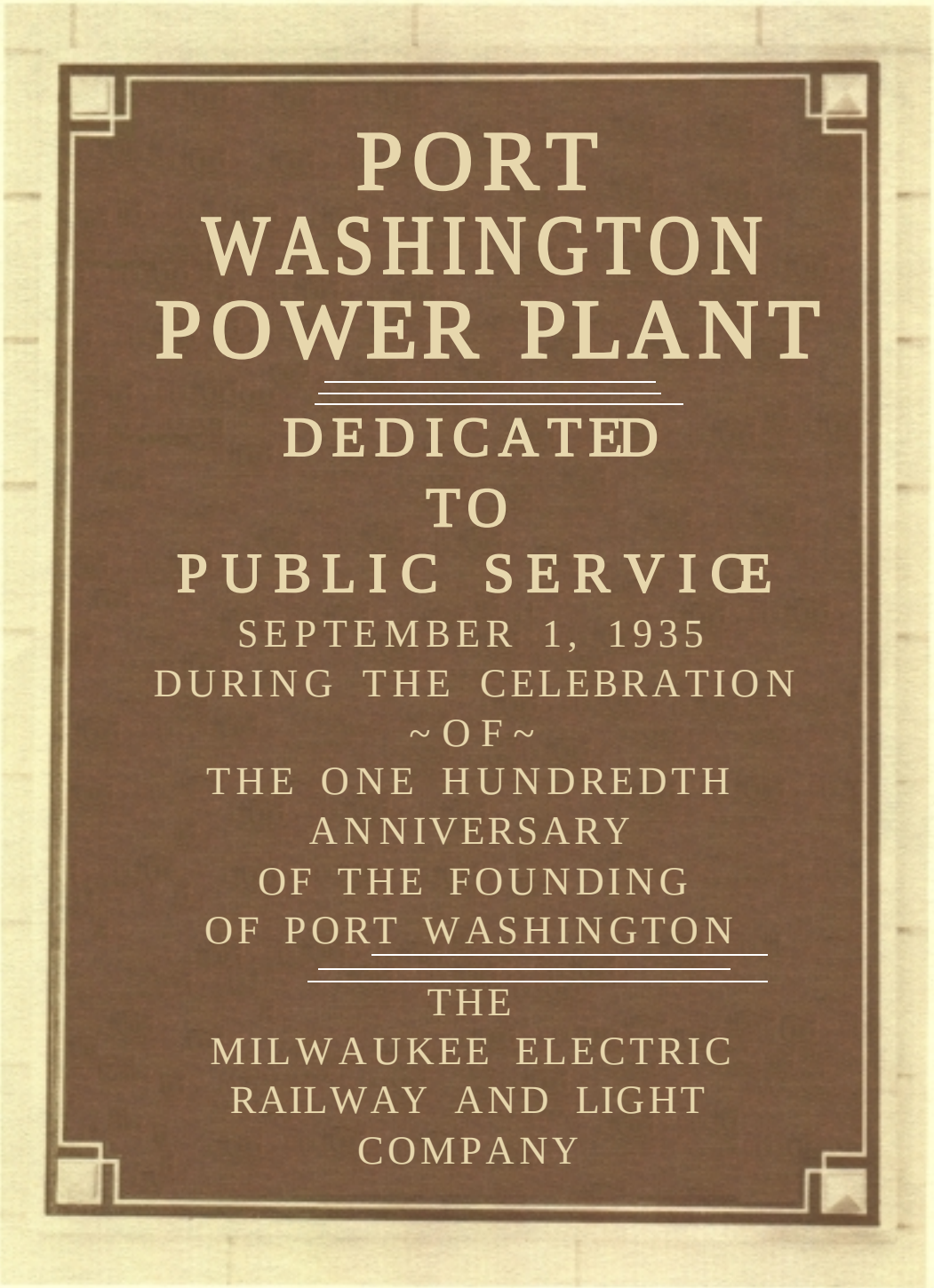
Higher steam temperatures were planned. Temperatures of 825 degrees Fahrenheit at the throttle, and at the reheat point, were designed to conserve fuel by being able to generate a given electrical output with fewer heat units. Generation of electricity at 22,000 volts also was planned as a move to reduce the amount of copper required for cable, switches and the bus structure.



Workers assemble the plant's 80,000-kilowatt Allis-Chalmers turbine-generator, one of the major pieces of equipment purchased through area companies as part of Wisconsin Electric's effort to keep Depression-time money within the service area.



The completed turbine at port washington.



The dedication of Port Washington Power Plant coincided with the 100th anniversary of the founding of the city in which it is located.

The biggest boiler ever . . .

Construction began in 1931 on what then was the largest high-pressure boiler ever built—a Combustion Engineering unit with a capacity of 690,000 pounds of steam an hour and a design pressure of 1,390 pounds a square inch.

The furnace was 55 feet wide, with a volume of 57,000 cubic feet. It was shielded by a water screen, another TMER&L innovation developed at East Wells.

The boiler had three drums—two steam drums at the top and one mud drum below—all interconnected with boiler tubes bent to give a design which provided the best circulation of water within the tubes. Such circulation was necessary to transmit heat away from the metal of the tubes quickly, and made for the most efficient use of the fuel burned in the furnace.

In the turbine room was an 80,000-kilowatt tandem-compound Allis-Chalmers turbine, operating at 1,800 rpm. The generator was air-cooled, and operated at 22,000 volts. Transformers boosted that voltage to 138,000 volts.

It took more than five years and about $7.5 million to build Port Washington. The building of such a plant normally would not require such a long time, but the years following 1929 were not normal years. Despite depressed business conditions and troubled time, however, the company persistently pursued the project.

The plant finally was ready to begin operation in the fall of 1935, and generated electricity for the first time on Oct. 14 of that year. The completion of the plant coincided with the city of Port Washington's centennial.

Assembly of one of the plant's boiler drums being fitted with boiler tubes

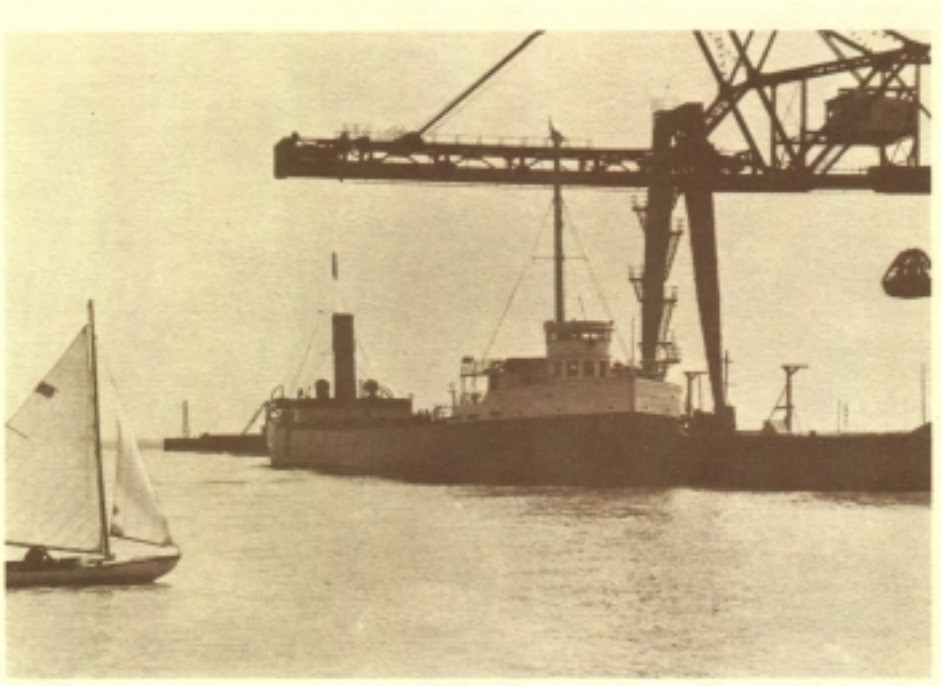
Something special . . .

Plant operating employes had the normal challenges associated with operating a new plant. Since new designs also were incorporated, employes had to verify the designs to determine whether the plant would perform as expected.

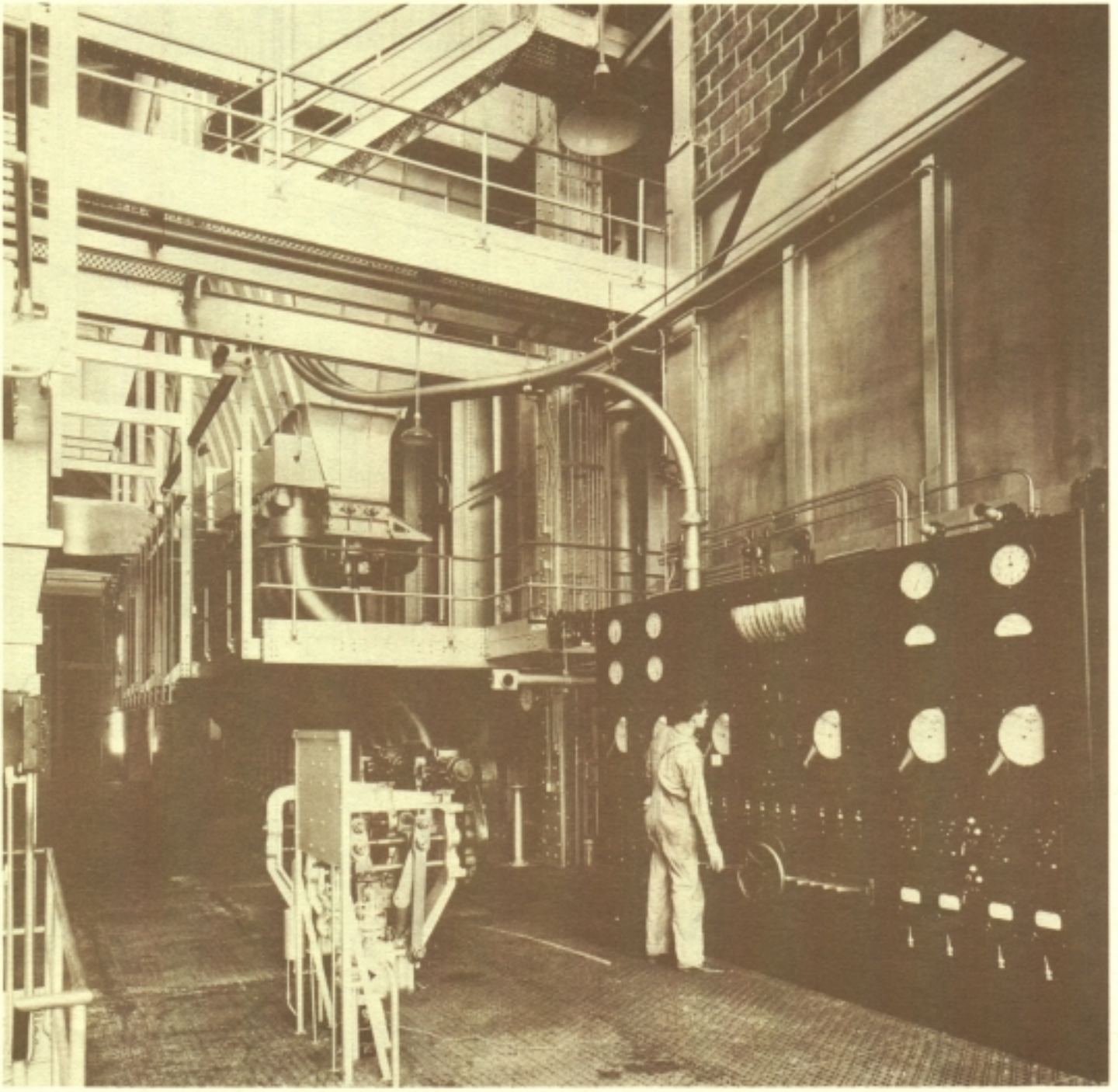
Compound-turbine operation with reheat never before had been attempted at any TMER&L plant. It was then decided to give employes practice in starting up, and bringing down, the unit several times before regular operation was attempted.

The initial shakedown demonstrated that some changes in the reheater surface were needed. Other adjustments and minor changes also were required. Once they were completed, the plant was returned to service. It didn't take long for the company—and the world—to learn that the Port Washington Power Plant was something special.

Performance records after only a few months of continuous operation showed that the plant was turning out kilowatt-hours at a higher efficiency than any other power plant in the world—even better than the company's own Lakeside plant.



First delivery of coal to Port Washington—Aug. 1, 1932.



A boiler control operator at Port Washington in 1936, monitoring what was at the time the largest high-pressure boiler ever built.

Port Washington's first superintendent, Harry Shaver, takes to the controls for the start-up of the plant's fourth unit Aug. 25, 1949. Looking on are W.A. Yost and C. F. John of Wisconsin Electric.

They planned it that way . . .

After five years of service, Port Washington continued to show a steady decrease in annual net plant heat consumption per kilowatt-hour generated. The plant was in operation 87.8 percent of the time and was available for generation over 89 percent of the time. This kind of reliability for such a high-technology plant was remarkable and demonstrated to the power industry that such technology would not affect reliability adversely.

The plant continued to pile up an impressive record, from the time it went into operation in 1935 until 1948—when newer power plants adopting the Port Washington and newer innovations finally surpassed it in overall operation.

In those first 14 years of operation, the plant consumed 10,800 BTUs for every kilowatt-hour it produced. This was during a period of time when the national average for electric power plant efficiency was well over 18,000 BTUs per kilowatt-hour.

New 80,000-kilowatt units were added to the plant in 1943, 1948, 1949 and 1950, bringing its total generating capacity to the present 400,000 kilowatts. The accelerated system load growth is measured approximately by the decreasing spacing of installation dates of the five units.

Why did Port Washington Plant produce such excellent results? G. G. Post, then TMER&L's vice president in charge of power, put it this way: "They planned it that way."

The "Pebble" House, built in 1848 of stone gathered along the Lake Michigan shoreline, and itself a Port Washington landmark. It still stands at the entrance to the Plant.

The National Historic Mechanical Engineering Landmark Program

The American Society of Mechanical Engineers (ASME) reactivated its history and heritage program in September 1971 with the formation of the National History and Heritage Committee. The committee's overall objective is to promote a general awareness of our technological heritage among both engineers and the general public.

One of the committee's responsibilities is to gather data on all works and artifacts with a mechanical engineering connection that are historically significant to the profession. It's an ambitious goal, and one achieved largely through the volunteer efforts of the section and division history and heritage committees and interested ASME members.

Two major programs are carried out by the sections, under the direction of the national committee. One is a listing of industrial operations and related mechanical engineering artifacts in local historic engineering records, and the other is the national historic mechanical engineering landmark program. The former is a record of detailed studies of sites in each local area, while the latter is a demarcation of local sites which are of national significance—people or events which have contributed to the general development of civilization.

ASME also cooperates with the Smithsonian Institution in a joint project to contribute historic material to the National Museum of History and Technology in Washington, D.C. The Smithsonian's permanent exhibition of mechanical engineering memorabilia is directed by a curator, who also serves as an ex-officio member of ASME's national history and heritage committee.

Other historic landmarks

Port Washington Power Plant is the 48th landmark to be designated since the program began in 1973. The others are:

Watkins Woolen Mill, Wawson, Mo.

First All-Welded Steam Drum, Chattanooga, Tenn.

Georgetown Steam Plant, Seattle, Wash.

Equitable Building Heat Pump System, Portland, Ore.

Shippingport Atomic Power Station, Pittsburgh, Pa.

Jumbo Nine Engine-Driven Dynamo, Greenfield Village, Dearborn, Mich.

Triple Expansion Engine-Driven Dynamo, Greenfield Village, Dearborn, Mich.

East Wells (Oneida Street) Power Plant, Milwaukee, Wis.

Ferries and Cliff House Cable Railway Power House, San Francisco, Calif.

Leavitt Pumping Engine, Chestnut Hill Pumping Station, Brookline, Mass.

A.B. Wood Low-Head High-Volume Screw Pump, New Orleans, La.

Portsmouth-Kittery Naval Shipbuilding Activity, Portsmouth, N.H.

102-Inch Boyden Hydraulic Turbines, Cohoes, N.Y.

5000 KW Vertical Curtis Steam Turbine-Generator, Schenectady, N.Y.

Saugus Iron Works, Saugus, Mass.

Pioneer Oil Refinery, Newhall, Calif.

Chesapeake & Delaware Canal, Scoop Wheel and Engines, Chesapeake City, Md.

U.S.S. Texas, Reciprocating Steam Engines, Houston, Texas

Childs-Irving Hydro Plant, Irving, Ariz.

Hanford B-Nuclear Reactor, Hanford, Wash.

First Air Conditioning, Magma Copper Mine, Superior, Ariz.

Manitou and Pike's Peak Cog Railway, Colorado Springs, Colo.

Edgar Steam-Electric Station, Weymouth, Mass.

Mt. Washington Cog Railway, Mt. Washington, N.H.

Folsom Power House #1, Folsom, Calif.

Crawler Transporters of Launch Complex 39, J.F.K. Space Center, Fla.

Fairmont Water Works, Philadelphia, Pa.

U.S.S. Olympia, Vertical Reciprocating Steam Engines, Philadelphia, Pa.

5-Ton "Pit-Cast" Jib Crane, Birmingham, Ala.

State Line Generating Unit #1, Hammond, Ind.

Pratt Institute Power Generating Plant, Brooklyn, N.Y.

Monongahela Incline, Pittsburgh, Pa.

Duquesne Incline, Pittsburgh, Pa.

Great Falls Raceway and Power System, Paterson, N.J.

Vulcan Street Power Plant, Appleton, Wis.

Wilkinson Mill, Pawtucket, R.I.

New York City Subway System, New York, N.Y.

Baltimore & Ohio Railroad, Baltimore, Md.

Ringwood Manor Iron Complex, Ringwood, N.J.

Joshua Hendy Iron Works, Sunnyvale, Calif.

Hacienda La Esperanza Sugar Mill Stream Engine, Manati, Puerto Rico

RL-10 Liquid-Hydrogen Rocket Engine, West Palm Beach, Fla.

A.O. Smith Automated Chassis Frame Factory, Milwaukee, Wis.

Reaction-Type Hydraulic Turbine, Morris Canal, Stewartsville, N.J.

Experimental Breeder Reactor (EBR-1), Idaho Falls, Idaho

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Credits
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