tric power requirements revealed the interesting possibility of generating the electric power needed along with steam for process. A tabulation of process steam and electric power requirements for normal plant operation was made.

Department	20-lb. Pressure Process Steam lbs.	kw.-hrs.
"A"	30,000	140,000
"B"	13,000,000	30,000
"C"	750,000	85,000
"D"	3,500,000	80,000
Heat	300,000	
Special Depts.	200,000	150,000
Lights		25,000
Power Plant	200,000	25,000
Total	17,980,000	535,000

Fig. 1—*Tabulation of process steam and electric power requirements for normal operation. Requirements of new processes estimated.*

Fig. 1 shows a normal operating month with estimated increased usage for the proposed installation. The graph, Fig. 2, shows actual daily relationship of electric power and process steam requirements for the factory in November, 1927. The maximum demand for electric power was found to be 1000 kw. Process steam was used at 20 lbs. and 80 lbs. gauge, 750,000 lbs. being used at 80 lbs. pressure and the balance at 20 lbs. pressure.

This tabulation showed that the installation of a back-pressure generating unit should be considered.

In the analysis, it was estimated that the low-pressure process steam demand would range from 24 to 36 lbs. for every kilowatt-hour of electrical energy used. Against back-pressure of 25 lbs., 1500-kw. generating units were available, with water rates varying from 21 to 36 lbs. per kilowatt-hour. With steam at an initial pressure of 200 lbs. and 60° superheat, the water rate would be 36 lbs. per kilowatt-hour; 24 lbs. with steam at 400-lb. pressure and 170° superheat; and 21 lbs. at 600-lb. pressure and 200° superheat.

A 1500-kw. generating unit with a water rate of 25 to 30 lbs. was selected. A tabulation of electric power loads indicated that such a unit would exhaust 13,700,000 to 16,500,000 lbs. of steam per month for process work. It was figured that a unit with a back-pressure of 25 lbs., generating all electric power required, would exhaust an amount of steam which could be used at all times for process heat.

An estimate of the cost of the new proposed plant was made to determine the saving which could be expected. A comparison of costs of steam and electric power when generating process steam and purchasing power, and when generating steam for turbo-generator and using exhaust steam for process, was made. Since all exhaust steam from the turbine would be used for process, cost records for the old plant could be compared with estimated costs for the proposed plant. As the existing steam plant was inadequate, $80,000.00 would have been required for changes and additions in any event. The additional investment to install the more economical plant was $140,000.00. The saving of $30,665.00 represented a return of 22% on the investment. In addition to the saving in power, the expenditure provided for a substantial allowance for expansion and increased power demand.

Having selected a generating unit requiring steam at 420-lb. pressure and 180° superheat, and having sufficient information about steam demands, the steam plant was planned. Two Babcock & Wilcox 500-hp. cross-drum water tube boilers were purchased. Combustion Engineering Type E heavy-duty, single-retort underfeed stokers were selected. A forced draft fan having a capacity of 30,780 cu. ft. per minute at 4½" static pressure was provided for each boiler. These stokers were designed and guaranteed to burn Pennsylvania bituminous coal passing through a 1½" round screen. The flue gas temperature at the outlet of the boilers was specified as 500° F. at 100% rating and 550° F. at 200% rating.

The two existing 100-ft. steel

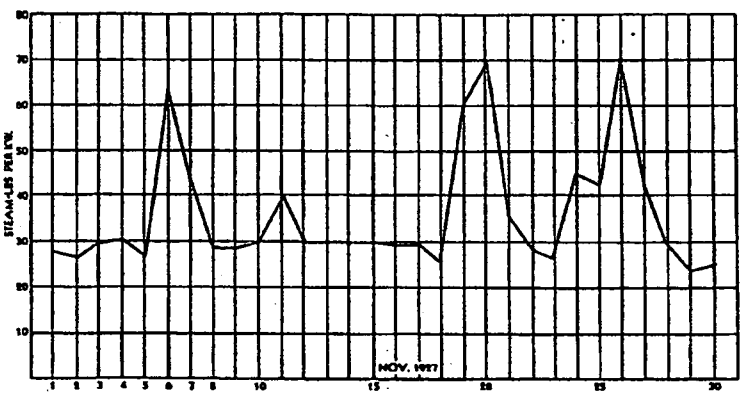

Fig. 2—*Daily relationship of electric power and process steam for the month of November, 1927.*