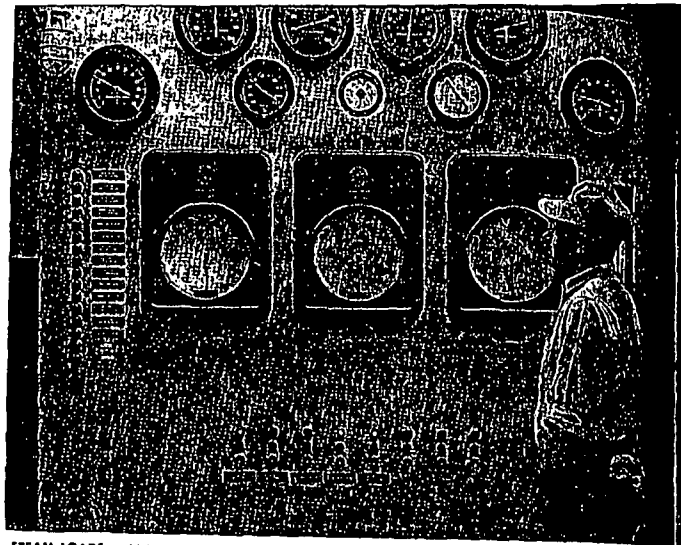

STEAM LOADS at Nekoosa mill indicated a 6000-kw turbine generator would fit into plant cycle but service limited to times when extraction loads were available. So compact, complete control setup was



additional steaming capacity is a 110,000-lb-per-475-psig, coal-fired boiler, similar to the existing unit



ELECTRIC output from new turbine just meets expected needs but loading varies enough to permit a scheduled maintenance



MAJOR expansion problems involved power services to new paper machine with several banks of dryers, steam turbine drive

Paper Mill Expands for In-Plant Steam And Tieline Power

Isolated paper mills gain greater stability for power circuits plus higher load flexibility by tying electric-generating capacity together. Here's how added steam needs do double duty

By P H COLDWELL, *Manager, Mill Power, Nekoosa-Edwards Paper Co*

► By 1950, Nekoosa-Edwards Paper Co saw its electrical energy load for the Nekoosa and Port Edwards, Wis., plants combined reach 13,000 kw. This energy came from a blend of three hydroelectric power sources plus byproduct steam power within each mill. When the time came to expand, the necessary power program involved two major projects: (1) adequate steam for production needs at Nekoosa only for the first step (2) ample additional electric energy but so supplied that it could serve both Nekoosa and the Port Edwards mills. First step of the expansion program was a boost of facilities at Nekoosa, up 30% in pulp, from 156 to 200 tons daily, and up about 90% in paper output, from 140 to 255 tons daily.

Steam needs at Nekoosa came in for detailed study. The existing sources were nowhere near enough. They were a 110,000-lb-per-hr 475-psi pulverized-coal boiler, a 60,000-lb-per-hr chemical-recovery unit of the same design characteristics and five low-pressure boilers acting incidentally as standby for the pulverized-coal unit and mainly as a disposal unit for waste wood.

Loading diagrams for the major steam users, steam load for the maximum month, minimum average hydro generation over the past ten years, the peak expected electrical loads on the entire system, and the top capacity of the chemical recovery boiler under the new conditions went into the planning considerations.

Resulting loading indicated about 75,000-lb-per-hr of added steaming capacity would meet the requirements. But when it came down to picking a specific boiler other factors entered the picture. For example, the existing 110,000-lb-per-hr 475-psig unit carried a full load normally through most of the year. A similar size and design of boiler would permit (1) easing the loads on present facilities (2) using duplicate equipment with its attendant maintenance and operating advantages (3) scheduling some additional growth.

Further, this size boiler could be spotted in an area occupied by two of the five old low-pressure boilers. The remaining three, during a period of about 6 to 8 weeks in midsummer, could be pressed into full service so one of the 475-psi units could be shut down for inspection, overhaul and maintenance.

Because additional electric power was needed other pressures and temperatures than the 475-psi 700-F boiler output were investigated. A lack of condensing facilities, though, indicated the additional investment would not pay off.

Low-cost fuel advantages, which the earlier pulverized-coal design gave, led to its selection again for the steam

Latest refinements, in soot-blowing methods and burner arrangement went into the new unit to get all the operating and performance

Boiler-Room Accessories. Coal and ash handling system, continuous blowdown equipment, combustion control, air-damper regulation, ventilation, coal scales and feedwater treatment were, in general, extensions of existing arrangements. The two old stoker-fired boilers, with their coal bunkers, induced-draft fans, ductwork, were pulled out, the site cleared up for the new boiler and the new bucket elevator relocated in front of the existing stoker-fired boilers. The remaining low-pressure units were furnished with a small coal silo and the existing bucket elevator adapted to work with this silo. A further adaptation transferred coal from the old bucket elevator to new bunkers supplying the new large-capacity pulverized-coal boilers. This introduced a definite flexibility in coal handling since it gave two ways of getting coal from railroad car to boiler coal bunkers. With it we could schedule maintenance on any of the coal-handling equipment at any time and it would ensure continuous operation.

Water Supply. The plant deaerator and condensate-return system proved inadequate under the existing plant. It held only about 3½ minutes of storage feedwater so it was intolerable under the expanded setup. Winter-load conditions in the Nekoosa plant, according to our studies, meant a supply of 300,000 lb per hr of steam. So we selected a new deaerating heater and storage tank. The deaerator can handle up to 400,000 lb per hr and the water-storage tank holds 75,000 lb, or about 15 minutes supply under winter-load conditions.

For much the same reason we added a new boiler feed pump, steam-turbine-driven. It supplies, in combination with trapped returns from process, a continuous blowdown system, and other waste steam, just about enough exhaust steam to meet feedwater heating requirements. Any additional steam that should happen to be needed comes from the 30-psi process-steam system through a reducing valve. One of the older, smaller feedwater pumps can carry the plant load during most of the summer. Two in parallel can, if need be, handle the winter-season load. This always leaves one or more pumps idle allowing time for maintenance and stand-by.

Turbine Equipment. When it came around to picking turbine size we fell back on our steam loading diagrams. These diagrams showed minimum steam requirements over the calendar year, the maximum available steam from wood refuse (which, of course, reduces by-product power supplied from turbine extraction) minimum hydro generation for the past ten years, no steam flow to paper machine dryers, but full power to keep the machines running, peak electrical loads on the full system, both Nekoosa and Port Edwards mills. Then we superimposed the new expansion paper machine and pulp requirements to determine total electrical needs.

Under the worst conditions, we felt 6400 kw was needed for the additional expansion load. An 0.8-pf 6000-kw turbine-generator with extraction at 30 psi would just meet this load. We recognized this size affords no allowance for future growth. Yet river-flow conditions vary enough so we could plan maintenance and overhaul enough ahead to keep turbine output at rating even in low-water periods.

Our load studies further indicated condensing power was needed only on an average of five months a year. Dur-