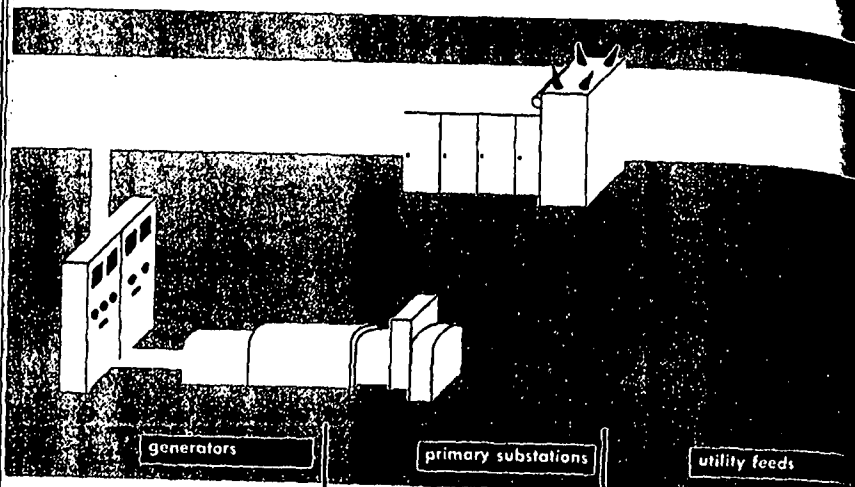


early planning—key to a modern system



Check possibilities for economical generation: Total-up plant process-heat needs as a yardstick. Is low-cost or by-product fuel available? If generation is indicated, what size units? How many? In planning layout, remember modern designs save basement space by banking cooling equipment alongside unit.

Decide early on ownership and location. Lower rate often goes with ownership but don't forget fixed charges, maintenance. Reliability of today's transformers justifies using one 3-phase rather than 3 single-phase units. Where utility feeds come in over long overhead lines, check lightning protection at substation.

Can utility supply plant's demands economically? Strive for several feeds coming from separate sources. What voltages are available? Agree on switching procedure to keep plant operating in emergency. Explain working schedule to utility so they can handle their maintenance without interrupting your feed.

...and finish your planning job by making decisions about supply

today's spread-out one-story plants, substations on the roof work well. There they can be reached easily by primary feeders. Or, consider putting them on balconies, up out of work zones.

Oil-filled transformers are still first choice for outdoor primary substations. Indoors, shift is away from vaults to askarel or dry type. Look into sealed dry-type where dust, moisture are problems. **Primary Feeds.** Choice for carrying them through the plant boils down to overhead vs underground. Underground is out of the way, unaffected by weather. But overhead offers lower initial cost, can be expanded readily. Keep feeders out of valuable work space—overhead trusses form good supports. **Circuit Protection.** A real must here is a knowledge of possible short-circuit currents. If you're fed from a utility, have them supply values at primary substation. From that point on you can determine what values will be at any point on your system.

With voltage, hp ratings of load, and possible short-circuit values, you have basic data to select switchgear. For primary substations, give thought to economics and advantages of both circuit breakers and load-interrupter fused switches.

Now you've worked your way back to the beginning of the system—power supply. Big question: Pur-

chase or generate? For some factors to be checked, see pp 80, 81. Here are some points to consider in planning for either plant generation or utility supply.

Supply plans finish the job

To select size and number of generating units, check your maintenance-shutdown schedule, which critical loads must be carried and which may be dropped, how much load, if any can be shifted to the utility, starting kva of large motors. Can a power-interchange contract be worked out with the utility?

If you plan to purchase, check your utility's ability to supply your load; power supply remains tight in some areas. And be sure utility knows what your demands, load swings and load factor will be. **Utility Feeds.** For critical loads, study utility's system for supply reliability. If only a single line serves you, it may pay to bring in an additional one. Check voltage regulation. Starting large motors may be a problem if your plant is at end of a long line. Voltage regulators on utility line or load-ratio control on transformers help hold voltage up.

For many plants, parallel operation with a utility is a good bet if it can be arranged. Consider value of provisions for quick disconnection if lightning is a problem and continuous processes are involved.

setting up your plant's power supply

¹ **Generation.** Relate generating-unit and load characteristics to determine number and size. In selecting generator itself, consider short-circuit ratio, cooling, regulation and voltage level.

² **Utility Feed.** First work out details of primary substation ownership, number of feeders, voltage, etc. Packaged equipment usually proves most economical. Check voltage-regulation needs.

³ **Protection.** Now overcurrent relays with voltage restraint can tell faults from permissible overloads. Transformer at primary substation should be guarded against surges and overloads.