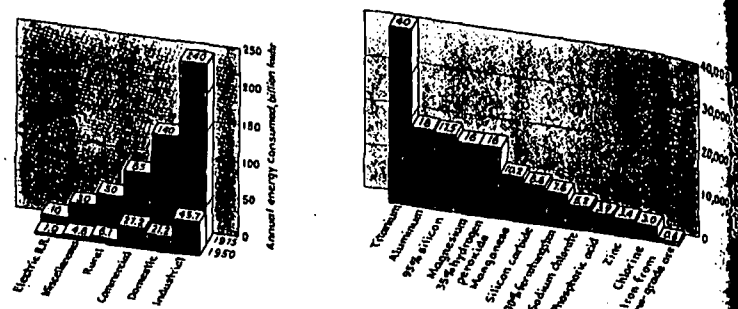
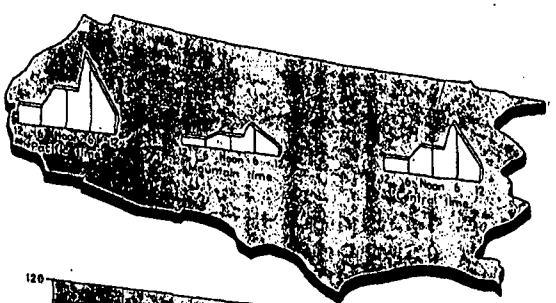
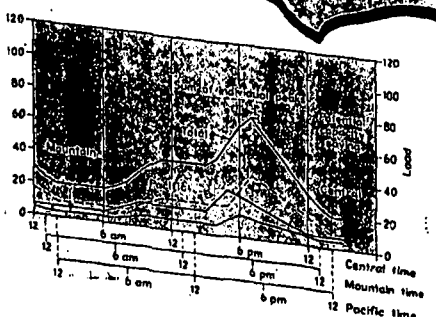


All Classes of Energy Consumption Will Grow

6 Electricity has just begun to be applied according to estimate of future need; increasing population adds to growth

7 Process needs for various products will boost industry consumption of electrical energy way beyond present level

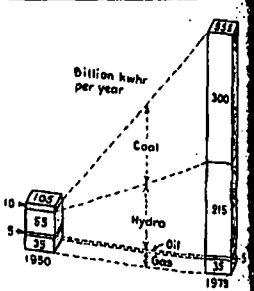




8 Diversity of peaks in relation to time zones makes saving in capacity possible with complete area network. Varying weather, temperature also reduce total peak

in the West. By 1975, they estimate that 47 million kw of this will be economically developed, compared to the 9.1 million existing in 1950. The Bureau feels that the oil and gas reserves, not decreasing percentagewise compared with tremendously increasing annual consumption, will not offer any increased economical energy source for electric generation by 1975. They foresee local oil- and gas-fired plants reserved for peaking and emergency duty. As a result, coal and lignite, Fig. 9, must produce the bulk of kwhr in 1975, with hydro generating most of the remainder.

Coal and lignite are the largest energy reserves we have in sight. A large



9 Both hydro and coal will carry added load, with coal taking major share

this lies in the West, Fig. 4. solid fuels may serve multiple Present research has shown ble to extract chemicals and oils coal and lignite, leaving a char ould be burned for electric gen-

Bureau does not estimate that olar heat, wind power, tides or energy will reach important mercial proportions for electric gen- by 1975. (*As an interesting side-*Detroit Edison Co has announced working on plans for a nuclear plant, *designs to be completed* year. It feels nuclear production be competitive with present meth- Construction *depends on* Congres- approval.)

Energy Transportation. Fig. 3 shows *comparison of kwhr needed* by each ched area in 1975 with the gener- that could be produced locally. *major problem* lies in choosing the economical method of transporting gy from the coal-rich states to the demand areas. Should the coal lignite be transported by rail to demand regions and burned in plants there, or should the fuel burned in mine-mouth plants and ctric energy delivered over high-volt- transmission lines?

The three major deposits of solid fuels are about 400 to 660 miles from the five energy-deficient areas. The Bureau study concludes that for the longer distance, energy can be transmitted in bulk at 500,000 volts for about 1.86 mills per kwhr. They compare this with a figure of 2.19 mills per kwhr for transportation in the form of coal by rail. The fixed-charge rate of 5.6% for substations and 4.75% for transmission lines used by the Bureau disagrees widely with rates, from 10 to 15%, that private utilities would use. This reflects the subsidy that government-built projects enjoy. The higher fixed-charge rate would make electric transmission more costly than coal transportation. This phase of the study is largely academic, however, since comparative costs can change radically in the next 22 years. It may be likely that a combination of the two methods of energy transport will prove most economical by 1975.

The Bureau states, "No doubt, elements of the system will be constructed by various power agencies operating in the area, both public and private." Prime value of the study lies in revealing the exciting possibilities of expansion during the next quarter century and indicating one course of development that might be followed. Fig. 5 shows the outlines of a 500-kv transmission-line network that the Bureau envisions for the future.

Large steam plants with capacities of 1.5 to 2 million kw would be located in the coal fields. Units of 300,000-kw capacity would be used to make up the *station capacity*. Power from several large plants would probably be brought to central substations for transmission over the high-voltage lines. Several parallel lines would be needed to carry the energy. Substations in the load *areas would step down* the voltage for distribution.

Experimental high-voltage lines show them to be feasible. Principal trouble lies in radio interference. While at the moment no satisfactory solution is in sight, probabilities are the problem will be licked.

Network Advantages. At times a network or integration of power systems may be difficult to justify solely on economic grounds. Other features may sway the decision to integrate. A network increases continuity of service. Improved flexibility may reduce operating costs by allowing fuller use of hydro power as it becomes available at a saving in fuel burned.

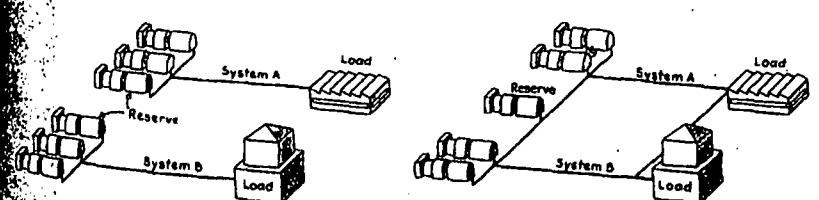
A network covering a large area saves in generating capacity by having a lower total peak load than the sum of the peaks on individual parts of the system, Fig. 8. This peak diversity in our case partly stems from the difference in time occurrence of darkness. Other factors contributing to increased diversity would be difference in local temperatures and weather over such a far-flung region, variations in local habits and others.

Integration makes a direct saving in capacity because of the reduced reserve needed, Fig. 10. Considering the simple case of systems *A* and *B*, the same reserve each requires for independent operation will do for combined operation since outages on the separate systems would hardly ever occur simultaneously.

CORRECTION

In the special report on GAS TURBINES, Dec 1952, p 106, identification of "Builders," bottom of page, is in error. Beginning with first item below it should read:

C—Clark Bros Co, USA, (not Elliott as shown)
E—Elliott Co, USA (not English Electric, as shown)
EE—English Electric Co, Ltd, England
El—Elsinore Shipbuilding & Engrg Co, Ltd, Denmark
FAI—Cie Electro-Mecanique, France
EW—Escher Wyss, Switzerland



Combining Power Systems Saves on Reserve Capacity

10 When two adjacent systems supply separate loads each must carry its own reserve capacity. When systems are interconnected, reserve for one system will do for both combined, as forced outages seldom occur at some time on both elements