More TECHNICAL BRIEFS

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of over 4-million acre-feet capacity. There are two identical power houses, *one in the U. S. and the other in Mexico.* Each designed for four 14,750-hp 163.6-rpm vertical-shaft Francis turbines driving 11,667-kva 6,900-v, 60-cycle 0.90-pf generators, of which three are being installed in each plant. It is expected that power generation of the two plants will average about 250,000,000 kwhr annually.

Practically the only difference in the two plants is in the arrangement of the intake works and penstocks. Generators in both plants will be connected to operate on a unit system. Each generator will connect to a 6.9 to 138-kv step-up transformer that in turn connects through an oil circuit breaker to the 138-kv bus. The high-tension switchyard is on the roof of each plant and has a main and transfer bus, with the usual complement of disconnect switches, current and potential transformers.

Estimated cost of the dam and two power plants is $49,205,000 excluding certain items borne separately by each government within its own territory, such as the acquisition of lands, relocation of highways and utilities, construction camps and access roads. It is expected that the plants will be ready for operation about April 1, 1954. *APC Paper, no number.*

An Evaluation of Our Water Sources. *By A M Buswell, Chief, Illinois State Water Survey.*

This paper reviews the possibilities of increasing our available water supply with particular reference to the State of Illinois. The author's conclusions are: (1) present water consumption is rapidly exceeding the capacity of developed supplies in many localities, (2) demands for water are increasing at rates which may reach the limit of our ultimate resources in the not too distant future unless new methods for water development and use are worked out, (3) present methods of evaluating our water resources are very inadequate and inaccurate. This is a sentiment widely expressed by today's water experts.

In view of the obvious need for more complete information on our developable water resources, the Illinois State Water Survey aided by representatives of the States of Indiana, New Jersey and Ohio, undertook in 1951 water resource studies. Examining the Federal side of the picture it is interesting that the federal water programs over the nation cost $13,200,000 in 1949. This was divided: Weather Bureau $4,800,000, Geological Survey $8,380,000, transferred from other interested agencies $4,740,000.

The need for increased interest by public agencies in water resource work is clearly called for. A greatly increased program is amply justified when we consider that our developed water supplies are valued at $7,300,000,000 per year while the amount spent on collecting information on this resource is only $14,000,000 or less than 0.2 of one per cent. New techniques developed to solve our water problems include: groundwater recharge, radar and statistical analysis. *APC Paper, no number.*

Electric Generators

Design and Application of Large Steam Turbine Driven Generators. *By C E Kilbourne and J B McClure, General Electric Co.*

Progress in the art of generator design depends fundamentally on the extension or removal of one or more of the basic physical limitations which determine how these machines can be satisfactorily built. The problems involved cover a number of areas of engineering including, basically: magnetics—how to carry more flux; electricity—how to conduct current better; dielectrics—how to contain voltage better; fluid flow and thermal dissipation—how to convey heat; and mechanics—the construction features to enable the proper performance of the preceding functions. Technical advances have recently been made in several of these areas and the extension of the corresponding limitations is the story of today's progress.

The rotors of large turbine generators, for example, are now generally made of solid alloy steel forgings. The original development of these parts of necessity emphasized the physical characteristics of the forgings above all else as it is always essential that uniform high physical strength exist throughout the rotor. This was done with the use of alloying elements, principally nickel, with some additions of chromium, molybdenum, and occasionally vanadium, and an elaborate heat treatment. These elements are generally detrimental to obtaining a high intrinsic saturation limit in a forging and often caused considerable variation in the magnetic characteristics of different rotors. Consequently, they tended to limit the flux carrying ability of the rotors.

After the problems of physical characteristics had been solved, an extensive investigation was carried on to improve both the magnetic limit and the uniformity of magnetic characteristics. It was found that a careful control of the carbon and chromium content, plus a revised heat treatment, would not only provide just as good physical properties as had been obtained earlier, but also would improve both the flux carrying ability and the magnetic uniformity of the rotors. The results have been excellent. Cases of high excitation requirements, which occasionally occurred earlier, have been eliminated and the magnetic loadings of the rotors have been increased.

A similar development has taken place for the magnetic parts of the armature. In this case, oriented-grain strip steel has replaced non-oriented sheet steel. This is advantageous for turbine generators because the large, heavy core sections, back of the armature teeth, can be materially benefited by the new material. The loss in this part, which is one of the major losses in the machine, can be reduced to between 65% to 75% of its previous amount, or more flux may be carried with the same loss, or a compromise between loss reduction and flux carrying ability may be used. Thus the magnetic parts of the armatures can be made smaller than they have been before, or, conversely, the same sized parts can be made to produce a greater output.

The ability to get more out of a given size machine is perhaps more spectacular than a decrease in dimensions of machines that have already

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TO OBTAIN COMPLETE TEXT

Material for these abstracts comes from the following sources unless otherwise stated. Order complete paper from source, not POWER.

American Institute of Electrical Engineers, winter general meeting, Statler Hotel, New York, N. Y. Jan 19-23, 1953. Identified by initials AIEE and obtainable through AIEE, 33 W 39th St, New York 18, N. Y.

American Power Conference, annual meeting, Sherman Hotel, Chicago, Ill., March 24-27, 1953. Identified by initials APC and obtainable in proceedings printed and distributed by R A Budenholzer, chairman, Illinois Institute of Technology, 3300 Federal St, Chicago 16, Ill. $6.00.