

As far as the transmission line is concerned, the lower the frequency, the less the induction drop, the smaller the charging current and the better the regulation. It is a foregone conclusion that as a purely transmission problem we will have to adopt the 25 cycle frequency. Our problem, however, is more complicated. The transmission line is only a chain in the link, and important as it is, it should not overrule the advantages of a higher frequency as applied to the distributing end of the system. In our composite problem the various advantages and disadvantages should be carefully weighed and the selection made on the merits of advantages of the entire system taken in its totality.

POWER HOUSE: The table of speeds of generators at 60 and 25 cycles shows a wider range of speeds, hence a greater flexibility when laying out a 60 cycle hydro-electric power house.

R. P. M. 25 cycles 300 250 214 187 166 150.

R. P. M. 60 cycles 327-300-277 256-240-225 212-200 190-180 172-164
156-150.

The speeds of turbine-generator units are limited by the number of wheels, type, head and output. Therefore a wider range of speeds permissible with a 60 cycle system will enable the selection of the most efficient generator-wheel combination. Inasmuch as increased peripheral velocities will result in a decrease in active material, the selection of higher speeds will enable us to choose cheaper hydro-electric sets. The above conclusions hold true except when higher speeds call for special construction, which will rapidly increase the cost.

SWITCHBOARD: The switchboard under the two frequencies is unaffected. All meters and potential and current transformers are designed for satisfactory operation on frequencies from 25 to 125 cycles. In our comparison of 60 and 25 cycles it may be said that while the temperatures of the switchboard shunt transformers will be less at 60 cycles, the series transformers will operate at higher temperatures, due to a higher iron loss. The temperatures, however, will be well within the margin of permissible safe operation.

TRANSFORMERS: Transformers built for 25 cycles are a much more expensive piece of apparatus as well as less efficient than when built for 60 cycles. Considering that there is with a generation, transmission and distribution of power a total transformer capacity equivalent to from 3 to 4 times the capacity of the generating apparatus, one will readily see the advantage of a higher frequency. This, however, must not be done at a sacrifice of other considerations, such as excessive charging current in transmission or extremely poor regulation. We shall come to the questions of charging current and regulation later on and now will take up the con-