

form a sweeping unified control over the dominant water powers of the country, as well as their related public-service interests.

Here, then, is the present situation of the hydro-electric industry:

(1) It deals with a basic necessary and its importance inevitably increases as the fixed supply of other sources of power decreases.

(2) Substantial control of mechanical power means the exercise of a function that is governmental in its effect on the public.

(3) Driven by underlying economic and financial forces, concentration of control of water powers in private hands has proceeded very rapidly. It is doubtful if anything can arrest this process, and a swift advance to a far higher degree of concentration is entirely possible.

(4) Any chance, then, of restraint by competition is rapidly disappearing, certainly over given sections, and public regulation is therefore an imminent necessity.

The extent of such regulation will depend mainly upon constitutional limitations. A state, roughly speaking, can at any time exercise a high degree of control over power companies as quasi-public servants.

The jurisdiction of the federal government covers a far wider range geographically, but involves some difficult constitutional questions. Over water powers on the public lands it has full control. I concede no merit to doubts as to the government's unlimited jurisdiction there.

As to powers on navigable streams not in the public domain, there is an undetermined constitutional question. No dam can be maintained in a navigable stream without the consent of the federal government. Nearly every one admits that the government may impose upon such grants any desired time limitation, and may thus require readjustment of terms at any desired period.

But some hold that the federal government, in exercising its arbitrary power as grantor, may also impose any further conditions it chooses upon such grant, as, for example, that the grantees shall pay a rental for the water power acquired. Others hold that the federal government can only impose such conditions as are directly connected with the federal power over interstate commerce, such as navigation. Even this view would apparently at least permit a rental charge, if applied to navigation improvement. Personally, I am strongly inclined to the former and broader view that any conditions whatsoever may be imposed, both on general principles and on well-established legislative precedents. In numerous bridge and dam Acts Congress has used the broad power and imposed conditions in no way related to interstate commerce. In the California Debris Commission Act, operative since 1893, Congress imposed a straight charge on placer miners for the privilege of emptying their refuse into the streams.

The scope of the federal jurisdiction is of first importance, because the waterpower problem is, in the main, a national one. Much of the power is transmitted across state lines or is used by interstate carriers, the bulk of the capital that is developing our most important powers comes from interests outside the states where the powers are located, and from the brief survey I have already given of the concentration of water powers and of the interrelationships existing between public-service companies it is obvious that state lines and state jurisdiction have no practical relation whatsoever to the sweep of these forces. The hydro-electric business has been largely nationalized by those who are foremost in it. They at least cannot now be heard to object to such national action as is adapted to meet the business conditions that they themselves have created.

Undoubtedly there are local forces and conditions which the state must handle. The nation and the state should therefore co-operate. But this does not mean that the nation should abdicate any of its powers. The nation and the state will both have to use their full powers to meet the water-power situation. The most effective time to use them is before, not after, private rights accrue. The one certain method is for the state or the federal government to retain its interest, or impose its conditions, at the inception, as a part of the grant. Then public control and private rights go together, as they must if we are to safeguard the public interest in water power.

Let there be no unnecessary hampering of hydro-electric development. There need be none. But let the public be in on the ground floor at the start, for at the start the public must grant the power and for all time the public will be the party chiefly interested in its use.

Specifically:

(1) The status quo of powers still controlled by the nation or state should be maintained until we know what we have, and can act intelligently thereon.

(2) No grant should be made except for a fixed period, with at least the reserved right to readjust terms at the end thereof. That period, however, should be long enough to permit adequate financing and complete development.

(3) Complete publicity of accounts and transactions should be required as well as a record of cost, and the real relation of investment to stock and bond issues. They are public-service companies and the public has a right to the information.

(4) Power to revoke the grant for breach of conditions should be lodged in a specified public authority. Otherwise there will always be the possibility of protracted litigation to determine the status.

(5) So far as is possible, direct provision should be made against excessive charges and monopolistic abuse.

(6) Public authorities should reserve such constitutional compensation or rental as will establish the principle of underlying public interest.

(7) All public easements of navigation, fisheries, etc., should be safeguarded.

(8) In the case of new grants, all those provisions should be made conditions of the grant.

Finally, the purpose and probable effect on the public of any grant should first be fully ascertained and carefully considered, in order to determine whether public interest justifies beyond a reasonable doubt the surrender by the public of even a part of its power over this great public resource. So long as such reasonable doubt exists, the surrender should not be made.

THE IMPROVEMENT OF STEAM PLANT EFFICIENCY.*

With Special Reference to the Use of Superheated Steam.

Carl C. Thomas,
Professor of Steam Engineering.

In the early part of the last century a well-known writer in New England wrote a communication to an English engineering periodical describing new machinery which was built at Newport, R.I., by John Babcock and Robert L. Thurston, for one of the first steamboats that ever ran between Newport and the city of New York. This writer prefaced his description with a remark which has been often

*Abbreviated from a paper in The Wisconsin Engineer.