

INTRODUCTION

1. In one of his earlier papers, [No. 1401, American Society of Mechanical Engineers] the writer presented the method of setting tasks for firemen as an isolated function of power-plant management. The most precise knowledge of what each man and each machine can do and the most eager desire to attain this aim are of no avail unless the human forces are directed in accordance with the plans consistent in every detail with all available knowledge. The object of this paper is to outline the main functions of an organization capable of planning the power-plant work so as to obtain the predetermined desirable results.

2. The elements of such planning work might be enumerated as follows:

- A. Securing the knowledge.
- B. Making the knowledge available.
- C. Creating conditions which make this knowledge applicable.
- D. Observing whether the proper use is made of this knowledge.

Whenever any one of these elemental requirements is not lived up to its ultimate meaning, the plant management is a haphazard undertaking and the automatic penalty varies between 10 and 40 per cent added to the operating cost. In the great majority of power plants the fundamental planning functions do not receive due consideration. The securing of knowledge is left to the resourcefulness of individual employees, often unaided with even most elementary instruments for observations, seldom possessing the necessary time and authority for experimenting and frequently unqualified for scientific research work. As to making the useful knowledge available to the other men, it is considered by the individual employee possessing such valuable knowledge decidedly against his interest, for fear the other fellow will become qualified to take away his job. For the management, unaided by a planning organization, such educational work and training of the employees is an impossibility, principally for the want of time. A fundamental requirement for the proper application of available knowledge and experience is a functional organization of foremanship, a feature totally foreign to the time-honored division of labor in American power plants. Lastly, observations whether the proper use is made of all available knowledge generally, if at all, is made in the final count only; that is, what the actual costs or thermodynamic results were, without due reference to what these results might have been under proper condition and what if these conditions were neglected.

3. In the following, the author* will present the description of a composite case of several power plants, widely varying in size and nature of service, where the application of the principles advocated here were responsible for material reduction of operating costs, increased security of service and marked stabilizing of expenses, besides greatly improving the relations between the management and the employees. The diagrams Figs. 1, 2 and 3 illustrate the trend of progress toward cost reduction—Fig. 1, in a small industrial plant, Fig. 2, medium size public utility central station, and Fig. 3, in a large electrified railway plant. The latter is particularly interesting inasmuch as the results were accomplished without the opportunity of paying a bonus, and are chiefly due to the careful planning of work in the limited sense of the word.

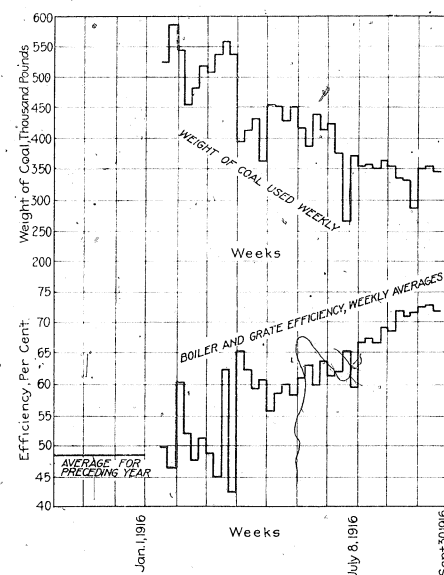


FIG. 1. Cost Reduction in Small Industrial Power Plant.

SECURING THE KNOWLEDGE

4. Broadly speaking, there are two ways of acquiring knowledge. The first and the most ancient method is based on the belief in the authority, either divine or human, and the second, as opposed to the first, is based on the critical analysis of phenomena. Francis Bacon Lord Verulamius laid out the canon of experimental or scientific analysis, whereas Immanuel

*Acknowledgement is here made of the able assistance rendered to the writer by Mr. Geo. Sheasly and Mr. William Schaller, who fought with him shoulder to shoulder to make a success of these principles.

Kant gave us the most remarkable critiques of our mental processes. Since then the modern or positive science, accepted as the criterion for any positive knowledge, indicates the extent to which the laws representing the relations between causes and results are known. In other words, we can say that we possess scientific knowledge only if we are in a position to precisely foretell the phenomenon in time,

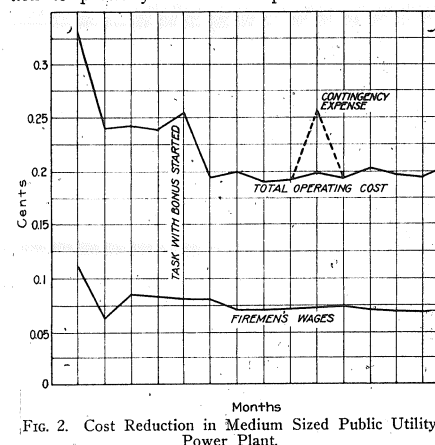


FIG. 2. Cost Reduction in Medium Sized Public Utility Power Plant.

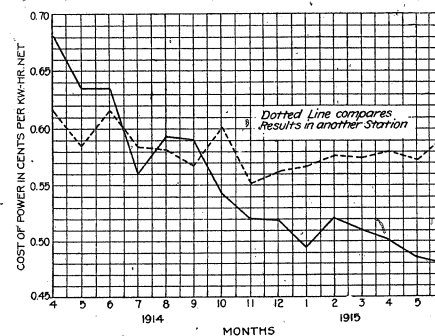


FIG. 3. Cost Reduction in Large Electrical Railway Central Station.

space and effect from the study of other phenomena causing and conditioning it. The distinction between the pure and applied science may be drawn where we can or cannot affect at will the conditions causing a desired result. Whereas it would be absurd to create a society to prevent the waste of heat from the earth during the next sun eclipse, it is well worth our while to labor for conservation of human and natural resources lavishly wasted in the power plants.

5. Whereas the designers of power-plant machinery may justly be classed as engineers working on scientific basis, inasmuch as exact character of per-

formance of this equipment is accurately predetermined by them before the drawings are sent to the shops, of few managers could the same be said. To predetermine what result can actually be secured from the operation of a plant appears to many as an idle quest. Wherever this has been done, however, the knowledge of what the plant is capable of accomplishing led to efforts to secure the results for which it was built.

The procedure of securing the data showing what a plant can do is, of course, the well-beaten path of scientific analysis and thorough research work. Three distinct steps should be pointed out:

- A. Investigation into what conditions result in the highest operating efficiency of each separate unit of equipment.
- B. Experimentation leading to the discovery of how these best conditions may be secured and maintained at will.
- C. Coördination of thus-found factors in a manner that will show what is the most advantageous interrelation of these conditions and the resulting individual efficiencies from the following aspects: (a) Security of operation; (b) welfare of employees; (c) cost of operation; (d) cost of maintenance; (e) idle overhead expense.

6. This research work is a logical prerequisite to any attempt to manage a plant—not merely "run it" by the grace of the Almighty. When this function of securing the knowledge is vested with the plant's planning department, it becomes its permanent duty to carry out investigations and researches. With every change of condition, be it a new grade of fuel, a different make of supply, a new employee, a change in the character of load or anything else, the planning department starts an investigation to find out exactly how to cope with the circumstances.

7. It would be beyond the writer's task to present here the monograph on methods of power-plant testing, but we deem it entirely in order to make a few remarks concerning the most common fallacies made in this work. The A. S. M. E. and other codes for conducting various power tests, textbooks and treatises written on the subject by professors, etc., totally and deplorably ignore the main point—what the tests are made for.

- A. Time and expense of testing made by untrained persons is a pure waste and often serious harm is done for the future by wrong conclusions derived.
- B. Tests that are made without keeping complete records of all conditions should not be run at all; only complete and continuous records are useful and dependable.