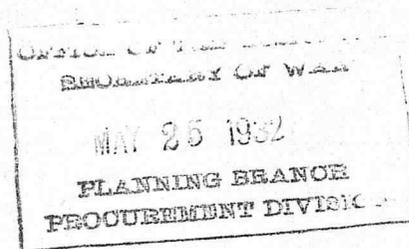


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POWER IN WAR

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I. Importance of Power.

1. Manufacturing depends first on men who are bred to the work; and then it depends on power other than the power in men. In the past of this country, New England was the place where manufacturing flourished most. There were the men who were bred to the work and there water power on a scale sufficient to meet the needs was available everywhere.

2. Manufacture, as does everything else, depends also on a market, and the market depends on transportation. In the early days, as now, the sea furnished the principal highways of transportation. New England had the sea and also had the ships. With the transportation, the raw materials were available wherever they could reach the sea.

3. So there are three things necessary to insure manufacture; first, the men bred to the work; second, the power to run machines; and third, transportation for the assembly of materials and the distribution of the product. Without all three of these things, there will be no manufacture of consequence.

4. Water power is still of great importance because of its inherent cheapness in certain localities, as Niagara Falls. But now coal, rather than water, is the source of the bulk of the power developed. Therefore, we see that New England is no longer preeminent in the manufacturing industry of the country. Coal is not found in New England; it has to be hauled there. Transportation, power and labor are the deciding factors, but the cost of the three combined is the sum that decides the whole thing.

II. Nature of Power.

1. Power must be transmitted from the point where it is produced to the point where the work is done. In the case of steam, the transmission was by belt or shaft, or both, and so it was with water power. Now the transmission is by electric current in addition to shaft and belt. The range of transmission has been greatly increased through the medium of electricity. We have seen shafts and belts a quarter of a mile long, but now we see electric transmission over a radius of 300 miles from the station where the power is produced. The advantage of electric transmission of power is so great that practically all large stationary machinery is now electric drive, and much moving machinery is also of that character. Important railway lines are being electrified; some ships are electrically driven; though Diesel engines are so handy for the purpose that electric drive seems superfluous. Of course, machines may be driven by direct connection to electric motors, or by belt connection, or by belt and shaft, as is most suitable and economical. But the long transmission of power is all electrical; there is no other way.

2. It is easy to conceive of a great central station, steam or

water power, at the center of a transmission net supplying power in adequate quantity to an area of two or three hundred thousand square miles. If contiguous areas are supplied with generation and transmission, it can be seen that, if they are interconnected; power can be made available to the entire country through a great connected net into which energy is driven from a number of generating stations. Such a system is responsible for the existence of the great power companies of today, for such a system is capable of being operated with the highest degree of economy and reliability.

3. The economy of electric power supply depends on using all facilities of generation and distribution to a high ratio of total capacity. At times, the demand of a locality is high for a part of the twenty-four hours of the day, and low for the other part. It is clear that for the period of low demand, the economy is low, for we are not supplying in accord with the facilities that we have installed. The ratio of the average load to the total capacity is called the load factor. If this factor were a hundred percent, then the economic conditions would be perfect. That will never be attained in any system; on the average, the ratio is more nearly thirty percent. But it is apparent that in a far-flung system of a wide character of demand, the load factor will be relatively high, and the economy relatively great. Economy is therefore to be found in large interconnected systems. It is possible to see that with a system broad enough, a shortage in any part of our great country might be made good by an average in any other part, however far away, though economical transmission was only 300 miles. It would be done by a step by step interchange. No such unification has yet been achieved, but it will be at some future time. Great progress has been made toward it in the last fifteen years.

4. It is apparent that the power question is on the way to its own solution in time of emergency. For if the utility be so flexible as is promised, no section can be well overloaded if contiguous sections can come to its relief. The danger of overloading one locality by requirements of manufacture is less now than it was ten years ago, and will be less in the future than is the case today, provided natural and economic development is not hindered or disrupted by artificial means.

III. Power Survey.

1. By direction of The Assistant Secretary of War, a power survey of the country is made annually by the Corps of Engineers. The object of this survey, as I comprehend it, is to furnish data for the allocating of orders for supplies in emergency, so that no district will be overloaded in so far as the power supply is concerned. There seems to me to be another result and a more important one to be derived from the survey. It is to provide an organization so familiar with the power situation as will permit of the necessary action to insure that in emergency the shortages in power that may develop, or do develop, will be remedied with promptness and certainty.

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2. The survey is now being made annually and in eleven districts or zones. It determines the total amount of power available in each district. The survey takes into consideration only those generating stations of 5000 kilowatts or over, the smaller ones being considered as negligible. Recommendation has been made to the effect that the number of districts be reduced to five, and that they be made coincident with the procurement districts defined by The Assistant Secretary. This is in line with the scheme of control that will probably be put into operation in case of war.

3. Of how much value the power survey is for the purpose of guiding allocations, I do not know. Maybe it is of no value for that purpose or is not utilized in any way for such purpose. It can be so used, or a study of the effect of allocations can be made to determine what changes must be effected in power supply to meet the requirements of independent allocations of manufactures. I have no doubt but this procedure will be the one that will be followed by design in the beginning or by force of circumstances as they occur. It seems logical to make the power requirements fit the allocation of orders rather than the orders fit the power situation. If this be the decision, we will make the power survey with that in view, and be responsible that the necessary action with respect to power be recommended in due time. It may not be necessary to make a power survey every year, but at intervals, depending on material changes in allocation of orders. The responsibility for power solutions will then be placed entirely with those who are most closely in touch with the power situation, and responsibility will be single rather than hopelessly divided. It must come to singleness in the long run. All of the worrying by those who place orders and know nothing about power may then be avoided. The power survey will be directed with more in view than the mere gathering of statistics.

4. I have noted that one of the committees of this college recommended that the power survey be omitted or discontinued. That is an easy solution indeed. Why not recommend that everything be omitted and discontinued? Then we would have nothing to do but to draw our pay and let the world rock along. But, some day, there will come trouble. Ignorance will contribute nothing to the solution of the difficulties of the situation. Knowledge may contribute something. All the time that is thrown away in idleness has to be made good at increased pressure when the emergency comes along. The power survey should go on, and the results that come from it should be put to use. If the results are not useful, then other results must be sought that are useful.

IV. Power Control.

1. There is a superior control of industry in war that will coordinate the needs of the Army, the Navy, and the civil population. That control is not present in peace time, nor will it be called into

action except in a case where the entire national strength will be required. Exactly how that control will be exercised cannot be foretold with accuracy because it depends on the ideas of a President not yet announced. There are two schools of thought that I have encountered on this subject. Both come from men of experience during the last war. Both contemplate single-minded authority and responsibility. The first is that an organization like the War Industries Board will be formed, but that the President will delegate to the chairman of that Board all of the authority necessary to exercise complete control. The other is that the President himself will exercise control through a body of administrators, each of which will be coordinate. When it is necessary for them to meet together for discussion and instructions, the President will preside and issue instructions. The occasion for such meetings ought to be rare. I prefer to believe that the second method will be the one followed, and I believe it because I believe that no President of strength will delegate so much power into the hands of any one man unless he has unbounded confidence in his judgement, knowledge and loyalty.

2. In either control body, there will be an administrator who will have the subject of power assigned to him. It seems probable and reasonable that power and fuel will go together, as they are practically of one significance. We are not interested now in the other administrators. There will be as many as may be necessary, but the smaller the number, the better, and it would seem that they should not exceed about seven to nine. It seems certain that all questions of far-reaching significance, as regards power, will be settled by the administrator of power, and that the organization for power control under The Assistant Secretary of War will be a part of the organization directed by the administrator in the interest of coordination.

3. The higher control need not bother us for a moment except that we know it will be called into being, and we know that the more knowledge that we have of the subject and of how our business will be affected, the lighter will be the task, and the more certain and sure will be the action of the higher control when it comes into action. The War Department should be well represented in the higher control and at all control points throughout the country. The object of this is to secure the power necessary in the manufacture of the things required for the Army. The Navy will have its representatives at such points as relate to its supply program. Conflicting interests will be adjusted by the power and fuel administration. It is evident that the sooner this administration comes into operation, the less confusion and delay there will be.

4. One of the most important results of the power survey as it appears to me should come from the informed personnel available to maintain touch with the power situation during emergency, and to see that the military needs do not suffer from a shortage of power in the plants engaged in their supply.

5. Those who are charged with industrial control of any sort will do well to consult the story of French railways from 1870 to 1914. It was realized that one of the most desperate failures in France during the short war of 1870 was the failure of railway transportation. In preparation for the great struggle that was to come, nothing was given more consideration than this. The methods used to control the railway transportation, so that the military needs as well as the civil needs would be met, were similar to what must be done in future in the control of various lines of industry. The French seemed to lean toward commissions instead of individual responsibility, but this may have been more apparent than real.

6. I note in the correspondence of The Assistant Secretary of War a few years ago some principles of control laid down as to power. They apply to all control of civil establishments in time of war. They aim to use existing organizations instead of creating new organizations. They contemplate the least practicable disruption of existing organizations. The only thing that is essential is that existing organization lend itself fully to the control that is necessary in meeting the military and naval effort. There is no idea of the government seizing upon industry and operating it, or of militarizing or drafting its operating personnel.

7. One essential thing that private industry will often require when the government imposes control, and that will be operating capital. The raising of capital during war by private initiative is difficult, and often impossible. The government will get private capital by tremendous bond issues that absorb what is available in the country. The railways and the power corporations will find difficulty in securing in the ordinary way enough capital for the necessary maintenance and betterments. Such was found to be the case during the last war, and I am informed that one of the principal reasons for the assumption of entire control by the government of the railways was the difficulty of financing railway operation and maintenance.

V. Peace and War.

1. The conditions of war are so different from those of peace that all men find themselves unable at first to adapt themselves to the change. Civilians have difficulty in adapting themselves to war conditions, especially in America, where they are accustomed to so much liberty of action. After a war is over, some soldiers have difficulty in realizing that the war is over, and, consequently, often make themselves ridiculous in comparison to their success in war.

2. I have noticed in the correspondence of certain power concerns with The Assistant Secretary of War that they are willing to cooperate in power control during an emergency. This expression of willingness on the part of these men to cooperate showed that

they did not appreciate what they will encounter. To cooperate in forming the proper plans is one thing, but in the execution of the plans, it is the obedience of orders promptly and willingly that they will have to do. It will be something more than cooperation. They will cooperate with those alongside of them, but they will obey the orders of those placed in control. The familiar expedient of taking over by the government that we hear so much about will not be a physical taking over, but it will be the displacing of an executive who will not execute orders by one who will execute them. The means of displacement are not of importance so long as the displacement takes place on failure to perform. Some such experience will be necessary on the outbreak of trouble by some who have the idea of cooperation with governmental authority rather than the taking of orders therefrom and promptly executing them.

3. There is in prospect a governmental control of power in peace time that will make the control in war easier. The only difference will be that the agency of control will be single in war rather than by commission. The use of electricity for power and light is one that is becoming so much a part of the necessity of life that the power business is bound to come under centralized governmental control due to this reason, and to the economic reason that the power business is coming more and more under centralized financial private control and ownership. There is local control by governmental authority now, but it is weak and is sure to be outgrown as power operation is destined to outgrow state lines. There are those who desire to see power properties come under general ownership or sufficiently so that such ownership and operation will itself regulate the industry. According to past dealings of the government with transportation agencies, which are more vital to the people than power can be, the governmental regulation of power is more probable in the future than is government ownership and operation.

VI. Conclusion.

From the development of the power industry in recent years in this country, it seems certain that it can meet any call that will ever be made by war conditions, and meet it easily. The same thing is true with respect to the railway system of the country. But extensive as may be the power system and the railway system, it seems certain that both are likely to get out of joint and inefficient in times of unusual strain unless close supervision be taken over them in such times by central governmental authority, insuring the needed capital and fuel supply, and the coordination of the various interests involved.