

SOME ASPECTS OF ELECTRIFICATION FINANCE

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A brief outline is made of the financial position of steam railroads. Figures are given to show how operating expenses have been increasing at the same time that revenue has been falling off. Suggestions are made as to ways and means of decreasing the investment charges necessary for electrification by trust certificates and by the purchasing of power from existing central stations so that advantage may be taken of the well recognized economies to be secured by such electrification. It is pointed out that a saner fundamental political policy towards railroads is much needed.—EDITOR.

Unjust treatment, by public authorities, of capital invested in American railroads has, among its many phases of injury to the future progress and prosperity of the country, done more than all else to retard electrification, as during recent years the railroads have in the main been thus prevented from undertaking more in a financial way than to care for the essentials to the operation of their immediate service. So the finance of electrification or of other important betterments has been seriously handicapped. This situation is more clearly pictured by the following statement, which has been specially prepared by an eminent steam railway authority for quotation herein:

"The most practical service which you electrical men can perform is to understand the financial situation of the railways, to recognize frankly their needs and to cooperate in re-establishing their credit. No man is ever in better business than when he is endeavoring to strengthen the purchasing power of his customer.

"A few simple computations will show the financial drift. In 1907 the operating expenses of the steam roads of the country per mile of line was \$7687. This had risen to \$8109 in 1915. The average annual wages of railway employees in 1907 were \$641. This had increased to \$826 in 1915. Taxes per mile of line in 1907 were \$357 and in 1915 \$534. The ratio of operating expenses to operating revenue in 1907 was 67.5 and in 1915 70.6—this in spite of the fact that in 1907 the roads had been hauling enormous increases of tonnage, whereas in 1915 a prolonged spell of starvation had got most of them down to hardpan.

"The result of this tendency is seen in the amounts which the roads of the country on the average had left after deducting operating expenses and taxes. This figure per mile of line in 1907 was \$3339 and in 1915 had fallen to \$2834. One of the uses to which this remainder has to be put is the payment of interest. Many of the roads during these

eight years greatly increased their investment per mile of line. The roads as a whole (1907-15) increased tons of freight car capacity per mile of line from 67,033,324 to 92,225,541; number of locomotives from 55,388 to 65,099, and miles of track per mile of line from 1.44 to 1.56. This says nothing of the great investment in terminals and the substitution of steel for wooden passenger cars. Another item which comes out of the remainder which I am talking about is additions and betterment out of income without any increase of capitalization. Finally there is decrease in the item of dividends on stock and surplus, which are the indications consulted by those who advise investors in order to determine the financial condition of a company.

"In short, railway credit has been impaired by a rise in expenses not accompanied by a proportionate increase in revenues. To remedy that situation the railway managers invite and in my judgment deserve your co-operation. They say that if regulation which affects interstate commerce could all be centered at Washington two grand results would be promised. First, needless duplication of expense to the roads arising from regulation by 48 states would be saved to the roads and to the public; second, the Interstate Commerce Commission could then be held responsible for the total financial results of the rates which they fix and of the expenses which Congress compels, and hence the country would at all times have a servant whose function it would be to watch for untoward tendencies in condition of the roads and act with promptness and decision in the public interest."

The economic advantages of electrification have now been so thoroughly demonstrated that railroad financiers and executives are fast becoming convinced of their existence, but as indicated by the foregoing quotation this alone cannot provide the funds required to undertake extensive electrification projects, for to readily accomplish this securities issued for such purpose, must be made more

attractive to investors than the great majority of railroad issues have been since governmental oppression has so seriously threatened their stability and prospective financial return.

Seemingly, therefore, the only ways in which railroad electrification can be greatly facilitated in this country, are these:

(a) By improvement of fundamental political conditions, thoroughly impressing the true financial situation of the railroads and the growing inadequacy of their facilities upon the people at large, making it clear to all that governmental authorities, supposedly acting in accordance with public demand, are responsible therefor, but in so doing have greatly injured the public interests; which condition should be remedied by the public itself.

(b) Under present prevailing conditions provide methods of finance for electrification, which will more strongly appeal to investors than do those available through the sale of ordinary issues of railroad securities, thus placing the finance of electrification in a different category than are nearly all other forms of extensive railway betterment.

(a) is a public duty incumbent upon every good citizen, which, however, has been sadly neglected by most of them. But as electric public utilities have endured and are still suffering from the effects of misguided public sentiment in ways similar to those that have been inflicted upon the steam railroads, necessity for such action is brought directly home to the electric fraternity.

The accomplishment of (b) is already well advanced; this principally through the rapid evolution and expansion of the central electric station industry along broader lines than is ordinarily appreciated by railroad men or others.

Extensive railroad betterments, other than the acquisition of additional rolling stock, are of course fixed in their character and therefore must usually be financed through the issue and sale of railway stock or bonds, for which, so far as stock at least is concerned, a favorable market does not exist at the present; while in many other instances legal restrictions prevent the making of further bond issue in a form which is attractive to investors.

Additional rolling stock, whose earning power is apparent, can be and is favorably financed through the issue of trust certificates or equipment obligations for which the equipment is pledged and whose principal is, in due course, paid out of increases in earnings thus made possible.

The popularity of this class of security is constantly evidenced by stock exchange quotations, while past financial experience has demonstrated that such trust certificates, as a class, have been the most reliable form of railroad investment.

Until recently, however, railroad men have considered it impractical to broadly apply this principle to the finance of electrification projects, believing that their corporations would in such connection be forced to finance the cost of power stations, transmission lines, substations and other forms of fixed investment. But from the day when Mr. Samuel Insull first pointed out and demonstrated the true economies of central station load factors, transmission, distribution, and sale of electrical power, a radical change was wrought in such regard; this to the great advantage of the railroad companies and consequently to the public.

Since then, Mr. John D. Ryan has directly exemplified the same truths on an extensive scale through arranging for the Montana Power Company to furnish current to operate the electrified divisions of the Chicago, Milwaukee & Puget Sound Railroad, relieving the latter from the finance of a goodly portion of the fixed investment required, and in so doing also avoided unnecessary duplication of electrical generating plants and transmission systems throughout an extensive territory.

To be more explicit upon what has just been outlined:

As is well known by those familiar with the electrical industry, experience has demonstrated that with a generating plant of the same character and capacity, a central station company can, under ordinary working conditions, produce current at less cost than can a railroad company for its own individual uses. This because the former, from a greater diversity of power supplied, will have a higher load factor than does the latter. It will usually be found also that, to a greater or less extent, existing transmission and distribution systems of central station companies can be utilized for electrified railroad operation, or can be so expanded in connection with electrification as to enable the generating companies to supply additional current to others than the railroad. This condition, of course, contributes further toward making it possible for central station companies to furnish current to the railroads at favorable rates.

To take full advantage of what is possible in this last-mentioned respect, certain of the

largest and most progressive central station companies stand ready to finance and furnish all of the fixed essentials to electrified railroad operation, other than the comparatively unimportant items of working conductors, rail bonding, and local feeders. So the one essential to electrification, which the railroads would be called upon to finance when dealing with them, is electrified rolling stock. True, this is the largest item involved in electrification but it can be financed by the issue of equipment obligations such as have been mentioned. Where central station companies

are ready to make this possible for the railroad companies, the prospective financial return to the railroads upon their investment for electrification purposes will, in nearly every instance, be most attractive. When it is remembered that electrification is popular with the public, and that its introduction does evidence progressive railway management, can it not be considered to possess, in addition to the economic advantages now demonstrated, elements which will operate toward the creation of a more just public sentiment as regards the railroads than now exists.

NOTES ON RAILWAY ELECTRIFICATION

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The author, from a wide experience in electrification engineering problems, writes some interesting and most useful notes. He emphasizes the importance of dealing with the whole problem broadly rather than becoming enthusiastic over a single element of the whole scheme, and gives some logical reasons for the success of the direct-current locomotive. The data presented concerning the amount of non-revenue freight hauled in the shape of fuel for steam locomotive operation are of particular significance.—EDITOR.

During the term of years that the electric locomotive was on trial, and before it had carried conviction to both the designing engineer and railroad operator, it was natural that its physical characteristics should be most actively discussed. It was found early that steam engine construction as a precedent failed to meet the necessities of this new type of motive power, and that radical departure from established forms of construction was necessary in order to best utilize the larger possibilities available. With the growing appreciation of release from the traditional restrictions of steam engine construction, the electric locomotive took shape in widely differing forms during this developing period, and drew its power supply from a miscellaneous assortment of conducting, distributing and generating systems. Some of the experiments met with instant and continued success, obvious failure claimed a few, while others, after years of development spent upon them, cannot yet be finally classified as a complete success and duplicated in other installations, or proved a failure and relegated to the scrap heap upon which progress builds the advances of the future.

Laying the foundation stones of such a gigantic structure as the electrification of our steam railway lines calls for the broadest possible treatment of the needs of the problem, supplemented by a prophetic view of the possible future state of the art as fore-

shadowed by the universally recognized successes of the present. The locomotive, contact, distributing and power generating systems all form part of a completed whole and abnormal development of any one cannot but result in seriously disturbing the balance of the others. As a good example for illustration may be cited the adoption in certain instances of electric locomotives that demand single phase power supply at 25 cycles or even lower frequency, while general power distribution is universally accomplished by balanced three phase circuits. In certain restricted localities, 25-cycle power is available and can be purchased single-phase at the expense of installing suitable phase balancers and synchronous condensers, to correct the voltage unbalancing and poor power-factor that might otherwise prove disastrous to the success of supplying railway, lighting and industrial power from a common bus. The record of sales of the manufacturing companies for the past several years, however, indicates very clearly the tendency toward 60-cycle power generation and distribution. In fact, west of Chicago and all through the mountain districts where electrification holds out its greatest promise of return, no 25-cycle power is available, while 60-cycle transmission lines are being rapidly extended over wide areas and fed from generating stations of large capacity. Even in the east, the higher frequency power supply is increasing in a faster ratio than the lower,