

Electrification of Main Line Railroads

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This brief survey of the main line electric traction field will be of both interest and use to many of our readers. It is not burdened with many details, but gives in a compact form a picture of main line electrification already accomplished and contemplated.—EDITOR.

For nearly 30 years electrical engineers have discussed the advantages which would be offered to steam railway lines by electrical operation. The first lines which used this form of motive power were forced to do so by special conditions. Among these may be mentioned the Baltimore & Ohio electrification of 1895 through the tunnel under the city of Baltimore; The New York Central electrification in 1906 in the New York terminus; and the electrification of the Great Northern Railway in 1909 through the Cascade Tunnel. All of these developments were forced by the impossibility of carrying on traffic through the tunnels on account of the smoke produced by steam locomotives. However, those most interested in the subject have always maintained that the most important reasons for railway electrification lay in its economic advantages and that when these were really appreciated main line electrification on a large scale could be expected to begin. It is only within the last few years that this economic value has begun to be generally understood and this accounts for the present widespread interest in the subject.

The electrification of the Norfolk and Western Rwy. and of the Chicago, Milwaukee & St. Paul Ry. are illustrations of instances where sections of steam railroads were electrified principally for economic considerations. The Chicago, Milwaukee & St. Paul electrification is the most extensive in existence in any part of the world. Among those who have not seen it, it is not generally understood that in the mountain sections of the trans-continental lines of the Milwaukee Railroad there is a section in electrical operation covering four former steam engine divisions. From Harlowton on the eastern slope of the Belt Mountains to Avery on the western slope of the Bitter Roots there is a distance of 440 miles crossing the ranges of the Belt Mountains, the Rocky Mountains and the Bitter Root Mountains where all train movements, freight, passenger and switching, are carried on with electric locomotives. When one realizes that this is a distance comparable to that from New York to Buffalo or from Boston to Washington, he sees that it is an

application of electrification on a scale which is unknown elsewhere.

The power for operation of this railroad system is furnished by the Montana Power Company. It is principally derived from hydro-electric stations scattered over the State of Montana. Fourteen of these stations with an aggregate installed capacity of 175,000 kw. take their power from the watersheds of the Missouri, the Yellowstone and the Columbia Rivers and furnish power for a high tension transmission system which supplies light and power to various cities and industries through the state. Among these the 440 miles of the Milwaukee Railroad requires a maximum of 30,000 kw. and an average of approximately one half that amount. The records of operation of this line for the last five years show remarkable confirmation of engineering predictions. The amount of coal formerly used by steam locomotives on this section was at the rate of 400,000 tons yearly. Today the cost of electric power on these divisions is 52 per cent of the cost of fuel on adjacent divisions for the same service. The repair of motive power equipment is 45 per cent of that on adjacent divisions and the total cost of operation including the maintenance of trolley and substation attendance is 65 per cent of the cost of operation of similar adjacent divisions.

In addition to this section of 440 miles there is a second electrified section of 207 miles from Seattle east over the Cascade Mountains. When the intervening gap is electrified, as it will be within a few years, the Milwaukee road will have a continuous stretch of 1000 miles of track electrically operated.

With such a record of accomplishment and confirmation of predicted results, it is no wonder that there is a widespread interest in the subject of electrification of steam railroads.

The Illinois Central Railroad is now actively engaged in a study of the possibilities of electrifying its Chicago terminus, of handling all suburban traffic out its 12th Street Station with multiple unit electric trains, and of operating its through passenger trains and the freight in its switching yards with electric locomotives.

The Delaware, Lackawanna & Western is studying the electrification of its heavy grade sections in the neighborhood of Scranton, over which a heavy coal traffic is handled. If this electrification is installed, it will be extended to Jersey City to handle the passenger and suburban traffic radiating from New York City.

An Engineering Committee appointed by Congress last year has recently submitted a report on the so-called Super-Power Zone. This is a proposal to tie together in one general transmission system all the large power houses from Boston to Washington and to furnish from a common transmission system the power required for lighting, industries and railroads throughout that territory. There is nothing untried in such a plan. The zone from Boston to Washington extending 150 miles inland is similar in extent to that covered by the Montana Power system, although there is a vastly greater use of power in the Super-Power territory.

It is, however, very probable that other parts of the world may anticipate the United States in the early application of electricity to trunk line service on a large scale. The greater price of coal as compared with this country, the possession of coal by some nations and the necessity of its importation by others, and the existence of ample water powers in many of the mountainous sections of the world all contribute to this end.

In South America the Paulista Railway, forced by the high price of fuel, has electrified 28 miles of its line from Campinas to Jundiahy. The Government of Chile has recently placed a contract for the electrification of 142 miles of the Chilean State Railways from Valparaiso to Santiago. The Central Railway of Brazil is inviting tenders for the electrical equipment of its suburban lines radiating out of Rio de Janeiro, a total of 90 miles of route.

Italy has for a number of years used electric locomotives for handling its trains in the northern section and along the approaches to the Alps. The Italian State Railway system now has in operation or on order a total of 222 electric locomotives. The traveler from Italy to Switzerland is hauled by electric locomotives through the Simplon Tunnel, a distance of 13 miles. From Brieg at the Swiss end of the Tunnel he is taken by Swiss electric locomotives down the Rhone valley and through the Loetschberg Tunnel to Bern and the Lake of Thun, a distance of 55 miles. Switzerland with its entire lack of coal and abundant supply of water power is rapidly

extending its plans for railroad electrification. At present it is electrifying the line of the old route from Italy through the St. Gotthard Tunnel and the traveler will soon find electric trains on this route as far as the Lake of Luzerne.

The Scandinavian peninsula is another section where great interest is being manifested in electrification. In Sweden the heaviest locomotives in Europe are in operation inside the Arctic Circle and handling heavy trains of iron ore from the iron mines at Riksgransen to Kiruna, a distance of 78 miles. This line is now being extended eastward to the Baltic Sea and when completed will be 270 miles in length. In Norway the suburban lines from Christiania to Drammen, a distance of 25 to 30 miles, are now being electrified. Probably the next section to be undertaken will be a stretch of 25 miles from Riksgransen to the Norwegian port of Narvik, all of which is on a steady grade of 2.6 per cent.

France, with its war time experience of dependence on other countries for coal, has embarked on a definite program of electrification, which will require perhaps 20 years for completion. Power for this purpose is being developed from water on the slopes of the Central plateau of France. The Paris-Orleans Railway has for over 20 years handled its traffic from the Quai d'Orsay Station in the center of Paris to the Austerlitz Station, a distance of 2.4 miles, by electric locomotives. It is planned to extend this zone as far as Orleans, a distance of 78 miles, and orders have been placed for locomotives and motor cars. The Midi Railway, running across the southern section of France from the Mediterranean to the Atlantic at Bayonne and Bordeaux and serving numerous short branch lines running up into the valleys of the Pyrenees is planning to electrify a large portion of its lines and has ordered locomotives and substations. The Paris-Lyons-Mediterranean R. R. serving the eastern border of France, is also planning the installation of electric equipment of its lines, particularly on the lines extending up to the Mt. Cenis Tunnel where it connects with the electric lines of Italy.

The electrification plans which have been discussed above are not intended in any way as an exhaustive list of the studies which are being made on the electrification of steam railways, but they have been presented to illustrate the extent to which interest has been excited throughout the world by this very important department of engineering.