Power Station at Page, Arizona, on Lake Powell-altitude = 1.3 km (4300 ft). The purpose of this railroad is to haul coal from the Black Mesa Mine to the power plant. The Black Mesa and Lake Powell is the first 50kV installation in the world. The advantages of using 50 kV were overwhelming, since the number of substations required for this railroad could be reduced from three to one.

The latest electric railroads in the United States are two in eastern Texas operated by Texas Utilities Services, Inc., to haul lignite from lignite mines to power plants.

A final illustration of the significantly higher level of power possible with an electric unit and the greater overload capability of an electric locomotive compared with a diesel is found in the high-speed passenger locomotives that operate in the Northeast Corridor. These have a continuous power rating of 4.5 MW (6000 hp), with 7.5 MW (10 000 hp) available on a short-time basis for acceleration of the train. They have demonstrated a capability of accelerating a seven-car train from a standstill to 160 km/h (100 mph) in 2 min.

This may be seen as a golden opportunity but, when we realize that electrification of railroads has been in existence since 1895, our progress would have to be classified as not too great.

I would like to close with my opinion of what will happen. We will see electrification of the main trunk lines on western railroads. The economic considerations are favorable, and few will dispute the arithmetic. When will this occur? That is hard to predict. One of the key issues may well be the federal energy policy that is being put together now. We do not know what it will contain. Today we are in a wait-and-see position. When you consider what alternatives there are, it seems that railroad electrification presents one suitable means for the transportation industry to do its share in conserving energy.

# Financial Considerations of Railroad Electrification

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Several years ago, the Federal Railroad Administration organized a task force to study railroad electrification in the United States. The task force was composed of representatives of railroads, equipment manufacturers, electric utilities, and trade associations and government officials. The report of the task force (1) included the conclusion that, notwithstanding the technical feasibility and operating benefits of electrification, the principal obstacles to electrification in the United States were financial considerations. In particular, the following issues were named as having influenced decisions by railroads not to electrify:

1. Investment in electrification creates a long-term obligation for a railroad and thus affects its credit standing and ability to obtain capital for other necessary improvements.

2. The long-term earnings prospects for the railroad industry in general have not appeared to be strong in recent years. This has limited the interest in long-term railroad capital investments and precluded the opportunity to take full advantage of tax incentives when making large capital investments.

3. The economic benefits of electrification occur gradually over a long period of time, but the large investments necessary to initiate the flow of benefits must occur first and over a short period of time.

4. The investment of fixed electrification facilities may become subordinate to previous railroad mortgage commitments.

For a railroad, the issue of electrification is ultimately an investment decision that must compete with other investment opportunities for available funds. The amount of the investment is formidable. Current estimates by Arthur D. Little, Inc., indicate that the cost of a typical electrification system, including catenary, substations, communications, and signaling, would approximate \$95 000/km (\$150 000/track-mile). Double track would cost about \$155 000/km (\$250 000/mile). Assuming an average cost of \$125 000/km (\$200 000/ route-mile), the total cost of electrifying the approximately 16 000 km (10 000 route-miles) in the United States that have traffic densities of at least 36 Tg/year (40 million tons/year), which is considered necessary by some experts under current economic and technological assumptions to realize a satisfactory return from electrification, would approximate \$2 billion.

In addition to the electrification system, there would be the cost of the electric locomotives, although in some cases this would not require substantial additional investment but rather would substitute in large part for diesel locomotives the railroad would otherwise have to purchase. There would, however, be the added cost of structural changes in track conditions, such as bridge and tunnel clearances, and new investment in electric power facilities. These costs could be very large in some instances.

In sum, the total cost of a national program of electrification would be at least several billion dollars initially, with potentially greater sums required if electrification becomes economical for route segments that have traffic densities of fewer than 36 Tg/year.

It is clear that the railroad industry cannot possibly, with its own resources, finance such sums. During the last 10 years, capital expenditures by class 1 railroads averaged approximately \$1.5 billion annually, most of which was expended on rolling stock. Only about \$400 million/year was expended on roadway and structures. Electrifying the railroads would be the largest investment in roadway and structures the railroads would make since the laying of the original track in the nineteenth century.

The declining fortunes of the railroads and the diffi-

culties they face in meeting capital requirements, exclusive of railroad electrification, have been well documented. A recent study (2) by First National City Bank (Citibank) projected that from 1976 through 1985 class 1 railroads, outside the Consolidated Rail Corporation (Conrail) system, would incur cash outlays for capital expenditures, deferred maintenance, debt service, dividends, and taxes of \$21.1 billion in excess of internal cash generation (net income before depreciation and other noncash charges but after dividends) and proceeds from rate increases, which will have to be met either from new capital or additional profits. Of this amount, Citibank estimated that \$11.8 billion could be raised through traditional means of equipment financing, leaving a \$10 billion financing problem.

Allowing for alternative assumptions and Citibank's hyperbole as a major lender to the railroad industry and creditor of the Penn Central Transportation Company, the railroads will undoubtedly have difficulty meeting their capital requirements in the years ahead. This makes it unrealistic to expect them to finance, from their own resources, the substantial sums required for a national program of electrification.

On the other hand, it is clearly possible for particular electrification projects to be financed by individual railroads. Although significant benefits of electrification may be realized on a route segment as short as 320 km (200 miles), it is more typical for railroads to consider electrification of route segments of 800 to 2400 km (500 to 1500 miles) or longer. A longer route segment, other things being equal, will tend to yield a higher return on investment. Using an average cost of \$125 000/ km, an 800 to 2400-km system would cost \$100 million to \$300 million, plus the cost of electric locomotives, structural modifications of rights-of-way, and additional power facilities.

There are railroads that are in a position to finance such sums. For such railroads, the problem is not the availability of funds but rather whether the railroad wishes to use its financial resources for an investment of this type. The answer will depend principally on the projected return on investment. In these cases, the financing problem is a conventional one of how best to finance a large capital project. There are four principal options.

# FINANCING OPTIONS

# Sale of Mortgage Bonds

First, a railroad can consider the sale of mortgage bonds. In recent years, the amount of railroad mortgage bonds sold has been limited. The costs have been significantly greater and the terms of maturity sometimes materially shorter than those of comparable industrial issues. In general, institutional investors have been wary of railroad obligations except for equipment trust certificates, which provide special security to the investor. The principal reasons for this are the generally poor earnings of most railroads, the low return on investment, the long-term deterioration of balance-sheet ratios, the bankruptcies of the northeastern railroads, and the unpromising outlook for many companies.

In addition, the treatment of creditors of the bankrupt northeastern railroads under the United States Railway Association's Final System Plan, whereby the railroad assets conveyed to Conrail were valued at net salvage value and consideration was proposed to be paid in Conrail securities, will tend to discourage private investment in railroad obligations. Insurance companies in particular, which have historically been the largest buyers of railroad mortgage bonds, have been reducing their investment in the industry over a long period of time.

There is an additional problem in railroad mortgages the "after-acquired property" clause, which is a covenant in many existing railroad mortgages that typically states that all property hereafter acquired is subject to the lien of the mortgage. This means that a mortgage issued on a new electrification system may be subordinate to existing mortgages on the underlying track. In such circumstances, the railroad may have to add the electrification system to the lien of the underlying mortgage and issue additional bonds under that mortgage.

Notwithstanding the declining interest of investors in the railroad industry, there is a market for mortgage bonds of particular railroads. There are nine major railroads whose outstanding mortgage obligations are rated A or better by Moody's Investors Service, Inc. These railroads probably can sell mortgage bonds, although in more limited amounts and at higher costs than comparable industrial issues. In addition, some of these railroads are subsidiaries of holding companies that have substantial nonrailroad income from natural resources, real estate, and other activities. In these instances, long-term debt could be issued at the level of the holding company and invested in the railroad subsidiary as debt or equity.

# **Common Stock Equity**

A second option for financing railroad electrification is new common stock equity. There have been no railroad common stock offerings in recent years, although the Burlington Northern did issue convertible subordinated debentures in 1972 and is in the process of issuing convertible preferred stock. The absence of railroad equity offerings is due partly to the low price/earnings ratios at which most railroad common stocks sell and also to the limited appeal that such issues are believed to have in the marketplace. Nevertheless, an argument can be made that certain railroads might consider common stock to finance, in part, a major investment in electrification.

Electrification is a long-term capital investment with an exceedingly attractive projected return that lends itself to permanent equity financing. Moreover, the shares of certain railroads currently sell at prices of 7 to 11 times their earnings, which makes the sale of common stock not unduly expensive. In addition, there is, in my judgment, a market for such issues, principally among institutional investors. It is based on good earnings records, substantial dividends, a very positive investor appraisal of management, and favorable prospects for both rail (especially where coal is an important element of traffic) and nonrail operations. For these reasons, rail stocks have performed better than the general stock market averages since early 1976.

### Leasing

A third option for financing electrification is leasing. Leasing would have the advantage of permitting the electrification system to be financed by itself, unencumbered by existing railroad mortgages. This could be desirable in cases in which there are restrictions on additional indebtedness under existing mortgages or in which the collateral of existing mortgages has insufficient value to support the issuance of additional bonds.

Although there is some question as to whether, under the after-acquired property clause, title to property as closely connected to the underlying track as an electrification system can be secured to a lessor, it appears that there is a reasonable possibility that this can be done in particular instances.

The disadvantage of leasing is that it tends to be more expensive than debt financing because of the possibility of disaffirmance in the event of a bankruptcy. Moreover, the tax advantages of leasing may not be available for the leasing of most railroad electrification systems.

On April 11, 1975, the Internal Revenue Service published Technical Information Release 1362, which set guidelines for advance rulings on certain types of lease transactions. The release reflects a continuing policy to discourage lease transactions as a means of passing tax benefits on to passive investors. In particular, the release and subsequent rulings of the Treasury Department indicate that it will be difficult to obtain advance rulings with respect to special-purpose property that is expected not to be usable by the lessor at the end of the lease term except for purposes of continued leasing or transfer to the lessee. This would probably apply to most railroad electrification systems. Without an advance ruling, lessors would be reluctant to enter into a lease arrangement in which the tax benefits would be important to the lessor's total return.

One type of electrification project that may possibly be leased in a manner that passes the tax benefits to the lessor is an electrification system that is leased as part of the lease of a new rail line. It may be argued that at the end of the lease term the rail line, including the electrification system, would have value for a number of parties and consequently would be usable by the lessor for purposes other than continued leasing to the lessee. In such a case, the tax benefits of accelerated depreciation and the investment tax credit, which the railroad may not be able to use fully, may be passed to the lessor with benefits accruing to the railroad through lower lease payments.

In November 1976, the Financial Accounting Standards Board published Statement of Financial Accounting Standards 13, which requires that capital leases, which would typically include leases of railroad electrification systems, must be recorded at their inception as an asset and an obligation of the lessee and amortized in a manner that is consistent with the lessee's normal depreciation policy. Interest expense must be recognized in proportion to the remaining balance of the obligation. Such assets and obligations recorded under capital leases must be separately identified in the lessee's balance sheet, and additional information must be disclosed in the footnotes.

The statement of accounting standards for leases applies to all leases entered into on or after January 1, 1977. Although the new accounting practice will not change the economics of lease financing and the additional disclosures should not prove burdensome for most railroads, the inclusion of the lease obligation as a longterm liability may create problems for current indentures, which sometimes define indebtedness restrictions in terms of debt and other long-term liabilities under generally accepted accounting principles.

# **Project Financing**

Fourth, there is the possibility of financing a railroad electrification system through project financing in which the system would be jointly owned or financed by the railroad, the utilities that provide the power, and institutional investors and would be leased to the railroad and possibly, in part, to the utilities as well. Railroad electrification lends itself to project financing because of the limited financial resources of certain railroads and their inability to fully use the tax advantages of ownership. There are many variations of project financing, but the basic idea is to spread the capital requirements and risks of ownership among several parties. The railroad, of course, would have to forgo part of the return to obtain these advantages.

Project financing can be structured in different ways and is subject to various technical considerations under indenture restrictions, accounting requirements, and tax regulations. A principal advantage is that it can be tailored to the needs of a particular project. One factor that suggests that project financing may play an important role in financing railroad electrification is that the major insurance companies, which until now have not been active in this type of financing, are becoming more interested.

For each of the above means of financing a particular railroad electrification project, there are various factors to be considered, including the financial condition of the railroad, its projected internal cash flow, future capital requirements, the marketability of its debt and equity securities, its tax position, relevant IRS regulations, accounting considerations, and indenture restrictions. There is also the possibility that an electrification project would be eligible in part for tax-exempt financing on the basis of its contribution to pollution control. Circumstances vary, and each railroad must select the financing package that best meets its particular needs.

# NEED FOR GOVERNMENT ASSISTANCE

Financing a national program of electrification in the United States at a cost of at least several billion dollars is, as stated previously, simply beyond the means of the railroad industry. If it is to be done, it will require government assistance.

Although the federal government participates directly in the economy through fiscal and monetary policy, regulation of certain industries, public ownership, promotion and subsidization of various economic activities, and other ways, it does not, for the most part, unlike some other industrial countries, participate in the process by which investment capital is allocated among various sectors of the economy. The amount of capital invested in specific sectors of the economy, such as electric power, transportation, or natural resources, is determined privately, for the most part, through financial intermediaries and the capital markets.

There are exceptions. First, in areas in which the federal government owns economic enterprises, such as federal power projects, atomic energy plants, military manufacturing facilities, the Government Printing Office, and the Postal Service, the federal government does as a matter of course use its own financial resources to channel funds to particular areas of investment.

Second, there are areas of economic activity in which the risk to the investor is such that they do not attract the amount of capital from the private sector, at reasonable cost, that is deemed desirable. In such cases the federal government may undertake to use its own financial resources to lend directly or to reduce the risk of investing in those sectors through federal loan-guarantee or insurance programs.

There are a number of federal agencies that make loans or guarantee loans for private economic activity. Among the more important activities that benefit from these programs are housing, agriculture, and foreign trade. The federal government has also made direct loans to corporations. For 20 years, the Reconstruction Finance Corporation was the largest lender in the United States. In more recent years, the federal government has made loans to or guaranteed loans for the National Railroad Passenger Corporation, Lockheed Aircraft Corporation, and Conrail. The Carter Administration has also proposed an urban reconstruction bank to make borrowing easier for large cities.

In addition to direct loans and guaranteed loans, there are numerous federal agencies that insure investor risks. Perhaps the most important are the Federal Deposit Insurance Corporation and the Federal Savings and Loan Corporation. Other important federal insurance programs that directly affect the allocation of capital are undertaken for housing, shipping, agriculture, and foreign investment.

A third exception to the general rule of private allocation of capital is the case in which the federal government, through tax subsidies, undertakes to make certain types of investment more attractive by improving the after-tax return to investors. The most important instance is found in state and local obligations that are not subject to federal income taxes. In the natural resource industries, depletion allowances and capital-gains treatment of certain types of investments serve a similar purpose.

In addition to the above, any governmental promotion or subsidization of economic activity has an indirect effect on the allocation of capital insofar as it improves the capacity of a particular economic activity to pay a satisfactory return on new investment. Thus, the Interstate highway system, by lowering the costs of highway transportation, helps the trucking industry to attract capital, just as public improvement of the inland waterways helps the inland shipping industry to attract capital.

The question of whether the federal government should intervene in the allocation of capital for the benefit of a particular economic activity is an important one that has not been adequately studied or discussed. Historically, the federal government's participation stems from political circumstances rather than economic theory. Many of these programs originated in the 1930s when there was an obvious need to stimulate investment, especially in certain sectors of the economy. In more recent years, the issue has been considered in terms of how the economic and social benefits of investment compare with the costs of promotion or subsidization.

There are two new factors that prompt a more careful look at the costs and benefits of government intervention in the process of capital allocation. First, there is the enormous size of certain capital investments, particularly in the energy field, that may be desirable as a matter of national policy and beyond the means of the private sector. Second, there are risks attendent on certain of these investments (stemming from the unpredictability of the price of energy in the long run and other factors) that make such investments inappropriate for the private sector. In the case of railroad electrification, the size of the investment in relation to the financial resources of the railroads has already been discussed. Equally important is the uncertainty of the investment return to the railroads, since no one can predict the relative costs of diesel fuel and electric power over the next 30 years, though this will in a large part determine the rate of return of an electrification project.

As a matter of national policy, the benefits of electrification would seem to lie in the areas of energy conservation (or at least the conversion of a major use of energy from petroleum to coal and nuclear sources), ecological considerations, and more efficient railroad operations.

As an investment banker, I can point out that, if federal government assistance is to be effective, it must provide an incentive for the railroads to make the investment in electrification projects and also provide an inducement for investors to advance capital to the railroads for this purpose. At the same time, the assistance should not be in such a form that electrification projects with relatively low rates of return are undertaken.

Given these objectives, the best means of government assistance would appear to be federal guarantees of loans or leases made for the purpose of railroad electrification. A program similar to that administered under title 11 of the Merchant Marine Act of 1936 would seem workable. A federal guarantee would provide a strong inducement for investors to advance funds for electrification purposes, since the obligations would be backed by the full faith and credit of the federal government. At the same time, a federal guarantee would provide an incentive for railroads to make investments in electrification projects, since it would assure funds at a substantially lower cost than other long-term funds and consequently would improve the relative attractiveness of investment in electrification. On the other hand, federally guaranteed obligations would still have to be repaid, which would tend to discourage railroad investment in electrification projects that would have relatively low rates of return.

From the federal government's point of view, a program of federally guaranteed loans or leases would have the advantage of not requiring the direct advancement of funds. Moreover, it may prove not to be expensive. The federal government's experience with such guaranteed loan programs has been favorable.

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