predict the success or failure of the resulting policies. The impact of industry restructuring and regulatory reform has yet to be measured. Nor has the issue of current promotional policies and their impacts on transportation been addressed. The impact of restructuring, regulatory reform, and modification of current promotional policies would need to be assessed before electrification could be justified on the grounds of transportation policy.

SUMMARY

There are convincing arguments that electrification can have economic and energy benefits. These benefits are not, however, sufficiently large now to merit extensive private investment, particularly in an industry that has the economic characteristics of railroading. What might be interpreted as a failure of the industry to adopt the best possible technology is really the reflection of conditions in an industry that is already highly capital intensive, has difficulty raising capital, and cannot afford risky or marginal projects.

In these circumstances, major electrification has to await basic changes in the industry's financial condition, further research, and perhaps government-sponsored demonstrations to reduce uncertainty, as well as the resolution of the basic uncertainties surrounding national transportation and energy policies.

REFERENCES


A Financial View of Electrification


We talk earnestly about a national policy for energy, especially for a number of industries that are subject to substantial change. This certainly affects electrification of the railroad industry, but there may be even more changes in sight for the utilities.

The utilities are now large consumers of oil and thus add to the nation's burden in buying oil from abroad. But the utilities can pass the costs of that fuel through to the bills of their customers and can thereby comply conveniently and readily with environmental standards on stack emissions by burning higher cost low-sulfur oil. If, however, they were to convert to coal, they would have to make capital investments in new boilers or boiler conversions. These capital costs cannot be passed on to the customers on a current basis; only after increases in rates have been approved can they recover capital costs. Therefore the utilities' conversion to coal would present capital problems similar to those electrification presents for the railroads.

Long delays, often caused by regulatory agencies, inhibit the recovery of capital costs by the utilities, which in turn dilutes their return on investment over the life of the new plant. Although a 15 or 20 percent return on capital may be anticipated in several years, there is no return until well after the plant is put into operation unless adequate flows of funds are available at the outset. In fact, there is often a negative return because the cash flow that provides the initial capital investment, regardless of source, is diverted from the assets column of the balance sheet of the utility (or the railroad company) making the investment, especially if there is a long lead time until completion.

The present tax incentives for additional investment are an important part of this. They are being offered by the federal government as an aid to economic recovery. Currently, the railroad industry is generating about 8 percent of the total investment tax credit generated nationally. But because the resultant net rate of return on railroad investment is so low—and therefore taxable income is likewise so low—this investment tax credit has not been fully used. So the proposed increases in investment tax credit as an incentive to conversion may not necessarily stimulate future additions to capital investment for industries that already have a low rate of return.
The 1976 Railroad Revitalization and Regulatory Reform Act has helped greatly by raising the amount of usable credit to 100 percent of the tax bill, but this soon reverts to 50 percent under the new law. The investment tax credit for equipment finance is reduced. To meet the capital needs of conversion, not only for the railroad industry but for other industries with long-lived plants and insufficient or even no returns on the investment to be made to achieve a shift in energy sources.

Electrification studies appear to focus on two areas—an answer to the energy crisis and the possibility of achieving a more efficient railroad operation. But such studies may not deal adequately with the problems of accurately forecasting the probable rise in electricity rates. In the last few years the price of electric power has lagged behind the increases in the prices of diesel fuel by as much as 2 or 3 years. I have not seen any serious studies of the relative advantages of switching to another source of liquid fuel, such as the conversion of coal to diesel fuel.

I recently checked with some organizations that are heavily involved in coal research and fuel conversion. Although not much work has been done yet on the liquefaction of coal, there has been research on coal gasification. Of course, there has long been available the inefficient Lurgi process (45 percent loss in processing) for conversion of coal to gasoline; it is now used in South Africa and was once used in Germany during World War II. Given a large-volume requirement and full implementation of today's technology, coal could be converted to diesel oil for a sale price of 21 cents/L (80 cents/gal). That is obviously more than twice its present price but, in view of both inflation and the large market for diesel fuel outside the railroad industry, economies of scale and economies of total capital employment might well bring that price down. This alternative should not be passed over lightly, since it would not make obsolete our oil and oil-products pipelines and tankers already in service that convey much of the production we live on today. Thus, the continued use of an in-place facility may further reduce the overall needs for new capital.

The solution of our energy problem is of overriding national significance because everybody in the country personally benefits if oil imports and the loss of our present price but, in view of both inflation and the large market for diesel fuel outside the railroad industry, economies of scale and economies of total capital employment might well bring that price down. This alternative should not be passed over lightly, since it would not make obsolete our oil and oil-products pipelines and tankers already in service that convey much of the production we live on today. Thus, the continued use of an in-place facility may further reduce the overall needs for new capital.

The solution of our energy problem is of overriding national significance because everybody in the country personally benefits if oil imports and the loss of our present price but, in view of both inflation and the large market for diesel fuel outside the railroad industry, economies of scale and economies of total capital employment might well bring that price down. This alternative should not be passed over lightly, since it would not make obsolete our oil and oil-products pipelines and tankers already in service that convey much of the production we live on today. Thus, the continued use of an in-place facility may further reduce the overall needs for new capital.

The solution of our energy problem is of overriding national significance because everybody in the country personally benefits if oil imports and the loss of our present price but, in view of both inflation and the large market for diesel fuel outside the railroad industry, economies of scale and economies of total capital employment might well bring that price down. This alternative should not be passed over lightly, since it would not make obsolete our oil and oil-products pipelines and tankers already in service that convey much of the production we live on today. Thus, the continued use of an in-place facility may further reduce the overall needs for new capital.

The solution of our energy problem is of overriding national significance because everybody in the country personally benefits if oil imports and the loss of our present price but, in view of both inflation and the large market for diesel fuel outside the railroad industry, economies of scale and economies of total capital employment might well bring that price down. This alternative should not be passed over lightly, since it would not make obsolete our oil and oil-products pipelines and tankers already in service that convey much of the production we live on today. Thus, the continued use of an in-place facility may further reduce the overall needs for new capital.

We can now say that the strong railroad companies have more recently been able to sell new issues of mortgage bonds very successfully. Southern Railway Company sold $75 million in first-mortgage bonds at 8.5 percent interest and Southern Pacific Transportation Company followed, in a slightly better bond market, selling $100 million at 8.2 percent; both were A-rated bonds. We can now say that the strong railroad companies have
reestablished their ability to raise major capital in the nonequipment market in spite of the record of the last 6 years in the bankrupt Northeast.

But now we are talking about installing today's electrification technology. This is something new—new transmission-line values, new kinds of locomotives, and an economic scene greatly changed from the 1930s. It is called project financing in the investment community rather than just routine underwriting. In other words, its financing would have to be put together and supported by technical expertise. The confidence and motivation of management would have to be behind it before a sufficiently large group of investors could be attracted.

On the brighter side, today's financial outlook for the railroad industry deals with a dozen strong railroad companies that are well managed and have improving finances. We look forward to the possibility that their equities may now grow faster on a net basis after the payment of dividends and repayment of debt, and we need more of this. But as of today, it is still premature to count on the private sector to finance electrification. The rest of my presentation will deal with questions.

**QUESTION:** How does the highway mode compare with rail for financial viability?

**ANSWER:** Highway construction and maintenance have a much broader base for sources of funds. The huge federal and state highway-user charges collected over the past several decades have virtually funded the whole highway system on a pay-as-you-go basis. As for the motor carriers, they are extremely efficient users of capital. A small amount invested in capital produces high revenues. The best example is Roadway Express, which has no debt. It meets all its capital needs from internally generated cash and, at the same time, has sustained a 20 percent growth rate in net income for the last 20 years.

The relative ease of highway financing is very difficult to duplicate. Where else is there such a broad base as the fuel tax and users as willing to pay for results? Since highway-user charges are collected and are collected by governments, the magnitude of those sources and the relatively light burden felt by the individual payer—the motorist—are nearly hidden. One must not overlook the significant decrease in cost entailed in financing on a pay-as-you-go basis—there is no interest expense.

**QUESTION:** Can you elaborate on your expectations that the railroad industry can improve its ability to finance expansion?

**ANSWER:** There are several strong companies today; others are coming along. A great deal of the weakness that remains is in pockets of underused or misused assets, particularly the freight-car fleet, which produces zero or less return on investment overall, and those segments of routes in weak carriers' hands that are underused because they are not in a high-density system. For instance, the current treatment of demurrage charges produces thousands of car-days a year that are not charged for because one kind of car receives fast unloading in order to offset it against another kind of car that has been ordered for outbound loading but is used in the interim to move the trash around the plant for a while before being loaded out. That kind of drain on railroad earnings is wasteful of railroad assets and perpetuates high freight rates. Demurrage charges themselves start too late and are too low. Two free business-days per load is too much; demurrage rates should pay a sufficient return to the car owner to compensate not only for his investment but also for his potential loss in operating earnings from a loss of revenue days.

In attempting to segregate the return on investment in freight cars from that in locomotives and track, we found in one instance that the return on investment in the rest of the railroad, including the locomotives, was three or more times the return on investment of the railroad as a whole; there was virtually no return on the freight-car fleet. And yet the asset value of the freight-car fleet was by far the largest amount on the balance sheet. Better management of the fleet through the proper use of computer technology, such as the Missouri Pacific Lines are now doing, and giving the shippers no more than one 24-h period free of a realistically high demurrage rate will make a significant improvement in railroad earning power, help reduce the growth of equipment debt, and thus make room for more nonequipment financing capability. Equipment financing has been a relatively sure thing for more than a century, even without any known rate of return on the assets that secure it.

But we need to be able to look at the rate of return on invested capital in the railroad itself after the electrification is installed. We also need some way to finance the long lead times that greatly drain cash flow during the construction years and the early years of little or no return on that investment. Some form of a tax-exempt security or even a non-interest-bearing loan during the first 10 or more years would hasten the installation of electric systems. But we still have no separate financial information on the freight-car fleet and its return on investment versus the rest of the railroad system. More than half of the debt and half of the assets of the industry are now tied up in freight-car financing.

**QUESTION:** Could you discuss further the joint use of utility and railroad power sources?

**ANSWER:** We have not heard much discussion about the gain from optimal utility plants. There may well be a quantum improvement in the utilization of a power plant built to generate railway electric power with maximum efficiency in the demand area as long as there is the opportunity to sell the surplus power. I suggested this to some utility people, but they are cool at this time to the idea of "co-generation" for a number of reasons, including the complications caused by possible alteration of the jurisdiction between the 50 state regulatory bodies and the Federal Power Commission and the fact that the privately owned and operated electric utility has to look to its own rate-base growth for all of its rate relief. But these are problems worth studying and solving, if we can get a stable source of cheap power.

**QUESTION:** Would not simplification in the terminals cut the amount of no-return investment in an area like Chicago?

**ANSWER:** I do not know about consolidation in Chicago specifically, but I have heard that idea put forth generally in the last few years as a way to reduce the amount of capital investment by the railroad industry. The utility people, however, after the fuel crisis, the 1975 recession, and the credit crunch are no longer looking for anywhere new customers. They have scaled down their own forecasts. They now have major problems caused by regulatory delay in getting their own rate of return on investment to acceptable levels before adding the burdens of new construction. They have the same cash-flow problems railroads have; they also have a continuing financing problem with the same constraints of debt-equity ratios and continuing heavy demands for all forms of new capital. Unlike the railroads, the utilities do have mandatory debt standards in their indentures, one
of which is that they do not have to build any more power plants if they cannot maintain earnings of twice the amount needed to cover their interest expense. But that is about the only protection they have from being forced to invest, a factor that may not be enough to prevent eventual disinvestment.

QUESTION: Do electric utilities have to add capacity?  
ANSWER: Yes, the utilities have to build additional capacity if the demand is there. That is the quid pro quo for getting a rate level that pays an adequate return on both new and old investment.

QUESTION: How have the utilities been able to do so well in the past?  
ANSWER: There are several factors. The overall growth in demand for additional electric power has been constantly heavy for several decades, which has inspired confidence in the long-term financial outlook. Improvements in efficiency in generation and transmission of power have also helped, especially through economies of scale. There has been much less overall pressure at the level of the user; consumers have enjoyed their larger disposable incomes, and their relatively low electric bills have reflected cheap and abundant fuel, until the fuel crisis. The costs of financing were relatively low before the period of runaway inflation. Much of the difference between individual electric utility companies in financing costs ultimately reflects the unevenness and myopia of the many different regulatory bodies. Until recently, the utilities have enjoyed a physical growth in the demand for power that has continually enlarged the cash flows over the historical life of the assets as a whole. But now that future growth rates are flattening to well below earlier projections, the incremental cash flow is no longer there. That puts another light on the subject.

QUESTION: How about using peak capacity for railroads as utility customers?  
ANSWER: Although the rails do operate around the clock, the pressure at the grass-roots level now is to give preferential treatment to the residential consumer; the industrial consumer is to become the incremental user and pay the higher rates. This is in part due to rising political pressures on public service commission regulators because of inflation and taxes that further erode the individual's take-home pay and disposable income.

QUESTION: What implications are there in the way the case of the Penn Central Transportation Company has evolved?  
ANSWER: The large creditors of the bankrupt railroads are quite disturbed by the very low values placed on the properties in the Final System Plan (FSP). They feel that railroad credit has been badly treated. This is particularly true of the life insurance companies that, after investing for the long pull, have been squeezed unnecessarily as a result of a crisis that is well short of the maturity date on much of the debt. The result of the FSP was enough to warn them that this was no longer debt suitable for a fiduciary. Their posture was made public in a letter of October 17, 1975, from James H. Torrey, the chief investment officer of Connecticut General Life Insurance Company, to several railroad presidents and investment bankers. A year later, as I mentioned, two prosperous railroad companies came eventually interested in debt than in stock or real estate as a result of the passage of the Employee Retirement Income Security Act (ERISA) in 1974.

Indeed the world of responsible financial management is moving toward more professionalism and financial prudence and away from faith and higher risk. So I cannot therefore be more specific in my answer because I do not know the specific kinds of institutions that bought the Southern Railway Company or the Southern Pacific Transportation Company bonds. This is private information, except for life insurance companies. But because the issues were successful—and I know they were quickly sold out and were oversubscribed—the railroad industry has made a significant recovery in its long-term credit.

QUESTION: How do the utilities compare with the railroads in their financial needs?  
ANSWER: Since I am a railroad analyst, I cannot speak too much about the utility industry; others follow it more closely than I do. However, I gather the experience with nuclear plants has been disappointing—cost overruns and unreliability of performance. Second, the external financial requirements of the utility industry are generally far larger each year than even the highest estimates for the railroad industry. Third, the often-asked question about the current size of the capital market is most honestly answered by saying that it is constantly changing in response to rates of savings by the U.S. population. When this is eroded by high taxation, inflation, or both, the sources of capital are seriously impaired. It is also related to prevailing monetary and fiscal policies and to the competition for funds. If the rate of inflation stays down, the capital market, even if it does not expand, can become more willing to take longer term risks, which puts money to work over a longer period and hence makes more efficient use of capital.

The long life of the assets is one of the inherent advantages of the railroad industry and of its electrification, especially when it is financed with fixed-rate long-term debt. Fortunately, railroads have not been heavy users of short-term debt (10 years or less) and thus have not felt the changes in the prime rate as it reflects changes in monetary policy. The improving cash reserves in recent years have permitted railroads to increase their earnings from short-term investments. As you may remember, not long ago business in general had borrowed heavily from the banks. Then it got caught when the prime rate started to climb as monetary policy was aimed toward forestalling the beginnings of the 1974-1975 recession. Then another change occurred gradually as a by-product of the 1974 passage of ERISA, which directed the management of employee pension funds to assume more responsibility and inevitably procure better grade securities. As to the competition for funds, the stronger railroad companies are improving their ability to participate in the private capital market, up to a point. But eventually both they and the industry will have to improve their rate of return. The core problem hinges on how much new equity will be generated, especially internally, so that there is a base for more debt. But if this trend goes the other way, so that the market substantially reduces the book value, the whole capital structure of the company is eventually threatened.

QUESTION: Can you elaborate on the cost of 21 cents/L (60 cents/gal) for diesel fuel made from coal?  
ANSWER: This is a ballpark figure that needs to be explored more thoroughly as an alternative to electrifi-
A Government View of Electrification

Thomas G. Allison, U.S. Senate Committee on Commerce, Science, and Transportation

The subject of railroad electrification in the United States presents something of a dilemma for those working in policy-making positions in the government. On the one hand, it is relatively easy to find statements supporting electrification made by both members of Congress and the executive branch. On the other hand, when measured against the progress made since the 1930s in electrifying heavy-density main lines in this country.

One reason for the lack of progress could be that the benefits of electrification have been somewhat overstated at times. In an article in Trains in 1946 (1), an electrification engineer was asked whether the electrification of the Pennsylvania Railroad had been successful:

"The answer is yes," he finally said, "but I am wondering just how to make the point clear. Perhaps this does it: It was the Pennsylvania Railroad electrification which, more than anything else, kept the government from taking over the railroads in this war as it did in the last. One might even say that if the Pennsylvania's eastern lines had not been electrified, we might have lost the war."

Asked to amplify, he continued, "The traffic to the central eastern..."