Infrastructure investment: the key to U.S. productivity

by Steven Bardwell, Military Editor

Alexander Hamilton, in his famous 1791 *Report to the Congress on the Subject of Manufactures,* outlined a program for the encouragement of industry which is sorely needed in the United States today. Hamilton defined what Henry Clay was to call 37 years later the American System of economics, a combination of:

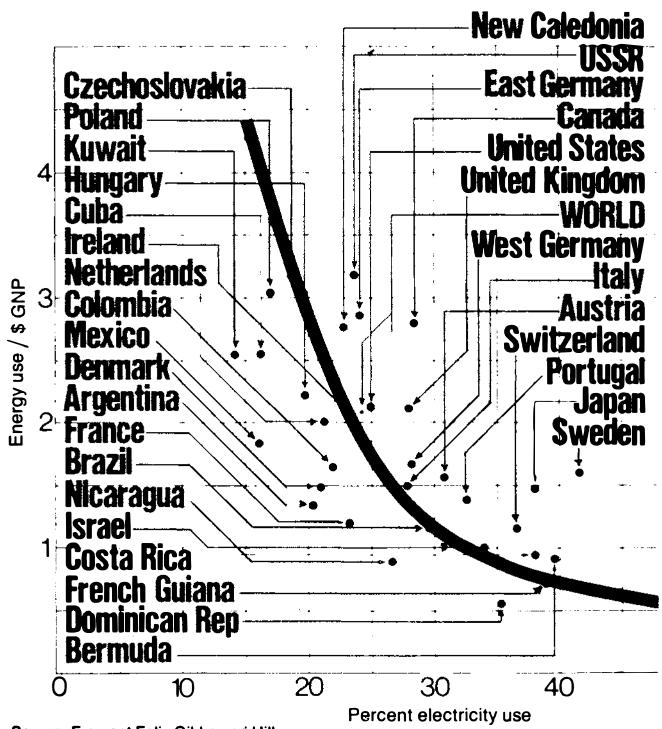
1) protective import and export regulations;
2) "encouragement of new inventions";
3) cheap and plentiful credit; and
4) "good roads, canals, and navigable rivers . . . the greatest of all improvements."

"Domestic improvements" remained for the next 75 years the centerpiece of economic policy for the group of American System economists who guided American industrialization. The results of a recent study by the economics staff of *Executive Intelligence Review* point to the efficacy of this plank in the American System platform today. The *EIR* study employed the computer model developed three years ago by a team of Fusion Energy Foundation researchers under the direction of *EIR* Founder and Contributing Editor Lyndon H. LaRouche, Jr. The computer model, known as the LaRouche-Riemann model, is designed not only to simply measure an economy's current performance, as are most conventional input-output models, but also to analyze the economy's ability to generate a profit to suport its activities and to reproduce itself at a higher level of applied technology and labor productivity.

The study's results have confirmed with amazing detail the importance of domestic improvements to the national economy, and most emphatically, have indentified the lack of such improvement (or infrastructure investment, in more modern terminology) as a central cause for the current disastrous situation of U.S. industry. Even more dramatically, the study results demonstrated renewed infrastructure investment on a broad scale by the federal government to be the most efficient ingredient in a program to re-industrialize the United States.

The LaRouche-Riemann model study, described in detail in the following article, showed that the decline in U.S. infrastructure investment since the late 1960s is closely correlated with the decline in the economy's productivity growth (measured in output per manhour) and in the thermodynamic efficiency of the economy (as measured in terms of tangible profit divided by tangible consumption plus depreciation). This correlation is especially striking during the past 15 years, in which productivity changes have not been correlated with capital investment, research and development expenditures, or other common measures of economic progress. More important, however, is the second conclusion of this study: investment in infrastructure in the United States, especially large-scale water control projects in the Western states and rapid expansion of the nation's electrical grid, is the most efficient and dynamic way of re-invigo-

Figure 1
Relation of energy efficiency and percent energy use



Source: Fremont Felix, Gibbs and Hill

rating our depressed economy.

Presenting the results of its study this February to an audience of local, state, and national leaders at a National Democratic Policy Committee-sponsored conference on water resources in Houston, Texas, the *EIR* team elaborated the high points of the NDPC's two-track program for gigantically increased infrastructure development in the United States. Track one consists of a massive water control and infrastructure project for the American West, modeled on the 1964 proposal of the Ralph M. Parsons Company known as the North American Water and Power Alliance (NAWAPA). The original NAWAPA project would have, at its conclusion, provided water and water transport for the western half of the United States, doubled the irrigated acreage for the entire country, created a new north-south inland waterways transportation grid, and generated 60 gigawatts of additional electrical energy generating capability. In the third section of this report, Sylvia Barkley evaluates both NAWAPA's current feasibility and the project's economic impact.

Track two of the National Democratic Policy Committee plan is crucial, the *EIR* specialists stressed, as it consists of an aggressive acceleration of construction of nuclear power generating capacity in the United States, leading to the completion of 150 gigawatts of new electrical capacity from nuclear installations by 1990. Momentum from a crash program of nuclear-energy development between now and 1990 would carry the United States through to the end of the century with a high rate of electricity growth which would have highly beneficial effects on the productivity of the economy as a whole.

The historical precedent

The central importance of infrastructure development was well known to the first American economists. Alexander Hamilton identified the interrelated issues:

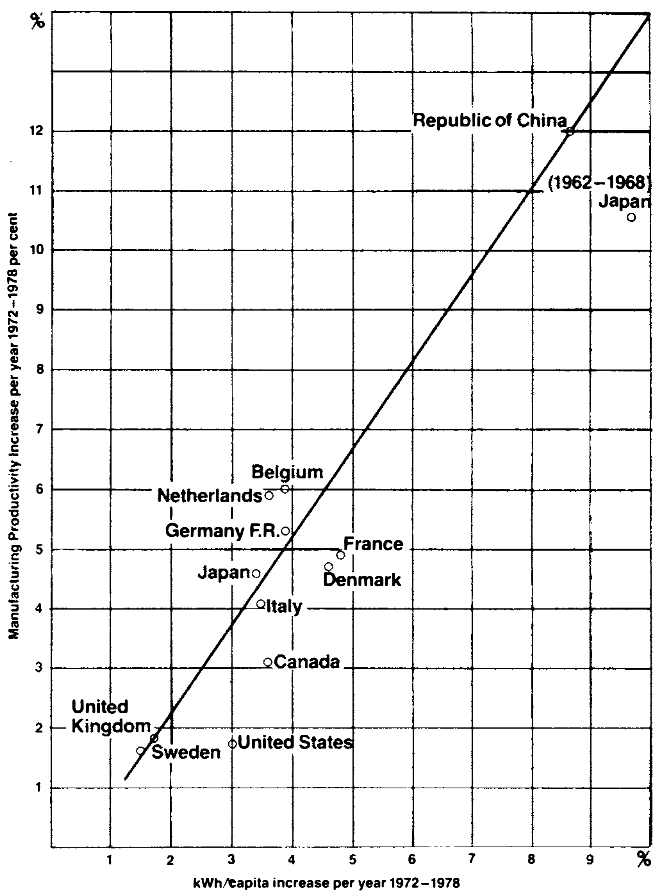
> Improvements favoring the facilitating of the transportation of commodities intimately concern all the domestic interests of a community; but they may without impropriety be mentioned as having an important relation to manufacturing. . . . There can certainly be no object, more worthy of the cares of the local administrations; and it were to be wished, that there was no doubt of the power of the national Government to lend its direct aid, on a comprehensive plan. This is one of those improvements, which could be prosecuted with more efficacy by the whole, than by any part or parts of the Union. There are cases in which the general interest will be in danger to be sacrificed to the collision of some supposed local interests. Jealousies, in matters of this kind, are as apt to exist, as they are apt to be erroneous.

Hamilton summarizes very neatly the basic political issues of infrastructure: it must be national in conception, centrally directed in execution, and evaluated in terms of general returns to investment, not local or private profitability. As Sylvia Barkley shows below, these issues of national planning and direction are the most difficult prerequisites for a competent infrastructure plan for the next 20 years.

The economics of infrastructure is surprisingly subtle, and it is a tribute to the genius of the American System economists that they so early identified the crucial nature of improvements in communication, transportation, and storage of commodities. First of all, infrastructure does not produce output or contribute directly to the production of output. Transportation, communication, warehousing, and energy transmission do not produce "value" as value is defined by the classical economists; the way modern market economists insist on jumbling the economic activity of these

Figure 2

Relation of productivity growth and electricity growth



Source: Fremont Felix, Gibbs and Hill

sectors with the rest of the economy as either a service or industrial sector is an indication of the shoddy thinking characteristic of modern economics.

As Hamilton and his successors deduced, infrastructure produces not output but *productivity*. The historic particulars of this hardly need restatement: infrastructure improvements speed the rate of commerce and accelerate turnover of commodities; they lessen necessary inventories; they cheapen the cost of raw materials; they expand available markets; they create new manufacturing processes dependent on rapid turnover; and they increase the efficiency of an economy by increasing the reliability of all transfer of goods and services.

This increasing economy-wide throughput has a profound meaning in terms of the thermodynamic efficiency of an economy. Here, we note two additional aspects of this question. First, an acceleration of the average velocity of transactions in an economy—either through improved communications or improved transport—provides a "hidden" source of productivity growth. This effect has been brutally shown by the effect of transport deregulation in the United States. Deregulation of the trucking and airline industries, according to a June 1979 study by *EIR*, was projected to result in an approximate 2 percent decline in average U.S. productivity because of delays in shipments, increased inventories, declines in reliability (that is, increases in thefts, illegal shipments, and hijacking), and shutdown of smaller routes.

The basis of this projection was a theoretical analysis of the role of infrastructure which showed that improved productivity in transport was mathematically equivalent, in engineering terms, to speeding up the economy. The computer model showed that a drop in transportation productivity was equivalent to slowing down the rate of time for the overall economy. Looked at in "real time," the economy was experiencing a decline in productivity. It is as if the transfer lines and conveyor belts in an assembly plant were slowed down—not only slower production schedules result, but new inefficiencies, mismatches between time-phased production steps, and the like. Improvements in transport, especially transport of raw materials and energy, function positively in the same way.

It is instructive to note the role of the massive infrastructure projects of the 1930s in the recovery of the U.S. economy during the war. Without the electrical capacity of the Tennessee Valley Authority, not only would Southern industry not have grown, the atom bomb would not have been built. Southwestern agriculture was built on the harnessing of the Colorado River from the same period. The existence of New York City as a modern urban center during the 1950s was a result of the Works Progress Administration reconstruction of the city's infrastructure.

Infrastructure in the form of transportation and water control falls directly under the theoretical analysis provided by the early American System economists. The role of energy in infrastructure is more complicated. It is the conclusion of several LaRouche-Riemann model studies that energy in the most general sense is *not* similar in quality to infrastructure but that electrical energy *is*. Hence, the emphasis on the growth of U.S. nuclear-based electrical generating capacity by 150 gigawatts by 1990.

Energy and infrastructure

A useful point of reference for this unique infrastructure role of electricity is a paper delivered by Fremont Felix at the 1980 Economy, Energy, and Electricity Conference held in Toronto, Canada. Felix, a consultant to Gibbs and Hill Company, studied the impact of the 1973 rise in oil prices on the consumption of energy in the industrial countries of the world. His conclusions illuminate the difference between energy in general and electricity in particular.

1) Figure 1, taken from Felix's study, plots the percent of energy used in the form of electricity in a country against the total energy per dollars of GNP. There is a very close *inverse* relation between the two. That is, greater energy "efficiency" in an economy is associated with a higher technological level of that energy consumption. *The higher the proportion of electrical energy in a country's energy budget, the more efficiently energy is used overall.* Note that this relation holds without regard to the overall level of economic development of the country—the Dominican Republic falls on the same curve as West Germany.

This demonstrates that the much-vaunted decline in energy use per unit GNP that occurred over the past decade is closely related to rising electricity use rather than conservation or other such measures. Many commentators have claimed that the final arrival of the post-industrial society is heralded by the decreasing energy content of GNP over the period of rising oil prices. This "decoupling" thesis has been the source of much evil speculation about the efficacy of conservation, the desirability of service-oriented economies, the necessary demise of heavy (and energy-intensive) industry, and the like. Felix shows, on the contrary, that there is a direct inverse correlation between the energy per unit GNP and electricity consumption.

2) *The growth rate of electrical energy is very closely correlated with the growth of GNP per capita.* For the same period, Felix derives a close relation between electrical-energy use and growth in output at a point when total energy use becomes almost totally decoupled from output growth. he formulates what he calls the "4-6-2.2 law": 4 percent growth for GNP per capita is associated with 6 percent growth in electrical consump-

tion per capita, and with 2.2 percent growth of total energy use per capita.

Felix comments: "Electricity growth is, practically by itself, the 'locomotive' of GNP growth, whereas non-electric energy, while basic to the economy, has very little relation to growth. At this time, we note that the growth in electricity use must either outpace economic growth by two percentage points or progress as a 50 percent faster rate, as the case may be." Felix's data for the 41 countries with the highest rates of GNP per capita growth during the 1970s show this pattern in every case with the exception of the East block countries. For these economies, there is a "5.4-5.4-3.1" law, a difference which Felix ascribes to the higher proportion of industrial investment (as opposed to consumer goods investment) in the East bloc economies.

Felix draws the following conclusion concerning the overall importance of electricity growth: "To those who would write off growth in electricity use as a luxury to be dispensed with, the above is a powerful reminder that whatever limitation is placed on electricity growth will amputate economic growth correspondingly."

3) Even more important
Felix finds *a close relation between productivity growth and growth in electricity consumption.* Figure 2 (also taken from the Felix paper) shows this relation for the major industrialized countries—those with the higher growth rates in productivity also have the higher growth rates in electricity consumption. Especially striking is the position of Japan, averaging productivity growth rates of approximately 10 percent a year, along with electricity consumption growth rates of 10 percent a year. This connection is the most indicative of the infrastructural nature of electricity production and consumption. Electricity is more than a source of energy, or a form of energy delivery. Its use qualitatively modifies the environment for all economic activity: *it produces productivity.*

Felix's conclusions regarding the cause of this extraordinary property of electricity are illuminating:

> Electricity, unlike any other energy source, is the end-product of a complex thermo-mechanical-electrical conversion process which delivers not just another fuel, but a finely elaborated, highly sophisticated form of energy. . . . Among the qualities of electricity that can be cited: the higher productivity, flexibility, and versatility of electricity at the point of use, the better working environment it creates, the contribution of electricity to innovative processes, the methods, designs, technological advances, and improvements towards the creation of new products, which, besides creating new jobs, conserve energy, reduce costs, improve quality, and enhance reliability.

The LaRouche model charts a path for industrial growth

by Sylvia Barkley

The importance of infrastructure—highways, power plants, waterworks—is appreciated by anyone who has been responsible for moving a factory, or even a family, to a new location. Most econometricians, however, lack such experience in how the real world works. By and large, they assert that infrastructure investment and maintenance should be assessed in relationship to the rest of the economy as an expense which produces little or no new value.

The LaRouche-Riemann model's computer analysis of the effect of infrastructure investment on the functioning of the U.S. economy demonstrates just the opposite: that investment in inland waterways, water delivery systems to farms, industries, and cities, and the rest of the "domestic improvements" encouraged by American System economists of the 19th century benefits overall economic productivity.

In order to assess the effect of the water- and nuclear-

Figure 1
Average U.S. infrastructure investment, 1960-80
(million constant U.S. dollars)