Science & Technology

U.S. steel can leapfrog ahead

by Marsha Freeman

The following report is based on a policy outline to be presented Aug. 1 by Citizens for LaRouche, the campaign organization of Democratic presidential contender Lyndon H. LaRouche, Jr., to the national convention of the United Steelworkers in Los Angeles, California.

Continued contraction of the U.S. steel industry will mean that nearly 40 percent of domestic steel needs would have to be met by imports in this decade, according to a recent report by the Congressional Office of Technology Assessment.

This projection assumed only modest growth rates of less than 2 percent per year in steel demand. Such a policy would put American industry into the same dependence on steel imports we now have on oil.

Is current underinvestment in the steel industry justified? Can U.S. economic viability and national security be maintained if steel is phased out as a "sunset" sector? The actual question is a broader one: whether the United States will gear up for the next generation of advanced energy and industrial technology, and for the exports the rest of the world needs.

Currently, U.S. deployment of *already available* improvements in basic steelmaking is the lowest worldwide. Energy-saving continuous casting accounts for 50 percent of Japanese production, 29 percent of European production, and 15 percent of U.S. production. Almost a fifth of America's basic steel production uses 19th-century open hearth furnaces, which have been totally eliminated in Japan. Of 190 U.S. blast furnaces, only five are classified as "large," while in Japan the total is 37 out of 72. U.S. steelmakers are not even taking advantage of economies of scale; the largest integrated steelmaking facility has a capacity of 8 million tons, compared with 18 million ton mills operating in Japan.

Reversing the technological stagnation of the 1970s requires preparations for 21st-century technologies. Reconstruction of American transport, energy and industrial infrastructure over the next decade will require a renaissance in the nation's ability to produce the most important and versatile construction material—steel.

Each conventional nuclear power plant requires 30,000 tons of basic carbon steel. Electrical power to rebuild and gear up U.S. industry requires 1,000 gigawatts of nuclear capacity on line by the year 2000. An equal number of new coal-burning plants will be needed. And if the United States decides to help modernize and reindustrialize the developing nations, the task will involve exporting nuclear power plants in the range of 1,500 units during the same time period. The nuclear component of this energy program will alone need over 158 million tons of steel in the next 20 years and more than 25 additional tons of alloy steels for domestic and foreign nuclear plant production.

One of America's chief international responsibilities is meanwhile to feed a good part of the world. A water development project on the scale of the North American Water and Power Alliance (see Economic Survey) will require 40 million additional tons of structural steel over its 10 to 15 year construction period.

Expanded ports and a modern railroad and inland waterway systems are crucial. The need for more than 300,000 new locomotives and freight cars will already bring railroad requirements for steel to over 10 million tons.

Therefore, it seems obvious that a crash program of greenfield construction using continuous casting, direct reduction, economies of scale, and other off-the-shelf technology must be initiated immediately. But at the same time, the United States can prepare to *leapfrog* the technologies now applied in Japan and West Germany.

Hundred-year-old plants should simply be phased out, not retrofitted. If more productive and energy-efficient technologies are brought on line, there will be no problem in meeting reasonable environmental standards. In an integrated steelmaking facility, for example, the top gas can be enriched and used as a chemical feedstock, rather than vented as a pollutant.

Energy transformation

The most important revolution in steelmaking to be developed for commercial application in the 1990s is in the field of energy. The nearest-term potential is in the application of nuclear-produced process heat and electricity for both carbon and alloy steels. Separating steelmaking from its current dependence on metallurgical coal will provide much greater geographical freedom in the siting of new steel mills, in addition to reducing total energy requirements for processing. This freedom in turn slashes transport and other overhead costs, while creating new employment opportunities.

One application currently under development in Japan and West Germany is the use of high temperatures (1400-2000°F) from advanced high-temperature gas-cooled nuclear reactors as a replacement for the combustion of fossil fuels to heat iron ore for direct reduction processes. Beyond this, the United States can take the lead, through an immediate cooperative program among the nuclear, chemical and steel industries, to bring the thermochemical and electrolytic production of hydrogen from water with nuclear energy into commercialization. The substitution of hydrogen, which is inexhaustible, for natural gas and coal as reducing agents in direct reduction will cut energy needs; and using nuclear power for 100 percent of energy input in steelmaking will free future steel production from its historic hydrocarbon base, freeing reserves for chemical feedstocks. At the same time, engineering R&D can be placed on a crash mobilization to bring plasma-based steelmaking technology on line by the turn of the century. Small-scale demonstration of high-temperature fusion plasma-based processes should be tested on a pilot scale as modules with fusion test reactors in the next 10 years.

Fusion's real promise is the direct use of the plasma itself in materials processing; low-temperature plasma steel melting is currently in commercial use in East Germany and the U.S.S.R. for high-alloy specialty steel. With fusion energy, however, a plasma will not have to be produced from an inert gas with tremendous energy input, but will be available from the fusion process itself.

Plasma reduction with fusion will not require the intermediate step of producing the hydrogen reductant. The charged particles of the fusion plasma are drawn off into a container and reacted directly with iron oxide particles. At the same time, other alloying materials can be added to this "fusion torch" to allow one-step steelmaking for the first time in history.

One important way to gain immediate experience with high-temperature plasma processes for the steel industry is to incorporate such technological development into the ongoing magnetohydrodynamics research program in the United States. Producing a 4500°F plasma from coal, MHD can be used both as a source of electrical power and a source of carbon-based plasma for steelmaking.

The current state of steel

U.S. steel production has been in a state of decline since the late 1960s. Peak production of 136.8 million tons in 1973 ran the industry at near full capacity, while total capacity in the late 1960s had hovered near 160 million tons. At the end of June, the American Iron and Steel Institute reported that the industry was running at 59.2 percent of capacity! Yearly production for 1980 will probably fail to reach 100 million tons.

For the first time in a century, U.S. Steel's giant Southworks plant has been shut down due to lack of orders. At the present time there are fewer steelworkers employed than in 1933—not because of technological improvements, but because of the Federal Reserve's cutoff of industrial credit, and because of the industry's own contractive policies.

The United States now produces 17 percent of the world's steel. In 1950 the industry had 47 percent of the world market. The volume of U.S. exports has remained constant at less than 10 million tons per year, while world trade rose to over 115 million tons in 1977. America cannot compete internationally.

It is now widely acknowledged that the wages of Japanese and West German steelworkers have become comparable to U.S. wages in terms of buying power. Even in absolute dollars, West German steelworkers now earn more than American ones, and the rate of increase in Japanese wages will soon bring them to a dollar-equivalent level.

Dramatic increases in labor productivity due to rapid investment in more efficient technology have primed Japan's competitiveness. From 1969 to 1979 Japan reduced the number of manhours required per ton of steel shipped from 14.69 to 9.2, compared with a U.S. reduction from 10.53 to 8.56. And the U.S. producers have by and large achieved that drop by enforcing speedup at all levels. It is projected that this year the Japanese will surpass the United States by this measure or productivity. A more telling gauge than the output per employed hour is the industry's energy utilization. In the United States, it takes one-third more expensive energy to produce a ton of steel than it does in Japan.

U.S. basic investment in steel has been negligible compared with the international competition. Since 1967 the U.S. has added about 10 million tons of steelmaking capacity; Japan has added over 100 million tons. Virtually no operating Japanese steel mills were built before 1955. In the U.S., 12 percent of capacity is over 30 years old and over one third is over 20 years old.

Both government and industry have abandoned R&D in steel. The OTA estimates that less than $5 million is devoted by Washington to steel R&D, and corporate outlays are not much higher. Of the nation's top 30 industrial sectors, steel ranks 28th in percent of sales revenue applied to R&D.

It is well known that American steel companies have "diversified" investment out of steel. And steel-related expenditures, declining in absolute terms, have been increasingly diverted to meet federal pollution standards; since 1976, the industry has spent over $2 billion in this effort, and if the costs of meeting Occupational Health and Safety Administration standards are added, these expenditures account for about 17 percent of annual U.S. capital investment in steel. Current projections are that the total will rise to over 30 percent in the next five years.