CHAPTER 2

Policy Options

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CHAPTER 2

Policy Options

Summary

It is in the Nation's interest to have a strong domestic steel industry that effectively uses domestic resources such as coal and scrap materials. However, technology alone is not sufficient to reverse the decline in steelmaking capacity, nor can new technology immediately help those parts of the industry that use old, inefficient, or poorly located plants.

Nevertheless, Federal policies that at least indirectly facilitate technological innovation and modernization are necessary to avoid temporary and superficial remedies. Even those segments of the industry that are profitable, competitive in the domestic market, and well managed need more and continued technological modernization to maintain and improve their competitiveness in the domestic and world markets.

The creation and adoption of new steel technology are hampered by a number of factors, the most important of which are inadequate capital formation, inadequate R&D, high regulatory compliance costs, and the threat of unfairly traded imports. In a world in which most foreign steel industries are either owned or heavily supported by their governments, the U.S. steel industry is at a disadvantage because it must generate from profits the capital it needs for modernization and expansion. Past Federal policies have affected steel costs and prices, and hence steel industry profitability, Most of the industry has been slow to adopt cost-reducing new technology as a means of coping with Federal policies. The superior technological and economic performance of some steelmaker demonstrates the potential for improvement in other companies. Both Federal and industry policies have contributed to industry's under-investment in capital plant, R&D, and innovation.

The industry has also been adversely affected by imports of steel and has had its export potential affected by foreign steel industries. For the most part, however, steel imports have led to complaints about Federal policies rather than to increased emphasis on R&D, innovation, and improved competitiveness. Some domestic market imperfections have resulted from foreign government policies favoring their steel industries, and it is apparent that substantial trade and tax issues exist with regard to the steel industry. Federal policies on these issues need examination, but policies are also needed to deal directly with technological issues.

OTA uses three scenarios for the next decade to examine costs and benefits of policy options. The Liquidation scenario implies the slow shrinkage of domestic capacity and employment. The Renewal scenario considers policy options linked to moderate increases in capital spending for modernization and expansion to revitalize the industry. The High Investment scenario examines policies compatible with greatly increased capital spending to quickly modernize integrated steelmaking facilities, OTA's analysis considers the following possible options for Federal policy toward the steel industry:

- provide greater capital formation through faster depreciation, investment tax credits, loan guarantees, or subsidized interest loans;
- increase support of basic research and large-scale demonstration projects, and provide incentives for industrial R&D;
- coordinate energy development programs with the needs of industry—for example, development of synfuel or coal gasification technology might be coordinated with requirements of direct reduction processes;

- reach a better understanding of the benefits of Federal environmental and occupational health and safety regulations on the one hand and, on the other hand, the costs to communities of a shrinking industry, the industry's capital and modernization needs, and the regulatory barriers to technological innovation.
- explore the controversial issue of limiting the export of energy-embodying ferrous scrap;
- examine the feasibility and adverse impacts of targets for ferrous scrap use, and compare targets with alternative mechanisms such as incentive investment tax credits for adoption of new technology that may use more energy;
- reexamine trade practices, particularly to assess the impact of unfairly traded steel imports on the industry's ability to make long-term commitments to new technology and investment in additional capacity;
- promote the export of high-technology steels; and
- emphasize long-term assistance to steel plants capable of technological rejuvenation, and at the same time provide short-term assistance to workers and communities impacted by closing old facilities.

New Federal policies, however, would be ineffective without appropriate shifts in the attitudes and policies of industry. For example, industry would have to reexamine its policies concerning using capital for diversification out of steelmaking, emphasizing short-term benefits from relatively minor improvements in technology, wanting to quantify the costs but not the benefits of social regulations, and resisting industry restructuring, including the expansion of small, scrap-based nonintegrated steelmaker.

Perhaps the greatest need is for a careful examination of the costs and benefits of a Federal policy for the steel sector that would first establish a set of goals consistent with national interests and industry needs and then initiate a set of coordinated, reinforcing actions that would effectively and efficiently help achieve those goals. The most important lesson to be learned from the past experience of the steel industry is that such sector policies may be needed for major domestic industries if international competitiveness is desired. Foreign governments, particularly Japan's, appear to use sector policies to achieve competitive industries. Without such a sector policy, improvement efforts may be at cross-purposes or fail to address critical issues. Isolated policies that deal effectively with capital formation or imports, but fail to encourage additional efforts in R&D and innovation, would not ensure a profitable and competitive industry in the long run.

The risks of adopting a steel sector policy include an overemphasis on the welfare of the steel industry to the exclusion of other domestic industries, insufficient attention to social goals and impacts, such as pollution abatement and worker safety, and possibly insufficient attention to smaller steelmaker.

Understanding the greater support that foreign governments give their private and public steel industries provides important insights for the examination of U.S. policies. Foreign governments have coordinated sector policies that link support for R&D and innovation with capital formation, protection of home markets, and the export of steel technology. The United States provides a much lower level of direct and indirect support than Japan, Western Europe, and Third World nations. The U.S. steel industry may never achieve international competitiveness unless Federal policies become more comparable to the policies of other countries towards their steel industries.

Reconciling Congressional and Industry Concerns

The past several decades have witnessed a reversal in the condition of the American steel industry. Before World War II, and for the decade following, the domestic industry was the world leader in steelmaking technology and production. It supplied domestic needs and was a net exporter of steel, Its profitability, though rarely as high as most domestic manufacturing industries, was markedly better than in recent years, During the last 10 years, however, a turnabout has occurred. The domestic industry shifted from technology leader to follower and from net exporter to dependent importer. Its profitability, moderate in the 1950's, became unacceptable by domestic standards in the 1970's. Domestic steelmaking capacity declined and a substantial percentage of this capacity (about 20 percent) became obsolete, All this happened during a period of phenomenal world growth in steelmaking capacity and demand, New technology, as a means to reduce costs and energy consumption, received greater attention abroad than in the United States.

Japan has emerged as the new world leader in steel technology and production, and it exports much of both. Although European steel industries have generally followed the U.S. pattern of decline, a number of developing nations have acquired considerable modern steelmaking capacity, much of it purchased from Japan. Japan, Europe, and Third World countries have used their steel exports to sustain domestic employment and obtain foreign currency; their industries have not been particularly profitable, however, even by U.S. steel industry standards.

The American steel industry, faced with increasing foreign capacity as well as unprecedented technological and cost competition, must also face a variety of Federal policies, carried out by a variety of agencies, that address a variety of national concerns. These policies, with their disparate but relatively narrow individual objectives, have added to the industry's problems. The Federal Government has contributed to the loss of international competitiveness in the following ways:

1. Cost-price policies:
   - formal and informal limits on domestic steel prices;
   - long capital-recovery periods that do not recognize the rising costs of building new steelmaking capacity; and
   - environmental and worker health and safety regulations that increase the costs of steelmaking.
2. Trade and monetary policies:
   - international trade policies that have allowed steel imports to capture a large share of the domestic market; and
   - little monitoring or control of the export of domestic ferrous scrap, a valuable source of both iron and energy.
3. Very low levels of support for research in steelmaking.
4. Contributions to international sources that make loans to foreign steel industries, which then export steel to the United States.
5. A loan policy aimed at maintaining employment in troubled companies, rather than modernizing or expanding steel capacity.
6. Monetary policies that, until recently, had the effect of keeping the dollar overvalued relative to major foreign currencies and thereby made domestic steel less competitive in world markets.

On the other hand, events and policies in the steel industry itself have also contributed to the industry's problems:

1. The cost-price squeeze and profitability:
   - a tendency to emphasize the size of steelmaking facilities rather than their profitability;
   - wage increases that have exceeded increases in productivity and have therefore resulted in higher real labor costs;
   - the tendency of some major companies to pay high dividends even during periods of low earnings;
   - insufficient attempts to reduce capital costs through the use of lower cost foreign steelmaking equipment, less costly designs, and more inhouse engineering and design;
   - costly attempts to delay compliance with environment regulations;
   - slowness in maximizing the use of domestic scrap; and
   - minimal attempts to export the technology-intensive steels in which the industry is technologically and cost competitive.
2. Technology:
   - minimal spending on R&D;
   - an emphasis on product rather than process R&D, and on short-term payoffs rather than long-range benefits from higher risk, major innovations;
   - few attempts to employ technical and managerial personnel from other domestic industries that have been successful in technological innovation and exporting;
   - insufficient long-range strategic planning for technology to minimize future production costs; and
   - insufficient matching of steelmaking processes with product characteristics to obtain optimum product mixes.

All these public- and private-sector actions and policies together, have shaped the industry's current problems and congressional concerns about them. The present time is critical in the history of the domestic steel industry—modern, competitive steelmaking capacity takes years to build, so what happens now will determine the shape of the industry for decades to come.

Congress has diverse and sometimes conflicting concerns about steel. Table 4 contains a summary of congressional concerns without reference to particular geographical, economic, social, or trade problems. The table also lists industry needs drawn from a major policy statement by the American Iron and Steel Institute (AISI), whose member companies produce about 90 percent of domestic steel. (Not all of the nonintegrated scrap-based steelmaker, who account for about 13 percent of domestic production, belong to AISI.)

Rising imports, for the most part, are an issue on which the Government and industry are in accord. Dependence on steel imports would threaten national security because of the critical role of steel in this society. The steady loss of employment caused by imported steel is also of major concern to the Nation, particularly for regions with concentrations-of older steelmaking facilities. Steel imports also contribute significantly to the trade-balance deficit. Imports may offer a low-price source of steel during brief periods of world oversupply, but their long-term net effect on the economy will probably be negative. Industry wants to limit imports in order to improve its domestic competitiveness and increase its profitability so that it can expand and modernize. As long as there is great uncertainty about future imports, however, industry will be reluctant to make major investments in steelmaking technology. For corollary reasons, increasing steel exports is an issue on which Congress and industry should also have common interests.

The increasing age and obsolescence of domestic facilities should be a matter of concern both to industry and Government insofar as it affects competitiveness. But compared to the risks of building new, modern plant capacity which imports might leave idle, operating old facilities can appear attractive for the short term. In some cases, the continued operation of older facilities, even at low levels of

Table 4.—Congressional Interests and Steel Industry Needs

Congressional interests		Industry needs			
Trend	Effects	Maintain/ improve cost competitiveness	Increase capacity	Modernize technology	Increase profitability
Rising imports	National security loss Increased competition Lower prices Potential inflation Trade deficit Unemployment	Accord	Accord	Accord	Accord
Declining exports	Trade deficit Unemployment	Accord	Accord	Accord	Accord
Aging facilities	Productivity loss	Accord	Conflict	Accord	Accord
Decreasing capacity	National security loss Unemployment	Conflict	Accord	Conflict	Conflict
Diversification out of steel making	Competitiveness loss Diversion of capital	Conflict	Conflict	Conflict	Conflict
Declining R&D and innovation	Competitiveness loss	Accord	Conflict	Accord	Conflict
Rising steel prices	Inflation	Accord	Conflict	Conflict	Conflict
Improved environmental effects of steelmaking (increased regulatory compliance)	Public well-being Increased costs of steel making Force new technology	Conflict	Conflict	Accord	Conflict

SOURCE Off Ice of Technology Assessment

profitability, provides a cash flow to support diversification out of steelmaking. To the extent that such diversification reduces capital investment, R&D investments, and capacity, it adds to congressional concerns.

In many cases, companies do not continue to operate old facilities, nor do they replace them with an equal or greater amount of new capacity. Some companies choose to become competitive and profitable by closing marginal or unprofitable facilities and modernizing only their best plants. These companies are among the largest steelmaker, and although the smaller companies are expanding, the net effect, of concern to Congress, has been a loss of domestic capacity and jobs,

There are areas of both conflict and accord with regard to declining R&D and innovation. Willingness to develop and use innovations in steelmaking can improve competitiveness, consistent with congressional concerns. However, the industry’s desire to increase profitability by investing in modernization and expansion may actually reduce investments in R&D and innovation.

Nor is the industry sympathetic with congressional desires to limit inflation by holding down steel prices. To the extent that controlling prices improves demand for domestic steel and thereby contributes to high rates of plant utilization, this policy supports cost competitiveness. But to the extent that it diminishes profitability and thereby discourages capacity expansion and modernization, it will undermine long-run competitiveness.

Similarly, the congressional interest in enforcing Environmental Protection Agency (EPA) and Occupational Safety and Health Administration (OSHA) regulations conflicts with industry’s concerns about cost competitiveness, profitability, and capital formation. Technology, however, may be a better way to reduce costs than relaxing these regulations.

Learning From the Steel Industry

The steel industry may be only the first of several domestic industries to face a decline in technological preeminence and economic prosperity. As the less industrialized nations begin to produce at lower costs and to consume more, they become more attractive than highly industrialized countries as a location for industry. The decline of established industries in advanced nations may also result from a partial loss of domestic markets through product substitution; moreover, these industries may not produce sufficient technological innovations to reduce production costs markedly or improve products dramatically. These explanations may not appear as valid in today's world economic order as they once did: the policies of various governments have introduced so many imperfections to the free-market and free-trade system that the role of traditional economic factors in international competition has been fundamentally changed, When each of the above factors is examined for the domestic steel industry, it is found that none of them can adequately explain its decline,

In the first place, no major foreign steel industry has had a more advantageous combination of labor costs, energy costs, raw materials costs, and industrial and technological infrastructure than the United States. At best, foreign steel industries have had slight advantages in one or two of these factors. Generally, such advantages have been short-lived and insufficient in themselves to account for those industries' penetration of export markets, particularly the U.S. market. What has occurred is that foreign governments have adopted policies that provide many direct and indirect benefits to their steel industries: many foreign steel industries have been built with public funds to serve social and political goals, Even though foreign demand for steel has increased substantially, foreign-produced steel is often exported rather than used to satisfy domestic needs.

Secondly, although steel has faced increasingly stiff competition from other materials—notably aluminum, concrete, and plastics—it still possesses a unique combination of properties, forms, and costs that ensures it substantial and growing markets. There has been no major technological displacement of steel in the marketplace.

Thirdly, contrary to accepted wisdom, there have in fact been major technological changes in domestic steelmaking and products during the past several decades, and all signs are that this will continue. Unfortunately, some domestic firms have justified their lack of progress with the "mature industry" concept, and have become defensive and antagonistic toward Federal Government policies rather than changing their corporate policies to meet changing social, economic, and political conditions. Others, in the meantime, have moved ahead with optimism and even boldness—taking risks, investing in the newest technology, and capturing the profits that are there to be made.

The lesson to be learned from the steel industry's experience is that private industries can find themselves losing price competitiveness because Federal Government policies are not comparable to those of other nations. Foreign government policies have distorted the workings of the marketplace, sometimes in ways unique to a particular industrial sector. The steel experience has shown that Federal policies can actually improve the profitability of foreign industries while having adverse impacts on domestic producers.

A Governmental Steel Industry Sector Policy

Steel market imperfections have led to underinvestment in three areas—equipment, R&D, and innovation—and policy changes that dealt with only one of these areas of underinvestment would be inadequate in the long run, The choice of policy options is further complicated by the fact that the domestic steel industry is undergoing a restructuring. The impact of policy options on this restructuring process requires careful examination.

It is often contended that the steel industry should not be singled out for Federal help and that legislation affecting all domestic industry is sufficient. However, steel has a unique combination of problems and assets, and it has already been uniquely and adversely affected by many Federal policies. Singling out the steel industry for a sector policy presents policymakers with difficult choices and opportunities for several reasons:

- The industry is essential to both the domestic economy and national security, but it is contracting and diversifying out of steelmaking. which can only result in increased imports.
- The industry's cost-price squeeze and capital shortfall are the result of prices that are too low to provide adequate return on investment, or costs that have not been kept low enough, or both; of Federal policies that have led to high regulatory costs; and of unfairly traded imports, which have captured a large share of the domestic market and contributed to artificially low prices.
- There is a nucleus of companies whose plants are highly competitive in costs and technology and who could contribute positively to the trade balance by exporting more steel.
- There are many short- and long-term technological opportunities for strengthening the industry and recapturing the premier status it once possessed.
- The industry has available to it the domestic material resources of iron ore, coal, and ferrous scrap, and a highly competent labor force, a large domestic R&D infrastructure, and a reservoir of managerial and entrepreneurial talent.

The most critical policy option may be that of a governmental steel industry sector policy, that is, for a coherent set of specific policies designed to achieve prescribed goals. The present state of the industry and the need for critical examination of policy options are, in large measure, a consequence of a long series of uncoordinated policies. These policies have not been properly related to each other or to a well-considered set of goals for the industry, goals that satisfy the needs of both the Nation and the industry. The lack of a sector policy and the designation of a lead agency to implement such a policy has led to policies that often conflict with one another, create an adversarial relationship between Government and industry, and fail to address critical issues. Examples of conflicting policies include: 1) the attempt to have domestic industry use more scrap, which requires capital investment, without providing realistic capital recovery; 2) the use of the trigger-price mechanism, which leads to price increases, while attempting to hold down prices; and 3) the promotion of energy conservation, while not allowing continuous casting to qualify for the energy investment tax credit.

A recent attempt by the Government to formulate a sector policy for the domestic steel industry was the report by Anthony M. Solomen, Undersecretary of the Treasury, entitled "A Comprehensive Program for the Steel Industry, " which was issued in December 1977. A number of this report's recommendations materialized, notably the trigger-price mechanism for steel imports, the loan guarantee program of the Economic Development Administration (EDA) of the Department of Commerce, and a slight reduction in the depreciation schedule for new machinery and equipment (from 18 years to 15 years). However, the Solomon report paid little attention to issues related to the development and adoption of new technology, and it formulated no clear strategy for the future development of the domestic steel industry. Although it recognized the problem of providing more capital for modernization, it made no detailed analysis of what those modernization needs were or of what the costs would be. Events of the past 2 years have shown that the policy changes stemming from the Solomon report have not succeeded, even though they were a promising attempt at a sector policy.

The report was an attempt to deal quickly with a crisis situation; as such, it contained little independent analysis of the situation and it made no recommendation for a centralized coordination of the diverse Government policies affecting the industry, The agencies playing dominant roles in steel policy as a result of the Solomon report were the Departments of Commerce and the Treasury, neither of which concentrated on problems relating to R&D, innovation, or restructuring. The establishment of the Tripartite Committee of industry, labor, and Government, while satisfying a need for better communication, has not facilitated decisive policymaking in Government, nor has it provided a mechanism for detailed and independent analyses of critical issues and options, focused on long-range problems and opportunities.

At present, a large number of people and agencies in the Government deal with steel, but they do not reinforce each other's work nor do they provide an accessible source of expertise and guidance for the industry or facilitate its efficient interaction with the Government. The waste of resources by both Government and industry in dealing with such divided and compartmentalized bureaucracies is enormous. The preeminence of the Japanese steel industry is in large measure due to the creation and execution of an effective steel sector policy. The Federal Government may seek reasons for the loss of international competitiveness in the steel industry, but its own lack of a sector policy also deserves examination.

The chief difficulty in establishing a steel sector policy is obtaining qualified personnel who are acceptable to all parties involved, and who could perform an ongoing analysis of the industry. There is also the jurisdictional problem of obtaining sufficient cooperation between existing agencies and whatever office or agency is assigned the responsibility for designing and implementing such a policy, The historically prevalent inattention to technology by both the Federal Government and industry would have to be addressed. Finally, there would be a risk that the interests of large steelmaker would dominate those of smaller companies, that the benefits of social regulations would be obscured by their costs, and that the interests of the steel industry would overshadow the interests of other industries.

The OTA Study

The overriding theme of OTA's study of the steel industry has been how technology enters into both its problems and their solutions. OTA interprets technology broadly technology includes the specifics of technical knowledge, the means for implementing that knowledge, and the factors that promote or discourage its creation and adoption. Consequently, technological issues cannot be isolated, This OTA study deals with related issues, such as trade, capital allocation, and profitability, to the extent that they affect technology, Detailed aspects of marketing and pricing have not been pursued, nor have the details of the literally thousands of Federal policies, regulations, laws, and agreements that affect the steel industry. The purpose of the following analysis of policy options is thus to deal with major trends, goals, and alternatives, rather than to give a detailed, quantitative analysis of current and future policies. The OTA analysis is more conceptual and strategic than it is tactical. It presents a framework, based on analysis, assessment, and forecasts of technology, in which Congress can examine its opportunities and its policy choices with regard to the U.S. steel industry.

A critical methodological feature of the OTA study is its treatment of domestic steel industry as three segments, based on a combination of process and product differences, rather than as a single entity. These segments are:

- Integrated steel producers, who make commodity carbon steels with conventional ironmaking and steelmaking technology: iron ore is converted to iron in blast furnaces using coke; the iron is then converted into steel in either a basic oxygen, open hearth, or electric furnace. To a limited extent, ferrous scrap is used with virgin iron in the first two types of furnace; the electric furnace uses ferrous scrap exclusively. These companies also produce a limited amount of higher quality, higher priced alloy/specialty steels.
- Nonintegrated steel producers, who primarily make simple carbon steels with scrap-based electric furnaces. Their product range is more limited than the integrated steelmaker; their plant capacities are generally about 10 percent of the size of integrated operations.
- Alloy/specialty steel producers, who primarily use scrap-based electric furnaces to produce relatively small quantities of the highest priced, most technology-intensive steels. Neither they nor nonintegrated producers engage in primary ironmaking.

Three Scenarios for the Future

OTA has developed three scenarios that postulate future possibilities for the domestic steel industry. Summary information on these scenarios is provided in table 5. The time frame for each is the next 10 years—there are too many uncertainties about general conditions to go beyond that period, except in the most qualitative terms. Nevertheless, events in this time period will have implications for the years beyond, and these are also examined.

Liquidation Scenario

In this scenario, no substantial changes in Government policy, improvements in industry profit; profitability, or changes in corporate objectives occur during the next decade. The trends of the past 5- to l0-year period continue. Faced with low profit levels, many of the larger steel companies diversify out of steel making, and capital investment in productive steelmaking facilities declines. * Profit levels themselves signify a decreasing real-dollar investment level.

Industry restructuring continues. The integrated steel producers' share of domestic production continues to decline, and that of the more profitable nonintegrated and alloy/specialty producers expands, depending on how effectively the new Multilateral Trade Agreement is enforced.

*The following examples illustrate the trend to diversification. According to Armco's 1979 Annual Report and public statements of company officia1s, the percentage of the firm's net alssets related to steel was 73 percent in 1976 and 62 perrent i n 1979, and will be 49 percent by 1983. Armco has been the leading large integrated steelmaker using diversification to improve corporate profits. The Nation's largest steelmaker, U.S. Steel Corp., also has been experiencing large losses from its steelmaking operations; according to its 1979 Annual Report, 37 percent of its invest mens during the past 5 years have been for expansion and growth of nonsteel businesses. In the industry's High Investment scenario, 11 percent of total capital spending is allocated to nonsteel investment.

Table 5.—Characteristics of Three Scenarios for the Next 10 Years of the Steel Industry

	Scenario		
Characteristics	Liquidation	Renewal	High Investment
Degree of capital investment	Low”	Moderate	High
Degree of Government assistance	Low	Moderate	High
Need for policy change	None	Moderate	High
Investment in R&D	Very low	High	Uncertain
Capacity change	Decrease	Moderate increase	Moderate increase
Degree of new technology			
Short range (1980-90)	Low	Moderate	Moderate
Long range (post-1 990)	Low	High	Moderate
Furtherance of industry restructuring	High	High	Low

aHigh restructuring means increasing market shares for non Integrated and alloy/specialty steelmaker

SOURCE Off Ice of Technology Assessment

No new Government policies provide direct or indirect assistance to the industry: no loan guarantee programs, no revisions in capital-recovery periods, no substantial change in import protection, no increase in Federal support of R&D or demonstration projects, and no great freedom to increase prices to levels that would raise return on investment in steel to the all-industry average or provide sufficient capital to allow extensive modernization and capacity expansion.

Only relatively small technological improvements are made, and these are concentrated in the best of existing facilities. Thus, though capacity would probably decline, remaining capacity steadily improves in technological competitiveness. However, the long-term prospects for creating and adopting major new technology would not be good,

If domestic capacity does not expand significantly and domestic demand grows at even moderate rates, it is possible that, by the end of the 1980's, imports could more than double. Domestic demand could range from 122 million to 132 million tonnes: domestic shipments might be only 82 million to 91 million tonnes, Steel employment would decline by about 20 percent, or some 90,000 workers, from the 1978 level. At 1978 prices ($440/tonne), the steel trade deficit would rise to between $14 billion and $22 billion annually, compared with under $6 billion in 1978. * (By comparison, the total balance-of-payments deficit in 1978 was $13,5 billion.) Moreover, forecasts of world demand and capacity suggest that by the mid- to late 1980’s there will likely be little overcapacity. Hence, steel imports, if obtainable, could be priced much higher than domestic steel; past experience in 1973-74 suggests that, in such circumstances, prices of imports could be 15 to 35 percent higher than domestic prices.

Although the money not invested in steel would go to other domestic uses, which would partially offset steel-related losses in employment, capital investment, and taxes. the net economic effect of this scenario is unlikely to be positive. The trade deficit would weaken the dollar, aggravate inflation, and drain domestic capital; the real increase in steel import prices would add further inflationary pressures. Since steel employment in older facilities is geographically concentrated, employment substitution would be difficult. Capital would be diverted to manufacturing sectors with lower labor and capital intensity than steel. Moreover. because capital markets set rates on the expectation of future events, anticipation of higher trade deficits, prices, and unemployment. and of steel shortages affecting other domestic industries, could raise capital market rates and increase current capital costs.

*All sums in this chapter are expressed in 1978 dollars unless otherwise noted.

Renewal Scenario*

In this scenario, the level of capital investment for modernization and capacity expansion is sufficient to accommodate a relatively modest (1.5 percent per year) increase in domestic steel demand while keeping imports to 15 percent of domestic consumption (approximately the same tonnage as 1978). Capital investment in productive steelmaking facilities is 50 percent higher than the prior decade's annual average (approximately $3 billion per year, versus $2 billion). The capital shortfall for minimum renewal amounts to at least $600 million per year, which could be obtained through a number of Federal actions such as reducing capital recovery time from the present 15 years to 5 years. A slightly higher 2-percent-per-year increase in domestic demand, which is possible, could raise the capital deficit to $1 billion per year. A reduction in depreciation time could also generate this much additional capital, and other means of Federal assistance, discussed below, might be used as well.

Under this scenario, the next 10 years see the adoption of continuous casting increase from the present 15 percent to about 50 percent, primarily through the modernization of old integrated mills and the construction of additional nonintegrated plants. Production costs are not reduced sufficiently, relative to high capital costs, to justify constructing new integrated plants, The market share for the nonintegrated companies rises from their 1978 level of 13 percent to as much as 25 percent (an addition of almost 10 million tonnes of shipments) as they broaden their product mix, adopt new production equipment, and begin using direct reduced iron (DRI) to supplement ferrous scrap (see table 6). This expansion of the nonintegrated segment is contingent, however, on adequate supplies of ferrous scrap and electricity in specific geographical areas.

*See ch. 10 for an estimate of future capital needs based on this scenario.

Domestic steelmaker maintain their market share under the Renewal scenario, and they improve their technological and cost competitiveness. Profitability also rises: given a modest 2-percent reduction in production costs as a result of modernization and expansion, return on equity should rise from its 1978 level of 7.3 percent to the average level for all domestic manufacturing industries, about 12 percent. Although no major new technology is adopted during the lo-year period, the domestic steel industry becomes profitable enough to participate in the development of new technology for the 1990's; by that time period, new integrated processes should reduce production and capital costs enough to justify building large new integrated plants at a time when the limits for nonintegrated steel mills are being reached. Under this scenario, the 1980's are the decade of growth for the smaller nonintegrated steelmaker and the 1990's--with increased capital investment—the decade for growth of larger, integrated producers.

High Investment Scenario

AISI recently created a scenario for the next 10 years that is based on the same assumptions about domestic demand and shipments as the Renewal scenario, [1] although its

[1] American Iron and Steel Institute, *Steel at the Crossroads: The American Steel Industry in the 1980's*, 1980. OTA purposely used the same basic production parameters in designing its Renewal scenario to permit close comparison of the two: both scenarios are described in detail in ch. 10.

Table 6.— How Scenarios Affect Three Industry Segments

Scenario	Industry segment: Integrated	Non integrated	Alloy/specialty
Liquidation	Very harmful	Slightly harmful	Uncertain
Renewal.	Beneficial	Useful	Useful
High Investment, ...	Very beneficial	Useful	Useful

SOURCE Off Ice of Technology Assessment

modernization and expansion paths differ considerably. The AISI scenario forecasts a need for $4.9 billion per year for modernization and expansion, a nearly 150-percent increase over the previous decade's average annual spending. The main reasons why AISI found greater capital requirements than OTA are: 1) AISI assumed higher unit capital costs in calculating the total needed for modernizing and increasing the capacity of integrated plants (nearly as costly as building new plants), 2) it assumed fewer nonintegrated plants would be built and at higher cost, and 3) it allocated greater sums to reducing the average age of facilities.

The capital shortfall in the High Investment scenario is approximately **$2,3** billion per year, assuming no increase in industry debt or equity and no change in existing capital-recovery rules. The industry would require considerable financial and policy assistance from the Government to meet its capital needs. AISI favors faster capital-recovery periods and marketplace steel pricing; the combination of price increases and improved capital recovery should give a return on equity comparable to other domestic industries.*

*The price increase would be at least 10 percent of the 1978 average price per tonne of steel. Such an increase would greatly increase the profits of nonintegrated producers, or allow them to capture a greater market share with more competitive prices than integrated producers. More importantly, greater trade protectionist measures would be necessary to prevent lower priced foreign steel from entering the domestic market.

The long-term consequences of the High Investment scenario, however—with its greater capital spending level and its emphasis on replacement and expansion of integrated facilities during the 1980's—make the adoption of major new integrated steelmaking technology in the 1990's less likely than under the Renewal scenario. The additional $2 billion per year investment would create enough new integrated capacity (using present technology) to satisfy future demand without constructing new facilities in the 1990's. The Renewal scenario, on the other hand, by delaying new integrated construction, ensures that these facilities will incorporate the newest technologies when they are built. This conclusion is based on a relatively constant, low rate of growth in steel demand for the next several decades; should demand growth be higher, opportunities for new integrated plants in the 1990's would exist under both scenarios.

The High Investment scenario leads to less restructuring of the industry than the Renewal scenario. There is no indication that the market share for nonintegrated companies (as opposed to the nonintegrated plants of integrated companies) would increase significantly, if at all (see table 6). Should nonintegrated companies fail to expand during the 1980's, they might do so in the 1990's, further discouraging the construction of high-cost improved-technology integrated facilities.

Implications of the Scenarios for Congressional and Industry Concerns

The impacts of the three scenarios on the congressional concerns discussed earlier are summarized in table 7. The Liquidation scenario fails to deal satisfactorily with most congressional concerns; all of the adverse trends that have led to those concerns continue. At best, steel exports might improve slightly because of the already enacted Multilateral Trade Agreement, which would open up foreign markets for the alloy/specialty steels in which U.S. producers have cost and technological competitiveness. Rising and inflationary steel prices would be stabilized, consistent with present policy. The impact on regulatory compliance is uncertain; there is continuing debate on the benefits of demanding increased compliance, and a congressional role that acknowledges the costs of compliance might slow the loss of capacity in the integrated segment.

Table 7.— How Congressional Concerns Are Affected by Three Scenarios

	Scenario		
Congressional concerns	Liquidation	Renewal	High Investment
Rising imports	Worsens	Stabilized	Stabilized
Declining exports	Improves slightly	Improves	Improves
Aging facilities	Worsens	Improves	Greatly improved
Decreasing capacity; decreasing employment.	Worsens	Improves	Improves
Diversification out of steel making	Increases	May decrease slightly	May increase slightly
Declining R&D and innovation	Worsens	Improves	May improve
Rising steel prices—inflation.	Uncertain	Constant	Increases
Increasing compliance with EPA/OSHA regulations . .	Uncertain	Improves	Improves

SOURCE Off Ice of Technology Assessment

The Renewal scenario generally deals with congressional concerns in a satisfactory manner. By improving profitability and encouraging modernization, expansion, and R&D without the need for real-dollar price increases, it strengthens the industry sufficiently in the near term to reverse most of the threatening trends of the past decade.

The High Investment scenario, with two exceptions, also deals with congressional concerns quite satisfactorily. Those two exceptions are continuing diversification out of steelmaking and rising steel prices. Under the High Investment scenario, more capital is planned for diversification than in previous years. Moreover, the lack of emphasis on technology and R&D suggests either a weak long-range commitment to steelmaking, or shortsightedness. Financing the rather large annual capital deficits that result from this scenario's high spending will require significant price increases, even after the most favorable anticipated reduction in capital-recovery schedules.

The impacts of the three scenarios on industry needs are summarized in table 8. The Liquidation scenario meets only one of the stated industry needs; that is, profitability would increase for the portion of the industry that survives the continued contraction, because capital spending would have been focused on the best plants. Long-range profit ability is less certain. With rising imports and declining technology and R&D, the integrated sector can hardly expect to retain its competitiveness or profitability; the nonintegrated and alloy/specialty companies might remain reasonably profitable. The argument that more imports at low prices would benefit consumers and help fight inflation may be flawed; a variety of factors suggest that major foreign steel production responds more readily to world market prices than to costs.

The Renewal scenario would satisfy all industry needs, and for the l0-year scenario period the High Investment scenario would satisfy them even better. But because of the combination of higher prices, reduced long-

Table 8.— How Industry Needs Are Satisfied by Three Scenarios

	Scenario		
Industry needs	Liquidation	Renewal	High Investment
Maintain/improve cost competitiveness.	Worsens	Improves	Improves greatly
Increase capacity	Worsens	Improves	Improves
Modernize existing plants	Worsens	Improves	Improves greatly
Increase profitability.	improves	Improves	Improves greatly

SOURCE Off Ice of Technology Assessment

term R&D commitments, and minimal restructuring of the industry, most of the benefits of the High Investment scenario accrue to the integrated companies. Foreign creation and adoption of major new steelmaking processes might well lead, in the long term, to a further loss of competitiveness and the need for additional Government assistance at a later date.

Major policy options for the Renewal and High Investment scenarios are summarized in table 9. Options in each of the policy areas except pricing (capital formation, R&D, regulations, raw materials, and trade) are discussed and analyzed in detail in the following section. The policy aspects of the two scenarios differ considerably in the amount of freedom they accord to the industry. The industry faces a tradeoff between corporate freedom and supportive Government intervention. From a national point of view, the social returns on Government investments in the domestic steel industry must be traded off against industry's freedom to choose its own course of action, including asking for interventions it thinks beneficial. The Renewal scenario, together with its policy options, is an attempt to channel Government assistance into those industry segments and technologies that offer both near- and long-term benefits to

Table 9.—Major Policy Options for Two Scenarios

Policy-area	Renewal scenario	High Investment scenario
Capital information	Improve through one or more of the following: • more rapid capital recovery, • loan guarantees, • industrial development bonds, • investment tax credit, • subsidized interest loan, or • emphasize technological rejuvenation of viable plants.	—More rapid capital recovery.
R&D	Increase Government support of basic research and demonstrate ion of major new technology. Provide incentives for industry R&D.	Increase Government support of research and costly pilot demonstration plants.
EPA/OSHA regulations	Correlate regulations with industry's capital and modernization needs.	Regulatory framework be modified to mandate only those requirements that are demonstrably necessary to protect public health, and that can be rationally justified on a cost-benefit basis.
Raw materials	Explore the controversial issue of limiting the export of energy-embodied ferrous scrap. Examine the feasibility and adverse impacts of Federal targets for ferrous scrap. Compare targets with alternative mechanisms such as incentive investment tax credits for adoption of new technology which uses more scrap.	Let market forces rather than Government mandate determine international trade.
Trade	Reexamine trade policies. Assess the impact of unfairly traded steel imports on the industry's ability to make long-term commitments to and investment in new technology and additional steelmaking.	Need vigorous enforcement of U.S. trade laws and improved mechanism for keeping import levels consistent with other nation's limits. Trigger-price mechanism should be changed. Favors International Safeguards Code, use of OECD Steel Committee, bilateral trade policies with LDCs and centrally planned economies, international commodity trade policy.
Steel prices	Not examined	Market forces would establish the level of steel prices, rather than Government price controls.

SOURCE: Office of Technology Assessment

the Nation and the industry. It does impose some constraints on industry—for example, with regard to diversification out of steelmaking and long-term commitments to R&D—and these are legitimate issues for discussion. The dangers of superseding the discipline of the market are considerable, and the fears that increasing Government intervention will have unfavorable impacts on the private sector are legitimate.

Both the Renewal and High Investment scenarios accept as a basic premise that long-standing market imperfections have caused underinvestment by the domestic steel industry in capital plant, R&D, and technological innovation. These market imperfections have resulted from foreign and domestic Government policies that have affected investments, costs, and prices.

If the international competitiveness of the American steel industry is to be markedly improved, Federal policies, which constitute the socioeconomic environment in which the industry operates, must be comparable with those of other governments, To be effective, the policies must also address the totality of underinvestment. The industry emphasizes its need for Federal assistance in redressing underinvestment in capital plant, but OTA finds an equally great need to deal with underinvestment in technology—in R&D and innovation.

Implications of the Scenarios for the 1990's

The Liquidation scenario would probably make it difficult for the domestic industry to rejuvenate technologically at the end of the 1980's. A large degree of its capability for technology improvement would be lost, particularly the R&D personnel and facilities needed to originate innovations. Most negatively affected would be integrated steelmaking which is vital for the large-scale processing of iron ore,

The High Investment scenario requires spending enough capital on existing technology to ensure a relatively modern industry by the end of the 1980's. The industry would then be more efficient and productive by today's standards, but the real issue is whether the industry might by then be technologically obsolete because of newly developed technology, or whether (having already spent so much on new plants) its opportunities for adopting new technology in the 1990's would have been lost. Only very rapidly rising demand for steel would reverse these adverse effects,

The Renewal scenario, on the other hand, sets the stage for a major rejuvenation of the industry in the 1990's based on basic innovations in process technology. This would necessitate high capital expenditures in the 1990's, particularly for new integrated steelmaking facilities. There is no guarantee that a radical change in integrated steelmaking will occur. But there are indications that it may, because the seeds of radical change are already planted.

Basic innovations, which create profoundly new industrial processes, products, and industries, occur not in a continuous manner but in clusters.' Research on coal-based direct reduction (DR), direct one-step steelmaking, and plasma steelmaking suggests that a radically different way of making steel might be commercially possible by 1990 (see ch. 6). Furthermore, major breakthroughs in any of the several areas of energy production (such as economical large-scale coal gasification, magnetohydrodynamics, or even fusion) could create an opportunity to combine steelmaking with energy production and gain unprecedented efficiencies.

The risks associated with the Renewal scenario appear to be minimal. Even if no wave of basic innovations in steelmaking occurs, the domestic industry should be well positioned for an expansion based on the best available technology. The ability and readiness to take advantage of new technology in the **1990's** could lead to a considerable competitive advantage over foreign steel industries. The Japanese and European steel indus-

G. Mensch. Stalemate in Technology--Innovations Overcome Depression Cambridge Mass.: Ballinger Press, 1979).

tries both have invested heavily in new plants in recent years; they already have considerable excess capacity as well as poor records of profitability. Third World steel industries will likely expand considerably during the 1980's using current technology; this investment will make it difficult for them to adopt radically new technology in the 1990's and it will be some time before their scientific and industrial infrastructures actively contribute to the adoption of basic innovations.

Problems will develop under the Renewal scenario if demand grows faster than anticipated, if shortages develop in electricity or ferrous scrap, or if nonintegrated producers fail to expand their product mix. All of these would lead to insufficient domestic capacity during the 1980's, which would result in the same negative effects anticipated for the Liquidation scenario.

If the United States is to reap maximum benefits from basic innovations in steelmaking in the 1990's, it must participate in their development during the 1980's. Adopting innovations developed by foreign steel industries would at best give the domestic industry technological parity, not technological advantage or leadership. This points to the need to link economic assistance with efforts to spur domestic development and early adoption of basic innovations. Government policies that fail to encourage technological innovation and modernization, at least indirectly, would only be temporary and superficial remedies.

With the moderate capital spending of the Renewal scenario there would be a need at the end of the decade for substantial investment in integrated steelmaking plants, particularly for new facilities to replace old plants which are too costly to modernize. The scenario delays investment in integrated plants by emphasizing expansion in the nonintegrated segment and by minimizing facility replacement. Although the rate of growth for nonintegrated mills is the same as for the past decade, the implementation of this scenario is contingent on the availability of ferrous scrap and electricity in specific market areas. Data on domestic scrap supplies indicate that if present export tonnages are used domestically and a few million tonnes of DRI becomes available there should be no major problems, although the price of scrap might rise substantially. The increased demand for electricity would amount to less than 1 percent of current domestic industrial usage; spread over a number of plantsites during a l0-year period, with some concentration in the South and Southwest, this is unlikely to be a major barrier to nonintegrated growth, except for firms in the industrialized areas of the Northeast and Midwest.

The Renewal scenario is linked to a coordinated set of policies encouraging R&D and capital formation. AISI's High Investment scenario gives less weight to remedying current deficiencies in R&D efforts; its economic scenario runs linearly for 25 years, apparently without emphasizing the creation or adoption of profoundly new technology during that period. The executive summary of the AISI policy report does not mention R&D; its three requests for Government action do not include R&D; increased Federal R&D assistance is discussed in three pages of an appendix.

Overview of Possible Policy Options

Steel's competitive problems are primarily in the areas of technological innovation, capital formation, regulatory compliance, raw materials, and international trade. The following sections discuss policy options that could be instrumental in improving the industry's competitiveness. These options are aimed at:

- increasing R&D and innovation,
- encouraging pilot- and demonstration-plant testing of new technologies,

- facilitating capital formation,
- reducing the adverse economic costs of regulatory compliance,
- improving the availability of scrap, and
- constraining steel imports and facilitating certain exports.

R&D and Innovation Activities

Investment in R&D and innovation activities in steelmaking would be stimulated by the following Federal policy options:

- increased support of basic research,
- increased support of large-scale demonstration projects for new technologies,
- changes in antitrust policies to permit greater industry cooperation in applied R&D activities,
- improved coordination of existing Federal programs with industry needs, and
- change in tax laws to provide an incentive for industry R&D.

All available data show that the amount of funding for basic research in steelmaking is very low, The industry itself spends very little on basic research, just 7 percent of its total R&D budget, which itself is a very low fraction of sales compared to the R&D spending of other domestic industries. However, the industry's R&D spending as a percent of profits is relatively high. Federal support of basic research also appears minimal, not only in industry but in the academic sector and in Government laboratories; total annual spending on basic steelmaking research by all sectors is probably less than $5 million. The factors that have led to the generally low levels of basic research are discussed in chapter 9.

A bill has been introduced (H.R. 5881, the Basic Research Revitalization Act) to provide a tax incentive for basic research sponsored by industry and carried out in the academic sector. The Act provides a tax credit for 25 percent of the amount contributed in cash to a basic research reserve, with the maximum credit limited to 5 percent of the taxpayer's business income. An income deduction is allowed for payment from the reserve. This Act could provide approximately $50 million per year for basic research for the steel industry, a tenfold increase over present spending. There has been little public discussion of the Act's potential utilization by industry or problems with implementing it, but it is a good example of a creative policy approach to a critical problem.

The option of providing the steel industry with an incentive to carry out its own R&D activities also merits examination. One approach would be to increase investment tax credits for R&D facilities; another would be to allow rapid depreciation of such investments; both could be contingent on the activities being steel-related, Because the level of steel R&D is so low, even substantial increases in R&D activities would cause a relatively minor loss of tax revenues.

Federally Sponsored Research Centers

It is widely accepted that the Federal Government is justified in correcting private-sector underinvestment in basic research, and OTA finds ample evidence that basic research in steelmaking could have substantial benefits in the long term. A feasible and attractive option would be the creation of federally sponsored research centers at universities. Such centers should have close working relationships with industry to ensure that research leads to results that are useful. Added benefits would be university/industry personnel exchanges and the maintenance of an adequate academic base for training technical personnel for industry (both are important manpower benefits—see ch. 12). Industry could help support such centers, although most of the funds would likely have to come from Government; funding for each such center would be $1 million to $3 million annually.

Several such centers could be designed around specific technologies such as integrated or nonintegrated steelmaking processes, the use of low-grade coals, and the use of new energy forms. The National Science Foundation is already well organized to pursue such activities: it has sponsored a planning grant for a center dealing with research in nonintegrated steelmaking, although in this case the center appears oriented toward applied research.

Pilot and Demonstration Plants

Because of the scale of steelmaking and its reliance on well-established technologies, the need for pilot-plant demonstration of new technologies is great, In recognition of the industry's limited profits and its underinvestment in demonstrations, the Federal Government could provide more funds than the small sums it now devotes to such activities. Further, the present focus of demonstration support is energy conservation, only one of many industry needs; other worthy goals include shifting to different resources, reducing capital costs, reducing pollution, improving labor productivity, and using new forms of energy generation.

Although direct grants for demonstration purposes are an accepted means of support, other options should also be considered. Some of these options might help to minimize the Government's role in deciding which technologies to support. For example, where Government funds the demonstration directly, an alternative especially important for small firms would be buyback arrangements for the recovery of Federal costs after the technology is proven.

Changes in patent and antitrust policies might also effectively promote demonstration projects. Although progress has been made in patent and licensing arrangements between the Government and industry, such arrangements still appear to involve confusion and bureaucratic delays. There is little doubt that industry expects to obtain some form of proprietary ownership or advantage to justify its cosponsorship or use of personnel in such demonstration projects. By promoting licensing, the Government can deal with the objection that Federal assistance can lead to unfair competitive advantage for some companies.

Large demonstration projects are extremely expensive, and it is difficult for any one company to justify an investment of that size and nature. In some cases, a joint industry effort might eliminate the need for direct Federal support, but the legality of joint participation by several companies needs clarification with respect to antitrust regulations. The antitrust issue also applies to the feasibility of joint industry efforts in traditional R&D activities: there are a number of areas, such as energy conservation and pollution abatement, in which the social returns would be sufficient to sanction joint efforts that would not be particularly anticompetitive.

Other Federal Options

There are opportunities for the Government to coordinate existing Federal R&D and demonstration programs more closely with the needs of the domestic steel industry. Large sums are now being allocated to a number of energy-related technologies without much apparent attention to their possible application to steelmaking. For example, Federal activities in coal gasification and synfuels could be examined for their ability to supply the necessary technology for providing gaseous reductant fuels for direct reduction of iron ore. Similarly, a systems approach to the combination of steelmaking with energy generation could lead to low capital costs and high efficiencies.

There also appears to have been inadequate examination of the potential ways in which Bureau of Mines facilities, formerly used for research in steelmaking, could be resurrected for R&D activities and possibly used for pilot plants as well. The apparent policy shift away from joint industry/Government work and the present Bureau policy of not performing ironmaking and steelmaking investigations appear to preclude using this means to assist in the modernization of the domestic steel industry. *

*"One example of the lethargy of the steel industry toward R&D is last April's shutdown of the experimental blast furnace at Bruceton, Pa., a cooperative venture involving the Bureau of Mines , and a consortium of private steel companies organized as Blast Furnace Research, a nonprofit corporation. This furnace had been responsible for most of the developments in ironmaking in recent years. In the 4 years of its existence, it was credited with saving the iron industry some $350 million per

Scenario Differences

The Liquidation scenario would maintain the current low levels of Government and industry support for R&D and demonstration plants. The most likely consequence of this policy would be further loss of technological and cost competitiveness for the domestic steel industry. Both the Renewal and High Investment scenarios would support more pilot and demonstration testing of new technologies. The High Investment scenario does not differentiate between basic and applied research, nor does it specifically consider R&D policies. The Renewal scenario emphasizes near-term basic research to support long-term innovation, with greater Government support for R&D. The Renewal scenario also sees a need for policies to support more industry R&D, coordinated with policies affecting capital formation and trade.

Continued (from p. 44)
year, or $5/ton of iron. Present technology developed at Bruceton is capable of reducing costs another $2.50/ton.

"In spite of this record of achievement, the government, for reasons of economy, declined to make its $470,000 contribution to the $1 million needed to run the furnace this year, and the companies refused to make up the difference. It is hard to ignore investments that yield a 350-fold rate of return, but in this case the steel industry and the federal government appear willing to do so because of shortsighted budget economies and ruffled pride." (R. S. Thorn, "The Trouble With Steel," *Challenge*, July-August 1967.)

Capital Formation

Four Federal policy changes could increase capital formation in the domestic steel industry without sanctioning significant price increases:

- reduced capital-recovery periods (accelerated depreciation),
- investment tax credits,
- loan guarantees, and
- subsidized interest loans, including industrial revenue bonds.

Summary information on these four approaches is given in table 10.

Faster Capital Recovery

Accelerated depreciation continues to receive the greatest amount of attention from both the steel industry and Congress. The Jones-Conable Capital Cost Recovery Act of 1979 (H. R. 4646) typifies the interest in reducing capital-recovery times for all industry. If enacted, this proposal would allow steelmaking machinery and equipment to be depreciated over 5 years instead of the present 15. Because the Act applies to all industries, however, its cost to the Federal Government in lost tax revenues would likely be very high. The administration has forecast a net revenue loss of $35 billion annually by 1984,

Table 10. —Features of Four Federal Options for Increasing Capital Formation in the Domestic Steel Industry

Federal option	Government cost	Administratlve burden	Bias against small firms	Promotion of new technology	Applies to steelmaking only
Accelerated depreciation					
Jones-Conable	High	Low	Yes	No	No
Certificate of necessity	Moderate	Low	Yes	No	Yes
Investrnent tax credit					
Increase capacilty	Moderate	Low	No	No	Yes
Modernization	Moderate	Low	Yes	No	Yes
Innovation	Moderate	High	No	Yes	Yes
Loan guarantee					
Increase capacity	Slight	Moderate	Yes	Yes	Yes
Modernization	Slight	Moderate	Yes	Yes	Yes
Innovation	Moderate	High	Yes	Yes	Yes
Subsidized interest loan					
Increase capacity	Slight	Moderate	No	No	Yes
Modernization	Slight	Moderate	Yes	No	Yes
Innovation	Slight	High	No	Yes	Yes

SOURCE: Office fo Technology Assessment

which would rise until 1988 and then stabilize, assuming the measure takes effect in 1980.[3]

The administration forecasts that by 1984 Jones-Conable would give the steel industry a tax saving of around 16 percent of projected investment, or some $1 billion for a projected investment of $6.7 billion per year,[4] a level corresponding to that of the High Investment scenario. Based on the Renewal scenario investment of $3 billion per year on productive steelmaking, the tax saving would amount to approximately $500 million in 1984, but presumably would rise thereafter. Thus, the level of capital-recovery increase accomplished through the reduction in depreciation time from 15 to 5 years is almost the same as the $600 million per year capital deficit projected in the Renewal scenario.

The Jones-Conable Act has the advantage of creating a relatively low administrative burden, but it can be criticized on several other grounds, One is that this approach does not promote investment in truly new, high-risk technology. Another is that it does not take into account the idiosyncrasies of any particular industry. For example, this general approach to improving capital formation is biased in favor of the large integrated steelmaker and against the smaller nonintegrated producers, The integrated companies already have a large capital base and could direct a large amount toward modernizing their facilities. Though they are less profitable than many small companies, they have larger absolute profits against which the increased tax offset can be applied, For smaller companies, with smaller capital and profit bases, the increased capital recovery cannot offset enough taxes for the large investment needed for a rapid rate of growth. That is, in a high-growth situation profits lag behind capital investment, and thus the faster depreciation cannot be fully utilized when it becomes available. Accelerated depreciation is biased in favor of a linear rate of capital investment growth. Furthermore, many large steel companies have nonsteel business that is more profitable than steelmaking, so they can write off more profits than smaller, less diversified companies. An indirect, but very substantial, benefit for the steel industry of a general reduction in capital-recovery schedules would be the overall national increase in capital spending. Nearly two-thirds of steel use is for capital projects, so domestic demand for steel should be boosted.

An alternate accelerated-depreciation option would be to use a limited-term approach that would apply to steelmaking investment only. This corresponds to the existing certficate-of-necessity reduction in capital-recovery periods during times of national emergency. This would place a limit, perhaps 10 years, on the time for taking advantage of accelerated depreciation, and it would pertain to steelmaking investment only. This option would have the same built-in bias against small steel companies, and it would not specifically promote investment in innovative technology, Applied to a particularly troubled industry like steel, however, it could make a large difference in profitability in the long run. Hence, the long-term costs to the Government would be low, because it would more than recoup in additional taxes whatever the measure had cost in initial tax losses,

A third option for accelerated depreciation would be to apply it to certain types of investment in steelmaking, Admittedly, this increases the administrative burden and influences the industry's freedom of choice. Nevertheless, criteria could be established for investment objectives such as capacity expansion or the adoption of innovative technology, energy-saving technology, and technology making greater use of abundant domestic resources.

[3] Testimony of G. William Miller, Secretary of the Treasury, before the Subcommittee on Taxation and Debt Management of the Senate Finance Committee, Oct. 22, 1979. The loss is after an assumed feedback effect by which some 30 percent of the static revenue loss is turned into additional tax receipts as a result of the economic expansion induced by the tax reductions.

[4] Jones-Conable could lead to even greater tax savings. Using the 5-year writeoff for equipment on an accelerated basis, coupled with the existing 10-percent investment tax credit, would lead to greater tax savings than if the equipment were expensed in the first year. (*Iron Age*, Nov. 12, 1979, p. 30.)

Investment Tax Credits

Investment tax credits are another tax approach to increasing capital formation, General investment tax credits have proven effective in raising the Nation's investment rate, and more narrowly focused tax credits have also been recognized as a useful means to accomplish specific aims like conserving energy. For the steel industry, several types of investment tax credits are possible, including credits for increasing capacity, modernizing facilities, or introducing innovative technology (see table 10). Focused tax credits would cost the Government less than general ones.

Clearly, the innovation option could be used to promote investment in new technology, although defining such activities would be a substantial administrative burden. A greater credit might be offered for high-risk innovative activities. The modernization option would be more advantageous to large integrated companies than to smaller companies with a smaller capital base, but credits for capacity increases and adoption of innovative technology would be less biased against sma11 companies than the accelera ted-depreciation option. Under current procedures, however, credits cannot be taken until the investment project operates, so it could still be difficult for companies with high debt-to-equity ratios to obtain capital.

A further advantage of tax credits over accelerated depreciation is that they could more easily be designed to accomplish the specific goals Congress deems most relevant to improving capital formation in the steel industry: however, they would be more difficult to administer. Industry clearly prefers the Jones-Conable approach, which provides maximum flexibility to industry to use additional capital for whatever purposes it chooses, Companies could even choose to diversify out of steelmaking and realize a tax advantage from diversification.

Guaranteed Loans

The third major option for increasing capital formation in the steel industry is the loan guarantee. Unlike tax approaches, which shift revenues from the Government back to the private sector and have little advantage for low-profit industries, loan guarantees place the burden of capital supply on the private money market and better meet the needs of less profitable companies. Moreover, a loan guarantee enables companies who would otherwise have trouble obtaining reasonable loans, if any at all, to borrow capital at low interest rates. In this respect, it favors the less profitable steel companies over more profitable ones; in the context of steel, that would amount to a bias against the small, profitable nonintegrated and alloy/specialty companies.

The costs to the Government of a loan guarantee are slight (assuming no defaults), because borrowers pay a small interest fee to the Government. Loan guarantees can easily be designed to apply to steelmaking only and, defined in terms of specific objectives, could be aimed at the objects of particular congressional concern. Even nonspecific industry loans would promote the introduction of innovative technologies, however, because the Government shares the risk of failure.

EDA Special Steel Program.—The administration established a loan guarantee program for the steel industry in 1977, under EDA of the Department of Commerce. This program, which is just now ending, did not focus on the adoption and development of new technologies, and it has been criticized by a number of steelmaker because of its orientation toward helping unsuccessful companies.

The EDA special steel program was established in response to recommendations by the 1977 Interagency Steel Task Force. Its purpose is to help improve the efficiency and competitiveness of financially troubled steel companies. The task force stated that:

> The use of EDA loan guarantees (would be) the simplest and most direct way to assure that viable modernization projects of (eligi-

ble) firms actually receive the funds necessary for their completion.[5]

The program has no mandate to promote innovative technology; its primary objective is to stabilize or increase employment levels in certain designated areas, *

The EDA program represents a substantial amount of Government assistance. Nevertheless, its funding level of slightly more than $500 million is modest compared to steel industry capital investment needs. At the present time, the Department of Commerce has no plans to extend or expand the EDA steel loan guarantee program: to do so would require a specific budget request and congressional appropriation, and no such special request was included in the administration's proposed budget.

During its year of operation, the special steel program has had mixed results. Implementation has been slow, in part because of industry concerns about the program's possible anticompetitive effects in the marketplace. Section 702 of the Public Works and Economic Development Act prohibits EDA from providing assistance to companies if that assistance might lead to unfair competition in the marketplace. Unfair competition could be brought about if Government-supported corporate investments in new technologies gave the assisted firms an undue cost or price advantage, As a result, the program has not encouraged industry to adopt innovative technologies: instead, it has emphasized pollution control equipment and incremental improvements in existing facilities and conventional technologies.

On the whole, the program can be best described as one of tradition-oriented renewal aimed at responding to contemporary economic and environmental problems. This should come as no surprise. The umbrella Office for Business Development Assistance, itself, does not have a "modernization" mandate. Furthermore, the Interagency Steel Task Force recommendations, and particularly the implementing guidelines, make it quite clear that genuine modernization can never play more than a limited role in the special steel program.

[5]Interagency Task Force, *Report to the President: A Comprehensive Program for the Steel Industry*, 1977, p. 12.

*The program guarantees loans and leases financed by private lending institutions at favorable interest rates to SIC 3312 firms with facilities having an annual production capacity of at least 225,000 tonnes of raw steel. The minimum capacity requirement eliminates a number of minimills. Eligible firms have to be located in redevelopment areas with an unemployment rate of at least 6 percent, or in special impact areas having either substantial unemployment or an actual or threatened abrupt rise in unemployment due to the closing or curtailment of a major source of employment. (13 CFR parts .10'2-304,)

Loan Guarantees—A Summary.—It would be desirable to examine the benefits of a limited-term loan guarantee program that would require: 1) evidence of the company's inability to raise capital through any conventional means, including new stock issues; 2) a degree of risk and innovation that is proportional to relative profitability, so that successful firms would be encouraged to develop risky, long-range, major innovations, while still allowing the less profitable firms to share in the Federal assistance program; and 3) commitments to delay diversification out of steelmaking until companies meet certain mutually agreed-on objectives for such factors as capacity, productivity, energy use, or pollution abatement. This approach, though complex, would least disturb the relative competitiveness of domestic companies, while providing a means of restoring domestic steelmaking capacity and technological leadership compared to foreign industries.

Subsidized Interest Loans

The fourth major option for increasing capital formation is the use of subsidized interest loans, including industrial development bonds, which could be designed for specific purposes. Like loan guarantees, this approach places the financing burden on the private money market and costs the Government a relatively modest amount. Here too, to the extent that this approach increases the borrowing ability of unprofitable companies, it is biased against those that are profitable or have not reached a debt-to-equity ratio private lenders consider the upper limit for borrowing, Considering the level of capital shortfall under the Renewal and High Investment scenarios, loan guarantees or subsidized interest loans might not be well received by the private financial sector. The increased burden on the private money market could be inflationary. However, the same argument can be made for accelerated depreciation and investment tax credits, which lead to reduced Government revenues and, under the assumption of unaffected Government spending levels, increased Government borrowing. Loan guarantees and subsidized loans bypass the normal budget process, because they are not expenditures and do not cause losses in tax revenues.

Summary of Capital Formation Options

In summary, all four of these approaches to improve capital formation within the domestic steel industry involve costs and benefits. Quantifying them for the near and long terms would require considerable analysis. Qualitatively, OTA finds that focused investment tax credits, or accelerated depreciation for capacity expansion and technological innovation, or risk-related loan guarantees could be used to raise the capital called for in the Renewal scenario. The additional capital required by the High Investment scenario would have been raised through steel price increases. There is a minimal risk in these options that capital will be used for purposes that would not address congressional concerns and that would have adverse impacts on small steel companies. The costs and difficulties of administering focused Federal assistance would be significant, but not insurmountable. Helping already healthy companies is best done through tax relief programs, The near-term direct costs of any of these programs would likely be offset by increased tax revenues after the rejuvenation of the domestic industry.

Scenario Differences

The Liquidation scenario would extend present policies and capital spending on productive steelmaking facilities would continue to decline, which would lead to further loss of capacity and increased obsolescence of facilities, The High Investment scenario is based on obtaining the benefits of the accelerated depreciation for facilities and a substantial increase in steel prices in order to maximize near-term investment in current technology. The Renewal scenario is dependent on policy changes that would generate at least $600 million annually; it considers a number of policy options that could accomplish this goal, but would be best accomplished by those options that assist modernization and expansion of steelmaker that are profitable. The Renewal scenario also favors policy changes that promote technological innovation in the long term and relatively low investment in current technology in the near term.

Regulatory Compliance Costs

The steel industry is one of the largest sources of pollution in the Nation, with the integrated steelmaker accounting for close to one-fifth of all domestic industrial pollution. The industry also has very high rates of occupational injury and illness. The harmful and toxic emissions of steel plants are a greater hazard for steelworkers than the general population. Consequently, the Federal and State governments have created a number of regulations to protect both workers and the public. There can be no argument against the goals of reducing environmental pollution and occupational risks; however, the impact of these regulations on the creation and adoption of new technology merits examination. Regulations can act as either a barrier or an incentive to innovation, While industry has tended to emphasize the barrier effect, there are opportunities for the regulations to serve as incentives for technological innovation. Because of the nature of this study, the impact of regulations on the steel industry has been emphasized; but this does not mean that the impact of pollution on workers and the general public is thought unimportant.

Complying with Federal environmental and, to a lesser extent, occupational hazard regulations has imposed additional capital and operating cost demands on the steel industry. These promise to increase because of more stringent requirements that will become effective during the coming years. Furthermore, EPA is in the process of reviewing Ambient Air Quality Standards and steel industry effluent guidelines, And finally, the number of EPA and OSHA regulations applicable to the steel industry is steadily increasing.

States and regions have some flexibility in considering economic and technical constraints facing individual steel plants. However, industrywide changes would require Federal action, The trend of increasing regulatory costs may be halted or reversed through changes in regulatory policies or through increased Federal support of steel industry efforts to meet current standards. In addition to reducing the regulatory costs, some available options could also foster replacement or expansion of steel capacity, The major options for changes in regulatory policies are:

- congressional endorsement of the "bubble concept, " which allows air quality control on a plant rather than a point-by-point basis:
- more even distribution among different industries of the cost of offset policy tradeoff requirements;
- relaxation of the limited-life facilities policy for plants owned by companies committed to replacing facilities or otherwise providing for regional economic growth:
- relaxation of fugitive air emissions requirements;
- use of administrative penalty payments for environmental technology R&D fund;
- improved coordination of OSHA compliance deadline when a company is considering innovation;
- improved coordination of EPA innovation waivers; and
- cost-benefit analysis of major proposed regulations.

The major options for increased Federal support are:

- additional acceleration of the depreciation schedule for pollution abatement equipment;*
- increased investment tax credit for pollution abatement equipment;
- loan guarantees, provided on a continuing basis;
- extension of industrial development bonds to cover in-process changes; and
- increased regulatory technology R&D and demonstration.

Regulatory Change

Regulatory cost impacts would be reduced under both sets of options, but changing enforcement approaches would not affect direct Federal costs. A few of the changes could also promote new regulatory technologies or facilitate replacement or modernization (table 11). Small integrated companies would benefit from such policy changes more than other industry segments.

Congressional endorsement of the bubble concept, which allows pollution offsets within a plant, would improve EPA's ability to apply this approach across the board to existing and replacement facilities. By varying the degree of control with the costs involved for individual point sources while still attaining air performance standards on a plant basis, companies could reduce their compliance costs by 5 to 20 percent (see ch. 11). However, the tradeoff between more and less hazardous pollutants within a bubble area requires assessment.

The offset policy requires that companies adding new, polluting plant capacity in a given geographical area offset that addition to the area's pollution by reducing pollution from another facility in the same area. Because of the steel industry's complex industri-

*Suggestions also have been made to eliminate the sales tax on pollution abatement equipment. Such changes would have to be made at the State level.

Table 11.— Regulatory Change: Policy Options and Consequences

Regulatory change	Social impact[a]	Promotion of new technology	Regulatory cost impact	Capacity
Bubble concept	Modest	Yes	Reduction	Facilitates replacement
Distributing cost of tradeoff requirements (offset policy)	None; increased equity among expanding firms in nonattainment areas	No	Reduct ion	Facilitates expansion
Extension of limited-life facilities policy while replacing steel facilities or otherwise providing for regional economic growth	Modest; at least partially offset by strengthening regional economy	Yes	Reduct ion	Replacement/ expansion
Fugitive emissions	High	No	Slow down growth rate	NA
Use of administrative penalty payments for environmental technology R&D fund	None, but goal change in favor of R&D	Yes	Transfer of costs	NA
Improved coordination of OSHA compliance deadlines	Modest	Yes, if given as condition for extended deadlines	None	NA
Improved coordination of EPA innovation waivers	Modest	Yes	None	NA
Cost/benefit analysis	Varies with cost-benefit tradeoff	No	Potential reduction	NA

NA - not applicable
[a]Social impact is defined as increased environmental degradation or occupational risk resulting from regulatory relaxation
SOURCE Off Ice of Technology Assessment

al processes, it has paid a disproportionately high price (compared to many other industries) for economic growth and capacity expansion in industrialized areas. Redistributing the "purchase cost" of emission offsets could help improve the steel industry's unfavorable compliance cost position. The Department of Energy's (DOE) energy entitlement program, aimed at equalizing the cost of expensive imported oil among domestic refiners, is one approach that could be considered.

The limited-life facilities policy calls for the phaseout of marginal facilities by 1982-83 unless they have been retrofitted with abatement equipment. Relaxation of this policy would enable steel companies to benefit from an extended period of continued operation. This approach could coupled with replacement, modernization, and expansion programs, perhaps at other plants.

Relaxation of fugitive air emission standards regulating conventional pollutants from steel plants would help slow down anticipated increases in compliance costs (see ch. 11), Such relaxation could put undue pressure on regional air quality, however, and inhibit economic growth potential as a result. Relaxation of standards or compliance dates could be especially problematic in heavily polluted regions of the country.

Administrative penalty payments made by the steel industry for noncompliance with environmental regulations are presently received by the U.S. Treasury. These funds could be used for public- or private-sector regulatory technology RD&D in presently underfunded fields such as research on innovative process or control technologies capable of improved protection or regulatory cost reduction.

OSHA compliance schedules and deadlines lack uniformity and are inconsistent in their consideration of industry economics and technology development. EPA innovation waivers for air and water also lack uniformity. Improved coordination could encourage the industry to make use of innovation waivers and technology development provisions.

A cost-benefit requirement for major regulatory policies could help clarify the tradeoff between the economic costs and the social benefits by placing the economic impacts in a broader social framework, To the extent that it is difficult to quantify the social benefits of regulations, such an approach may not be feasible.

Increased Federal Support

Some options, if applied without any accompanying regulatory relaxation, would increase Federal costs in varying degrees. Regulatory costs would be reduced in all cases, and new regulatory technologies would be promoted in a few cases (table 12), Capacity would not be affected by any of these policy options, except to the degree that they improve capital formation. These options would indirectly tend to benefit small integrated companies more than any other industry segment because of those companies' proportionately greater regulatory costs.

Industrial development revenue bond (IDB) financing is presently a more attractive option for pollution abatement equipment than is the use of available fiscal incentives. IDB financing makes large sums of capital available to industry at relatively low cost to the Treasury. Thus, one option would be to expand the scope of IDB financing to include specifically the financing of in-process changes for environmental compliance purposes whether or not there are cost savings. However, increased use of IDBs would increase pressure on the municipal bond market, which could inhibit capital projects for local governments.

As an alternative, some IDB financing could be replaced by a continuing flow of federally guaranteed loans or by more effective fiscal incentives. Fiscal incentives could include allowing higher investment tax credits for regulatory investments (currently 10 percent) or further reducing the accelerated depreciation schedule for regulatory compliance equipment (from the present 5 years to perhaps 1 year). Fiscal options would likely entail higher Federal costs than either increased IDB or federally guaranteed loan financing.

RD&D of innovative regulatory technologies and cleaner steelmaking technologies are not receiving sufficient public- and private-sector support. Consideration should be given to a strengthened program to increase direct Federal cost-sharing support of regulatory technology RD&D not readily undertaken by the steel industry.

Scenario Differences

The Liquidation scenario assumes a continuation of current policies—continued strict enforcement of existing laws and standards. The likely effect would be a moderate increase in capital spending and production costs related to EPA and OSHA regulations, which would influence the profitability of domestic steelmaker. For those firms with older, inefficient facilities, this could contrib-

Table 12.—increased Federal Support for Regulatory Compliance and R&D: Policy Options and Consequences

Increased Federal support	Federal cost	Promotion of new technology	Regulatory cost impacts
Improved accelerated depreciation	High	No, unless specified	Reduction
Increased investment tax credit	Modest	No, unless specified	Reduction
Loan guarantees	Modest	No	Reduction
Extend IDB coverage for regulatory equipment to in-process change	Modest. pressure on municipal bond markets	Yes	Improves capital availability y
Increased Federal regulatory technology R&D	Modest	Yes	Reduction

SOURCE: Office of Technology Assessment

ute to plant closings and a further loss of domestic capacity. The High Investment and Renewal scenarios both make use of the cost-benefit approach to determine the extent to which the social goals of EPA and OSHA regulations are also consistent with the goals and needs of industry modernization and expansion. The Renewal scenario provides a more thorough examination of policy options that would reconcile industry and national needs, with particular attention to the need to promote technology change and innovation leading to cleaner steelmaking technologies.

Raw Materials

Potential future shortages of coke and ferrous scrap have raised the general problem of inadequate data and analysis of such supply problems. In the cases of coke and scrap, the Government has had to rely on limited data from different segments of industry. Because of differing interests in the problem, there are contradictory findings concerning future domestic supplies. This uncertainty is acting as an incentive for the development of DR and other technologies. Existing legislation relating to ferrous scrap affects both demand and supply, but not necessarily in a cons is tent manner.

Scrap Use

On the demand side, two legislative acts have been passed that attempt to maximize the use of scrap and other waste sources of iron genera ted in steel plants. The requirements of the two acts may he summarized as follows:

- Section 461 of the National Energy Conscrvation Policy Act (Public Law 95-619) of 1978 mandates that DOE set targets for the use of recovered materials for the entire ferrous industry —ironmakers and steelmaker, foundries, and ferroalloy producers. Such targets, now set, are voluntary, but steel producers are concerned that they might become mandatory.
- Section 6002 of the Resource Conservation and Recovery Act (Public Law 94-580) of 1976 amends the Solid Waste Disposal Act and deals with Government procurement, It requires that Government procuring agencies shall procure items composed of the highest percentage of recovered materials practicable, and it instructs the EPA Administrator to promulgate guidelines for the use of procuring agencies in carrying out this requirement. It also requires suppliers to the Government to certify the percentage of recovered materials used in the items sold. As yet, EPA has not set these guidelines, nor has it proposed a schedule.

Although instigated by the scrap industry, these acts have satisfied neither scrap users nor suppliers, Users believe that targets or guidelines for scrap use do not make economic or technical sense on an industrywide basis, and suppliers believe that the Government targets have been too conservative. OTA finds both are correct.

Although it is in the national interest to maximize the use of recovered materials in order to save energy, the setting of scrap-use targets or guidelines presents a number of problems; it may not be technically or economically feasible in all cases to use recovered materials to the extent suggested or required by the Government. There has been no apparent recognition by DOE and EPA of the differences between steel industry segments and the unique constraints and opportunities they have in regard to scrap use. Another problem is that a numerical target rests on many assumptions about future scrap availability and use, as well as total steel demand and changes in technology, all of which are highly controversial in themselves.

Targets could, in fact, be counterproductive to the original goals of maximizing recovered materials use and saving energy, 'Unrealistic targets could be circumvented, for example, by companies selling their home scrap to others and purchasing other firms' home scrap.* If targets and guidelines increase de-

*This could be a paper transaction unless prohibited by the target legislation since physical transport of scrap would be costly in most cases. See ch. 7 for a full discussion of future supply, demand, and uses of scrap.

mand for scrap, and thereby raise prices, the impact on nonintegrated companies would be much worse than on integrated steelmaker; if this led to a decrease in nonintegrated output, it could result in even less total scrap use. Technically and economically, it would be extremely difficult for integrated steelmaker to increase substantially their use of recovered materials in existing facilities; and if they modified their equipment to use more scrap in basic oxygen furnaces, they would probably use more oil or natural gas as well. Targets and guidelines are irrelevant for electric furnace steelmaking; this process presently uses nothing but scrap.

With the advent of DR and the availability of DRI, a technology that may offer benefits for both the industry and the Nation (see ch. 6), electric furnace steelmaker could use less scrap. Hence, targets or guidelines could actually discourage the introduction of DR. Even though the percentage of scrap used per unit of output would decrease in electric furnace shops using DRI, it can be argued that the use of DRI in conjunction with scrap would promote an expansion of electric furnace steelmaking, with the net result that the total use of purchase scrap would increase.

Is it necessary for the Government to set any targets or guidelines for ferrous scrap use? OTA finds no compelling reason to legislate broad goals for the industry. The economic advantages of using scrap have been sufficient incentive to increase scrap use, especially by the nonintegrated producers who rely solely on ferrous scrap. Even the integrated companies have changed their attitudes and recognized the economic benefits of maximizing their use of scrap to the degree their facilities and capital permit. A more direct and fruitful approach to increasing domestic use of domestic scrap would be to provide a financial incentive for adopting scrap-using processes. For example, a special investment tax credit could be offered for adoption of equipment that allows an existing plant to use more scrap. Because scrap is embodied energy, it might only be necessary to redefine some terms to qualify such equipment for special energy conserva tion investment tax credits.

Ferrous Scrap Exports

Perhaps the most critical area for policy analysis is the issue of ferrous scrap exports-. Domestic steelmaker are uncertain about future scrap supply and maintain that exports greatly influence domestic prices. The scrap industry favors free export of scrap. It contends that there is sufficient domestic scrap for export, that more scrap becomes available as market forces increase prices, and that historically the integrated steel producers have not attempted to maximize their use of scrap, To some extent the latter has been true, although the situation appears to be changing.

The importance of examining policies affecting the supply and demand for ferrous scrap is shown by data demonstrating the inflationary effect of scrap on steel prices. During the past 2 years, when scrap exports have reached very high levels, so too have scrap prices, The increase in the producer price index for ferrous scrap from 1977 to 1979 was 52 percent, compared to increases of 21 percent for labor, 6 percent for metallurgical coal, 16 percent for iron ore pellets, 18 percent for electrical power, and 33 percent for fuel oil. For the same period the price increase for the entire steel mill product mix was 21 percent, but the price for reinforcing bars (which unlike the other products are made entirely from scrap) rose 37 percent. Available data point to direct relationships between scrap exports and domestic scrap prices and between scrap prices and finished steel prices.

Scrap exports make a positive but relatively small contribution to the Nation's trade balance; for 1979, they equaled only about 15 percent of the net steel-related trade deficit. By exporting scrap, moreover, a valuable source of both iron and embodied energy [about 17 million Btu/tonne) is being exported. The more scrap used domestically, the less energy, time, money, and labor will be expended to mine, process, and reduce iron ore. When scrap is exported, these savings are realized instead by foreign steelmaker, whose government-subsidized steels then return to compete in the domestic market. To the extent that steel and steel-intensive products are imported, such as automobiles, the Nation may eventually add to the domestic scrap supply at the expense of that in steel-exporting nations, like Japan; at present, however, these nations are able to buy back their scrap from the United States. These scrap exports cause the domestic price of scrap to rise, giving foreign producers a net price advantage because of the devalued dollar and their inherently greater energy costs.

Present-day steelmaking processes use more scrap and produce less, than did previous methods. Steelmaker are becoming more dependent on purchased scrap, which is declining in quality. The domestic demand for scrap is so great, and increasing so rapidly, that the scrap industry may have no long-range economic need to export; it is even possible that a domestic shortage of ferrous scrap may develop during the next decade unless DRI becomes available. Perhaps the most significant long-range consequence of continued scrap export is the possible detrimental impact on the nonintegrated steel producers, who depend on electric furnace steelmaking. If formal or informal Government price controls on steel cannot be released quickly enough to offset quickly rising scrap prices, these companies may be caught in a cost-price squeeze that could drive them out of the market. This impact is particularly acute now, when DR is in the early stages of domestic introduction and DRI is not yet readily available as an import.

The Export Administration Act of 1979 offers a means for monitoring and controlling scrap exports. To the extent that substantial market imperfections exist as a result of U.S. and foreign government policies, interference with free trade can be rationalized. The long-range consequences of permitting unlimited exports of scrap for the competitiveness of the domestic steel industry are sufficiently serious to warrant responsible implementations of the Export Administration Act. The welfare of the domestic scrap industry must also be considered, however, and to this end any limits placed on scrap exports could, in the near term, be balanced by appropriate Federal incentives for increased domestic use of scrap by, for example, special investment tax credits for the adoption of continuous casting and certain modifications to steelmaking furnaces.

Scenario Differences

The Liquidation scenario implies a continuation of existing policies with regard to ferrous scrap, resulting in continued problems due to uncertainty about future supply and demand. Moreover, policies related to scrap could remain controversial and to a large extent contradictory. There is particular need to balance control of scrap exports with promotion of domestic scrap use. The High Investment scenario allows market forces to determine raw material supply and demand and does not deal with specific policy changes. The Renewal scenario emphasizes better coordination, which would include examination of policy changes that link incentives for increased domestic use of ferrous scrap with appropriate monitoring and, if needed, control of scrap exports. The Renewal scenario also supports DR technology, which would offer a substitute to ferrous scrap in electric furnace steelmaking in the future.

Trade

Although worldwide trade in steel is not the central focus of OTA's study, certain aspects of that trade do affect technological levels in the industry. OTA has addressed two of these aspects:

- the impacts of the new Multilateral Trade Agreement* on the export of technology-intensive alloy/specialty steels, and

*This new international trade treatv. signed by most of the industrialized and increasing numbers of Third World nations, promotes trade under equitable, competitive conditions.

- the impact of uncertain levels of steel imports on investment decisions relating to modernization, capacity expansion, and innovation.

Vigorous enforcement of the Multilateral Trade Agreement, which will govern much of the world's trade and other domestic trade laws and policies, such as the trigger-price mechanism, * is necessary but not sufficient for bringing about a revitalization of the domestic steel industry. Lax enforcement, however, is sufficient to perpetuate present trends and to assure the slow but inevitable demise of much of the industry.

Even if the new trade agreement is vigorously enforced by the United States and its trading partners, it could do little to solve the fundamental problems of the domestic steel industry. At best, there would be an uncertain amount of decline in imports and an increase in exports. The most important benefit of an effective trade agreement would be to reduce domestic steelmaker' uncertainty about both their potential for capturing growth in domestic demand and their rewards for long-term investments in technology, If the new trade agreement is not vigorously enforced, other policy changes aiding the industry could be nullified by surges in unfairly traded imports, or by the producers' fear of such surges.

Of the issues related to the Multilateral Trade Agreement, the subsidy issue is the most critical. Domestic steel producers have expressed concern that the definitions and implementation of the subsidy provisions will result in increased penetration of the domestic market by imports at prices kept low by foreign government subsidies of their steel producers, According to C. William Verity, Chairman of Armco.

> The steel industry's other major concern has been about the effect of the negotiations on our domestic laws governing international trade. We're specifically concerned that the international codes on subsidies and countervailing duties and anti-dumping, and the legislation necessary to implement these codes, could weaken our present statutory defenses against dumped, subsidized or otherwise damaging imports—thus making it more difficult for American manufacturers to obtain relief from unfair or injurious imports.'

*This procedure attempts to detect dumped steel quickly by setting a price below which imports are examined for dumping,

The proposed process to establish whether a subsidy is illegal is complex:

> The (subsidies) Code provides for two routes (or tracks) of redress for parties who claim they are being injured by foreign subsidy practices or claim that their international trading interests are being prejudiced by the payment of foreign subsidies in violation of the Code's obligations. The first track is domestic action intended to prevent injury to national industries through the traditional means of countervailing duties. The second track provides a multilateral mechanism through which signatory countries can enforce their rights under the Code. The second track would be used, for example, when a country is losing a share of a third-country market to subsidized exports from another signatory country."[7]

This issue arises because, increasingly, most industrialized countries are subsidizing their exports by providing loans, loan guarantees, interest subsidies, and related assistance to exporters. A recent report by the Congressional Research Service provides a comprehensive summary of such subsidies." In brief, the programs of major exporting countries are as follows:

- France. The report judged that the French "have the broadest and most confessional' program. Private banks can make medium-term, fixed-interest-rate export loans and then borrow against such loans under "attractive refinancing arrangements" at the French central bank. In addition, the govern-

' C. William Verity, "International Trade Pact—Steel's View." Trade Negotiation Panel. AISI Press Conference, May 1979.

*"Wrapping Up the MTN Package. " Business Amcrica, Apr. 23, 1979, pp. 4-5.

"Congressional Research Service, *Export Stimulation Programs in the Major Industrial Countries*, Washington, D. C., 1979.

ment provides direct loans to finance up to 85 percent of long-term (over 7 years) loans. Exporters can also often obtain foreign-aid loans with 3-percent interest rates and 25-year repayment periods for some shipments to developing countries. Finally, the government offers insurance to protect exporters against political risks and the impact that inflation or exchange rate changes could have on their costs.

- Japan. The Japanese Export-Import Bank offers direct credit for about half the value of exports financed with medium- and long-term loans; the interest rates (6 to 9 percent) are close to market rates. The Japanese also mix foreign-aid credit [with interest rates of 4 to 6.75 percent and maturities up to 25 years) with normal export loans and guarantee private banks against losses on export loans.
- Great Britain. The Export Credit Guarantee Department (ECGD) provides subsidies on private bank loans to exporters; that is, the private bank makes a fixed-interest-rate loan at below-market rates, and the ECGD makes up the difference. The ECGD provides such subsidies not only in pounds but also in other currencies, including the dollar. It also provides insurance and guarantees against losses on export loans.
- Italy. "On paper, " the report says, "the Italians have a highly confessional export financing system, but in practice the actual level of government support is limited by budget shortages in the administering agencies, " The Italians provide interest-rate subsidies for private bank loans as well as insurance against export loan losses; in 1976, however, only about 9 percent of Italy's exports benefited from insurance protection.
- West Germany. Most export financing is handled privately through a consortium of private banks, but some medium-term credits (generally 2 to 5 years) can be refinanced through the central bank. A government agency provides up to 45 percent of long-term export loans to developing countries, and Hermes, a private company supervised by the government, writes insurance and guarantee policies.
- Netherlands and Switzerland. Both countries leave export financing largely to private banks, although the Dutch have a small program that allows export loans to be refinanced at the central bank and the Swiss Government writes export insurance. In 1976, however, only about 9 percent of Switzerland's exports used this insurance.

In the past, the United States' attempts to subsidize exports have been relatively limited. Recently, there has been significant change in this policy by the Export-Import Bank of the United States (Eximbank).' In summary,

> The Eximbank offers both direct loans and protection against losses on private loans. Through the Foreign Credit Insurance Corporation (FCIA, a consortium of the Eximbank and private insurance companies), it offers insurance for U.S. exporters that finance their own overseas sales; if the foreign buyer doesn't meet its payments, the insurance will cover the exporter's losses. There's a similar guarantee program for banks if the foreign buyer doesn't repay the loan, the Eximbank makes up the loss. Banks can also discount loans at the Eximbank; that is, they can borrow at the Eximbank against one of their own export loans. And finally, there are direct loans, which the Eximbank makes either to foreign buyers or foreign banks.

Eximbank's role in providing export support has been increasingly significant in recent years. In the fall of 1979, its outstanding commitments were about $27 billion, but these were concentrated in only a few manufacturing sectors of the economy: powerplants—$7 billion; civilian aircraft—$6 billion; and heavy industry—$5 billion. The domestic steel industry has had no support from the increased Eximbank activities.

'See: Robert J. Samuelson, "The Export Credit Subsidy Game—If You Can't Lick 'em, Join 'em." *National Journal.* Apr. 14, 1979, pp. 597-602.

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Scenario Differences

Since there is so much going on at present in the trade policy area, it is difficult to tell what the Liquidation scenario (based on continuation of existing policies) implies in this area. The main problem has been the uncertainty domestic steelmaker face with respect to future imports of steel. Vigorous enforcement of the new Multilateral Trade Agreement could remedy this uncertainty; both the Renewal and High Investment scenarios require such enforcement, as well as other trade policies that promote greater certainty about steel imports in order to make capital investments rational, but this is not an area that the OTA analysis has dealt with in detail. The Renewal scenario places some additional emphasis on the potential for increased exports of the high-technology steels in which the United States already has technological and cost competitiveness.

Foreign Government Policies Toward Steel Industries

It is not within the scope of this study to give an exhaustive review and analysis of foreign government policies toward their steel industries. However, it is clear that other governments have played a very large role in the international steel market and that their policies tend to be better coordinated than are U.S. policies.

Table 13 uses eight general factors to rank relations between government and industry in four geopolitical regions. Japan emerges as having the most beneficial policies toward its steel industry; following Japan, but with less difference among them, are Third World nations, the European Community, and the United States. The ranking system uses the perspective of industry and what would be most desirable from the corporate viewpoint toward maximizing management's freedom of choice, minimizing costs, and maximizing profits.

International Comparison of Cost Recovery Allowances

Table 14 presents a more specific international comparison of capital cost recovery allowances for major steel-producing countries. The table includes all special allowances, investment credits, grants, and deductions generally permitted in each country; regional incentives, if any, have been excluded.

The data presented in the first column, "representative cost recovery period, " refer to the total number of years required to recover 100 percent of the cost of an asset, in-

Table 13.—Ranking of Factors for Government-Steel Industry Relations

Factor	United States	EEC	Japan	Third World
Stature of steel industry	1	2	3	3
Good Government/industry relationship (adversarial v. cooperative)	1	2	3	3
Minimum Government involvement in steelmaking decisions	3	2	3	1
Government protection of domestic steel markets	2	3	3	3
Availability of emergency funds	1	2	3	3
Government support R&D	1	2	3	1
Producer's pricing freedom	3	2	3	
Low pollution abatement requirements	1	1	1	3
Ability to lay off workers	3	2	1	1
Total	16	18	23	19

NOTE Ranking has been interpreted from the perspective of what is desirable from Industry viewpoint, with the highest numerical value representing the most advantageous Government policy.

SOURCE Office of Technology Assessment

Table 14.—Comparison of Cost Recovery Allowances in the Steel Industry

	Representative cost recovery periods (years)	Aggregate cost recovery allowances (percentage of cost assets) First taxable year	First 3 taxable years	First 7 taxable years
Australia [a b]	10	35%	59%	88%
Belgium [a c]	9	26	55	86
Canada [a d]	2	63	109	109
France [e f]	7	41	78	105
West Germany [g h]	10	25	58	87
Italy [a i]	6	25	75	100
Japan [j k]	11	31	55	84
Netherlands [m]	8	37	57	97
Sweden [a n]	4	48	86	118
United Kingdom [o p]	1	100	100	100
United States [q r]	11	35	57	86

[a]No special relief provisions are available for pollution control facilities

[b]Capital cost recovery is computed on a straight line or accelerated (150-per. cent D.B.) basis with an additional 20-percent deduction available in the year of acquisition (40 percent prior to 6/30/79) 150-percent D B depredation over a 10 year period plus the additional first year depredation has been assumed Australia s sole steel manufacturer may have negotiated a special cost recovery arrangement

[c]Capital cost recovery is computed on a straight line or accelerated (200-per cent D B.) basis As a temporary measure to promote Investments, a onetime special deduction of 15 percent is allowed on certain acquisitions of fixed assets made during 197980 The special deduction will be allowed to the extent that 1979 or 1980 investments in fixed assets exceed the average annual investments for the years 197476 The 15 percent deduction is applicable to a maximum of 40 percent of the total new investments 200. percent D B depredation over a 10 year period plus the additional first year depredation has been assumed

[d]Capital cost recovery may be claimed at a rate of 50 Percent in the Year of acquisition and the remainder in the next succeeding year A 7-percent (5 percent if certain legislation is not extended during 1979) Investment tax credit may be claimed in the year of acquisition and has been Included in the table computation Investment tax credits reduce the cost of property for purposes of computing cost recovery allowances Based on proposed legislation, Investment tax credits of up to 20 percent may be available depending on the location of the asset

[e]Capital cost recovery is computed on a straight line or accelerated (250 percent D.B.) basis. Based on proposed legislation an additional 10 percent deductlon may be claimed on the net increase in assets over the preceding year without reducing the Increase in assets over the preceding year without reducing the basis for regular depredation Over an 8-year period 250 percent D B depredation plus the additional 10-percent deduction has been assumed

[f]Through 1980. pollution control facilities attached to building in existence prior to 1/1/76 will qualify for a 50 percent special cost recovery allowance in the year acquired The tax basis of such facilities are reduced by the special allowance for purposes of computing regular cost recovery If the pollution control facilities do not qualify for the special allowance described above, regular cost recovery may be claimed *over* a shorter useful life than is generally allowed for other assets (e. g , 6 Instead of 10 years)

[g]Capltal cost recovery is computed on a straight line or accelerated (250-percent D.B.) basis Regional Investment grants of up to 20 percent of the cost of certain assets may be claimed in the year of acquisition. Over a 10-year period 250-percent D.B. depredation has been assumed

[h]A special Capital cost recovery allowance is available for Pollution control facilities purchased or constructed between Jan. 1, 1975, and Dec. 31, 1980 A capital cost recovery of 60 percent may be claimed in the year of acquisition and 10 percent in each of the 4 following taxable years

[i]Capital cost recovery is allowed at a rate of 10 percent per year plus an additional deduction of 15 percent for each of the first 3 taxable years

[j]Capital cost recovery is computed on a straight line or accelerated (206-percent D B) basis A 10-percent Investment tax credit is available in the year of acquisition Over a 14-year period 206-percent D B depreciation plus a 10-percent investment tax credit is assumed

[k]A sspecial capital cost recovery allowance is provided in lieu of Investment 'ax credit for pollution control facilities at one-thlrd of the cost in the year of acquisition This special allowance reduces the cost of the facility for purposes of computing regular cost recovery discussed in footnote (j) above

[l]Capital cost recovery is computed on a straight line basis Investment tax credit ranging from 7 to 23 percent is available in the *year* of acquisition depending on the type of asset Straight line depredation over a 10 year period plus a 13-percent Investment tax credit is assumed In addition, where production capacity or the number of jobs is increased grants of up to DF L 5 million are available

[m]If a particular business is subject to air pollution regulations which are more severe than would be expected for the type of business, the government may indemnify the business for the extra cost Incurred This subsidy is determined on a case by case basis, without limitation and reduces the cost of the facility for purposes of computing the Investment tax credit discussed in foot. note (1) above

SOURCE: Richard M. Hammer. National Office, Price Waterhouse & Co , June 1979

eluding the tax benefit of any investment tax credit or other allowances. The useful lives used are considered representative for the country for which the depreciation computation is made. The present value of cost recovery allowances has not been taken into account. Note, however, that in some countries investors must agree with the tax authorities as to the rate of depreciation and other benefits available before they invest in fixed assets; such agreement would, in many cases, have the effect of substantially increasing the allowances presented in the table.

The data indicate that the United States and Japan have the largest representative cost recovery period—l1 years. In Canada, the representative period is only 2 years, in Sweden, 4 years. The aggregate cost recovery allowance (percentage of cost of assets) for the first 3 taxable years is a significant measure of the attractiveness of capital investments in steel. The United States, with a 57-percent recovery, has a lower rate than most other nations. Only Japan and Belgium have smaller recovery allowances; a number of countries have much larger allowances.

Europe

The EEC Commission

The discussion of government policies for the steel industries of Europe is made complex by the combination of individual policies of nations and the presence of the Commission of the European Economic Community (EEC), which has absorbed most of the policy functions of the European Coal and Steel Community (ECSC). Management of the European steel industry is now conducted through the EEC Steel Directorate. The supranational policies of the group are discussed first. It should be noted, however, that the policies of the ECSC and EEC are not always followed by member nations, although there appears to be increasing agreement on policy implementation.

The Davignon Plan.—Current policies of ECSC have one major emphasis—that of overcoming the crises of the European steel industry, which resulted in job loss for more than 100,000 workers between 1974 and 1979 and may lead to an additional 80,000 lost jobs in 1980. The state of the European steel market in the spring of 1977 was described in these words:

> The present situation is that production is falling, new orders are continuing to stagnate, the rate of utilization of production capacity is running at no more than about 60 percent, prices are low, exports slack and stocks large, and short-time working is at almost the same level as during the most difficult period of the earlier recession, [10]

At a special meeting on March 16, 1977, the Commission adopted a new set of policy guidelines which set forth the group of steel policy measures that came to be known as the "Davignon plan." The proposed policy was accepted a few days later by the European Council—the heads of state and government—which issued the following declaration:

> The European Council has considered the situation in the steel sector, on the basis of a communication from the Commission. This sector is experiencing a depression more serious than at any time in the history of the Coal and Steel Community, The heads of state and government have taken this opportunity to reaffirm their resolve to restore to the steel industry through the appropriate measures, the viability and competitiveness essential to the maintenance of a truly European industrial potential.
>
> The European Council expresses its appreciation of the efforts being undertaken by the Commission to put forward at an early date practical proposals and initiatives for short-time remedial measures to stabilize the market, for a longer term structural reorganization of the European Steel industry and for measures in the social field to assist workers adversely affected by such reorganization.
>
> The European Council expresses the wish that the Council of Ministers gives its urgent attention to the Commission's proposals and initiatives on these issues.[11]

The new policy guidelines, aimed at strengthening the Community's crisis measures, were grouped into four main categories: 1) preservation of the unity and openness of the market, 2) accomplishment of a modernized production capacity, 3) market intervention, and 4) retraining and redeployment of workers.[12] Most (but not all*) of the policies of the Davignon plan have been accepted by the European steel-producing countries, and the Commission has obvious strength in formulating and executing supranational policies affecting the steel industry in Europe.

The present powers of the EEC Steel Directorate include:

- veto power over new investments in steel;
- the power to enforce or waive major antitrust rules;
- setting minimum prices;

[10] *Bulletin of* the European Community, No. 3, 1977, p. 28.

[11] Ibid. p. 29.

[12] Ibid.

*For summary of the problems facing Davignon plan see: "Davignon Plan Fate at Stake," American *Metal Market*. Aug. 16, 1979, pp. 1-4.

- setting production quotas for each country and suggesting production ceilings for each company;
- negotiating voluntary quotas for exports of steel to the EEC by Japan and Eastern European and Third World nations;
- consolidating industrywide confidential data on their operations and plans;
- making projections of planned capacity set against likely demand for every category of steel;
- providing supplemental funds to deal with displaced workers; and
- veto power over all government subsidies to steel; however, the Steel Directorate cannot force a company to close a facility.

In addition to the policies to minimize problems arising from the currently acute overcapacity of European steelmaker, the Commission has implemented other important policies. It has for many years helped finance capital investment programs. As an entity, the Commission is able to borrow funds at lower rates of interest, in part because of its authority to levy a tax on the value of steel and coal produced within the EEC. It then loans the funds it borrows in the open market to steel enterprises within the EEC at lower interest rates and longer payback terms than they could otherwise command on the basis of their individual credit. Between 1954 and 1974, the Commission granted a total of $2.4 billion in low-interest loans to EEC endeavors. This averages $120 million annually, including $65 million that is distributed directly to the iron and steel industry. During 1974 alone, the Commission granted low-interest industrial loans totaling $42.2 million to finance such production facilities for high-grade and specialty steels, environmental equipment for the steel industry, modernization of coal facilities and iron ore mining, and a research center for specialty steels.

The Commission also has significant long-range planning functions and has recently formulated its "General Objectives for 1980-85" for the iron and steel industry. This statement sets priorities and establishes guidelines for the EEC iron and steel industries through 1985, with particular stress on the areas of specialty steel and raw materials (scrap, iron ore, and energy). The objectives were developed by a steering committee composed of representatives from major iron and steel producers, national governments, and the Commission. While these objectives are described as "guidelines," they are nonetheless real objectives since they constitute the framework for the Commission's extensive financial investment program.

The Commission has also extended its influence beyond Europe by establishing formal ties with the Organization for Economic Cooperation and Development (OECD). The OECD Ad Hoc Working Party on the Iron and Steel Industry, set up at the request of the EEC to provide a forum for discussions of the world steel crisis, was transformed into a permanent Steel Committee[13] a year later for the following stated purposes:

- continuously follow the evolution of national, regional and world steel industries with regard to employment, profits, investments, capacity, input costs, productivity, and other aspects of viability and competitiveness;
- develop common perspectives regarding emerging problems or concerns in the steel sector and establish, where appropriate, multilateral objectives or guidelines for government policies;
- regularly review and assess government policies and actions in the steel sector in the light of the current situation, agreed multilateral objectives and guidelines and the GATT and other relevant international agreements;
- identify deficiencies and gaps in existing data needed by the Committee with a view of improving national inputs to the Committee and cross-national comparability of data.

OECD's responsibilities for policymaking are distinctly limited. Nevertheless, OECD can advocate certain policies related to steel in-

[13] See "Problems of the Steel Industry: And a Search for Solutions,'" *OECD Observer*, November 1978.

dustries in member countries, including the United States and Japan.

Regulatory Policies.—Regulatory compliance costs for European steel companies have generally been at levels similar to those experienced by domestic producers. However, European steelmaker enjoy rather favorable fiscal incentives and attractive financing to help them meet those costs. Furthermore, there is a considerable level of public support for regulatory technology R&D in all areas of steelmaking.

The less competitive steel industries of Belgium and France have experienced relatively low environmental compliance costs. Should European steel-producing nations, as expected, adopt future environmental requirements similar to those in the United States, then French and Belgian regulatory costs will gradually approach U.S. levels. ”

European steelmaker generally benefit from preferred rates for accelerated depreciation of pollution abatement equipment. This places these industries at a significant advantage over U.S. producers, particularly because their general depreciation schedules for industrial equipment are already more favorable. They also have ready access to loans made available by the ECSC or national governments. Moreover, since 1975 the ECSC has supported research on environmental protection and occupational risk reduction technologies at levels two to three times higher than U.S. levels. *

R&D.—The ECSC has funded a considerable R&D “effort, particularly in the technical aspects of steel production and in pollution abatement and occupational health issues. Funding of production-related R&D activities was initiated shortly after ECSC was established in 1951. The basic purpose is:

> .,. to encourage the development of new technology for subsequent incorporation in the construction and operation of steel plant and equipment and to advance the quality of the wide range of semifinished and finished products that are manufactured within the Community’s industry. The ultimate objective of this effort is to enhance the ability of the European steel producers to compete in both home and export markets.[15]

ECSC support for R&D activities has varied over time but has averaged from $15 million to $20 million per year. The funds are allocated through the Iron and Steel Technical Research Committee, staffed by ECSC member country iron and steel experts who evaluate R&D proposals and make recommendations. The scope of the research is considerable: in 1979, for example, ECSC allocated $24.75 million to 73 different R&D projects whose total costs were $79 million; table 15 provides a partial breakdown of these projects. ECSC funding does not rule out direct support by individual governments.

National Policies

There is extensive government ownership of European steel industries. For example, approximately 80 percent of the United Kingdom’s and 70 percent of France’s steelmaking capacity is government owned. These industries are far from profitable. The approximate 1978 losses per tonne of shipped steel were $55 for the United Kingdom and France. These and other foreign steel industries are sustained by the favorable financial, export, and tax policies of their governments.

Conflicts Between National Subsidies and EEC Policies.—In light of relatively weak demand for steel products worldwide, most if not all subsidy and procurement policies in the EEC have been directed towards reducing capacity by early closure of older mills and by

‘‘OECD, “Emission Control Costs in the Iron and Steel Industry,’” Paris, 1977. p. 95-96; and Hans Mueller and E. Kawahito. “The International Steel Market: Present Crisis and Outlook for the 1980's.'" Middle Tennessee State University, conference paper No. 96, 1979, pp. 26-27.

*From 1974 to 1978, ECSC provided $2.2 million annually for this purpose, For the next 5 years, starting with 1979, ECSC has made $3.8 million annually available for regulatory technology R&D. (Official Journal of the European Communities: Informotion and Notices, June 13, 1979, No. C147.)

‘Commission of the European Communities, “Memorandum on the Implementation of an Iron and Steel Research Program, With a View of Obtaining Financial Aid Under Article 55(2)(c) of the ECSC Treaty, ” February 1979, p. 1,

Table 15.— Distribution of R&D Projects Funded by ECSC, 1979

	Funding total (millions of dollars)	ECSC aid (millions of dollars)	Subject area percent of total
Ironmaking	$ 7.5	$ 4.50	9.5%
Steelmaking	47,8	6.70	60.5
Rolling mills and related areas	2.3	1.38	2.9
Measurements and analysis.	4.6	2.76	5.8
Properties and service performance of steels	16.8	9.41	21.3
Totals. ., ...	$79.0	$24.75	100.0°/0

SOURCE: Commission of the European Communities'. Memorandum on the Implementation of an Iron and Steel Research Program With a View of Obtaining Financial Aid Under Article 55(2)(c) of the ECSC Treaty.' February 1979.

early retirement of workers. These policies are in direct conflict with those of some member countries, however. The British Steel Corp. (BSC), for example, has had plans for considerable expansion. In June 1978, BSC's expansion plans involving continued investment of $2 billion annually were slashed by the Labor Government. But since then, a new investment revival has taken place, and the Conservative Party plans to continue it.

> British Steel's investment plans are not likely to be halted by the conservative government. The corporation is near completion of the biggest spending program on steel plants ever seen in Europe. Work is so far advanced that it could not be stopped. Spending will continue at a rate of about $1 billion a year until 1980 but should fall away sharply in the early 1980s. British Steel will be the biggest and most modern equipped steel company in Europe with more than 22 million tons of highly productive capacity. It will also be the third biggest steelmaker in the western world, after U.S. Steel and Nippon Steel. "

In Belgium, where government policies are controlled by labor unions, a new policy toward the steel industry has been adopted that clearly conflicts with the ECSC plan for member countries. The key elements of this policy are increasing employment levels, lowering nonwage labor costs such as social security contributions, keeping wage increases in line with inflation, and linking public spending to gross national product levels.

" Steel Week.May 7, **1979,** p. **7.**

Likewise, but to a lesser extent, the Governments of West Germany, Austria, and Italy have been under union pressure either to continue and even expand operations of their steel mills in order to provide employment opportunities. This in turn has resulted in significant national subsidy payments in various forms to the steel industry.

Loans and Subsidies.—National governments are extensively involved in financing steelmaking production. The Fond de Development Economique et Social (FDES) is an important source of low-interest, long-term credit in France. FDES loans, which are advanced by the national treasury, are given to private borrowers through the Credit National. Applications must be approved by the Regional Development Agency or the Ministry of Industry. As a basic industry, iron and steel receives special consideration in granting these loans; for example, FDES is lending roughly one-third of the total project cost of a $1.75-billion steel complex at Fos-en-mer. These loans bear an interest rate of only half the market rate and require no payment of principal or interest charges for 5 years.

Italy is another country where the government is extensively involved in the iron and steel sector. The Instituto per la Reconstruzione Industriole (IRI), a state holding institution, is contributing 80 percent of the capital (in the form of government-guaranteed low-interest loans) to increase the capacity at the Taranto steel complex at a cost of $2.5 billion over a 5- year period. The $1,6-billion Calabrin steel complex at Giora Taura is also heavily funded by IRI. Loans for these projects are classified as being used for regional development purposes.

In Belgium, government has for a number of years aided the steel industry under a program administered by the Comite de Concertation de la Politique Siderurgique (CCPS). Under the CCPS program, approximately $101.6 million in grants and low-interest loans has accrued to the Belgian steel industry during the lasts years.

In 1972 the British Government reduced the equity obligation of BSC by writing off almost $480 million of public dividend capital held by the government. Thereafter the government also wrote off the equivalent of $360 million in loans that had been due to the National Loans Fund. The statutory corporations bill (financial provisions), published in May 1975, will raise British Steel's borrowing limit by $1.7 billion to a total of $4.5 billion.

Export Incentives.—Export credits financing and export insurance are widely employed methods of stimulating exports that have been particularly effective in Western Europe. For example, the British Government has set interest rates for export credit finance since 1972. Clearing banks that provide export credit are furnished with refinancing for any such lending beyond 18 percent of their current account deposits; more importantly, the government guarantees that banks can earn a return on export loans that is 1.25 points above the average of their rates on treasury bills and loans to nationalized industries. Interest rates for export credit are much lower than those charged for domestic working capital, with the government making up the difference.

British insurance is primarily handled by an autonomous government agency that maintains credit ratings for foreign firms. Insurance is available against default by the buyer, government action that blocks or delays transfer of payments, imposition of new import-licensing restrictions in the country of purchase, war, or "any other cause" of loss occurring outside the United Kingdom and not within the control of the exporter. There are also policies to cover goods being processed or goods being held in stock abroad,

Italy offers export credit/financing through several banks and institutions and keeps medium- and long-term export financing at favorable rates. Export credit rates are currently about 6.5 percent, in contrast to 10.25 percent for nongovernment financing. This form of preferential or export financing must be approved by the Ministry of Foreign Trade, with extensions for longer than normal periods of time requiring approval by the Treasury. Insurance at low premium rates is granted by a public agency that implements decisions adopted by an interministerial committee, which in turn operates within the framework of the Institute of Foreign Trade.

In Belgium, the central bank helps firms obtain export credit at preferential rates by issuing special "visas, " which make the acceptances eligible for rediscounting with a semipublic organization. Interest rates for export credit range between 5.2 and 6.0 percent. Credit Export, an organization formed as a financing pool by public agencies and private banks, operates in the field of long-term export financing. Insurance at favorable premiums is available for exporters from a public institution that insures against commercial and political risks.

The French Government actively encourages exports through low-cost export credits. Medium- and long-term credit is available at a special Bank of France rediscount rate of 4.5 percent for exports destined to countries outside the EEC. Insurance is granted by a quasi-public firm, at government-guaranteed premiums, and covers commercial and political risks, currency fluctuation, unretrieved costs of advertising and promotion in foreign countries, and increases in costs of production.

The West German Government grants export insurance through an authorized syndicate, which receives applications and prepares them for approval by the Interministerial Committee for Export Guarantees. This committee includes representatives from the Ministry of Economics, the Ministry of Finance, and the Ministry of Foreign Affairs. Coverage includes both commercial and political risks.

Tax rebates are another way foreign governments stimulate exports. The value-added tax rebate, which is prevalent in Western Europe, provides a competitive edge for exporters, because it permits them to avoid conventional income tax as well as the value--added tax. The following list reflects the percentage of value-added tax rebate on exported products by European governments:

Austria	16
Belgium	18
France	20
Italy	12
Luxembourg	10
Netherlands	16
Norway	20
United Kingdom	8
West Germany	11

Other forms of direct export assistance in the United Kingdom include financial support for trade missions, exhibitions, market research, and export promotion schemes. Grants are also available to United Kingdom-based exporters to set up offices, warehousing, and related sales facilities for joint overseas marketing ventures.

Raw Material Supply.—In the United Kingdom, the National Coal Board operates a system of direct government subsidization which averages between $20 million and $30 million annually. Added to this are substantial sums being received from the ECSC, which has also subsidized coking coal production for several years. In 1973, the EEC Commission authorized the Governments of the United Kingdom, Belgium, West Germany, France, and the Netherlands to grant subsidies to the coal industries in their respective countries. The more than $800 million in subsidies granted in 1973 was significantly higher than previous years.

Japan

The socioeconomic and cultural environment in which industrial policies are made and carried out by the Japanese Government differs markedly from that of the United States. This affects their steel industry in several ways. First, the Japanese steel industry, like most other sections of the Japanese economy, specializes in its own area of business to a much greater degree than does its U.S. counterpart. Second, there is considerable cooperation between Japanese steel firms and related enterprises. Third, although the Japanese Government does not own its steel industry, it has close relations with it through the Ministry of International Trade and Industry (MITI), which guides the operations of the industry and creates financial conditions that enable it to compete effectively in the world market. These unique aspects of the Japanese steel industry's socioeconomic environment are well summarized clearly in a recent book by Ezra F. Vogel:

> Virtually all major Japanese firms specialize in a single sector like banking, trading, real estate, department stores, heavy industry, electric appliances, petroleum, and textiles. This pattern—developed partly through bureaucratic guidance—to encourage the most competitive performance is very different, for example, from American conglomerates, which spread over several sectors and leave and enter various industrial sectors with relative ease. Given the specialization of Japanese firms in a given industrial sector, the aggregation of interests can take two directions. One is the organization of all firms from a single industrial sector, which maximizes the cooperation that comes from looking after their common interests in building up their sector. The second is the organization of firms into "groups" consisting of one firm from each sector. A firm in a group has the advantage of special Zaibatsu (literally, "financial clique") groups (like Mitsui, Mitsubishi, and Sumitomo) link firms formerly united under their prewar holding

company, and non-zaibatsu groups (like Fugi, Sanwa, Daiwa, and Dai-ichi Kangyo) center around large banks.

In addition to these two types of organization, a third type combines virtually all firms of given size in all sectors: Nikkeiren (Japanese Federation of Employers), for example, deals with labor problems of all large firms, Keidanren (Federation of Economic Organizations) and the either other regional associations deal with all issues aside from labor confronting big business, and the Chamber of Commerce (composed of all companies) includes all firms but now particularly represents small business.

Depending on the issue and the extent of common interests, trade associations, or ad hoc groups of companies in a sector, look out for a range of interests impossible to represent in the United States, where antitrust laws are more rigid, To make sure that they have entree when politicians consider issues like tax rates, consolidation and rationalization of firms, industrial and safety standards, and protection against foreign industrial threats, they make regular collective political contributions as a sector. On more detailed issues they deal regularly with the bureaucracy, and major trade associations include staff members who were elite bureaucrats in big ministries, creating smooth relationships with the bureaucracy, The associations discuss virtually every issue considered by MITI in their sphere, for even if MITI eventually resolves the issues, it would not do so without fully understanding the dominant views of the sector. [17]

As a "priority sector, " Japanese steel producers obtain loans from private lending institutions with relative ease and apparently with implicit assurance of government support in the event of default on such loans. The Japanese Government also has provided its domestic steel industry with government loans during crucial time periods such as the early reconstruction period after World War II and during the first modernization program (1951-55). In the 1960's, the aid fell to a low level but then rose again beginning in 1971, mainly for environmental protection expenditures. Until 1961 these loans were made at interest rates that were typically 1.3 percentage points lower than the prime rates charged by private long-term credit banks; in subsequent years, the rates were the same. In Japan, however, loans are allocated through an informal rationing system applied by the Bank of Japan and the large city banks, a system that has assured the Japanese steel industry the capital it needs for modernization and expansion.

Because of this financial leverage, MITI and other government agencies play a major role in all other aspects of steelmaking. For example, MITI's long-term forecasts of demand govern the expansion of the steel industry. As a rule they are submitted on a periodic basis to the Industrial Structure Deliberation Council (an advisory body to the Prime Minister), and the Council's decisions normally become established as government policy in the industrial sector. Another planning technique is the "target production goal:" MITI establishes quarterly and annual production levels after consultation with steel industry representatives and a review of market conditions. Although this is referred to as a "guideline, " in practice it allows the government to coordinate production and stabilize prices.

MITI is also instrumental in the procurement of supplies and in the creation of cartels. In order to assure a supply of raw materials, MITI has established the Stockpile Council, which makes industrywide recommendations for raw material acquisition. At the beginning of 1975, under the guidance of MITI, the industry established a Japanese Ferrous Scrap Stockpiling Association, which handles both imported and domestic scrap. It is expected that in the first 3 years a total of 450,000 tonnes of scrap will be stockpiled. Proposals call for purchases and releases to be arranged among steelmaker, the Ferrous Scrap Council, and scrap processors.

In addition to economic stockpiling, the Ministry of Finance and MITI have also funded surveys and studies of overseas min-

[17] Ezra F. Vogel, *Japan Has Number One Lessons for America*, Cambridge, Mass., (Harvard University Press, 1979), pp. 108-199,

eral development, sea-bottom mineral resources, metal deposits, and stable import sources. They also grant credits, issued through the Bank of Japan, to domestic producers of raw materials that are hard hit by rising inventories of ore and concentrates imported under long-term contracts.

Beyond these financial assistance and planning functions, MITI also funds and directs the activities of the Agency of Industrial Science and Technology (AIST), one of the principal R&D centers in Japan, which undertakes large-scale R&D projects and encourages industry to innovate. Four policies have been enacted and are administered by AIST for this last purpose:

- subsidies for R&D effort,
- tax credits for increased R&D expenditures,
- low-interest loans for the commercialization of new technology, and
- establishment of a research association to promote mining and manufacturing technology.

AIST itself operates 16 research laboratories with a staff of 3,800 and annual budget of 32 billion yen ($133 million at 240:1).

Another policy area in which the Japanese differ substantially from the United States is the promotion of exports. The cornerstone of Japanese steel export policy is an orderly international market in steel, with stable prices controlled by the governments of steel-producing countries. The Financial *Times* of London has commented that:

> The Japanese were among the first to be converted to the idea of controlling the world steel trade, a notion which is anathema to emerging low-cost steel producers such as South Korea. In fact, it was Nippon Steel chairman Yoshihiro Inayama who many years ago introduced the term "orderly marketing" to the world trade vocabulary.
>
> Yuzuru Abe, the executive vice president of that same company, in a recent U.S. speech went so far as to say, "Until the current significant demand-supply gap can be closed . . . some coordination is necessary in order to maintain fair international trade. Conventional principles of free trade are not enough to cope with the additional tonnage from the emerging nations or the continued flow from government controlled steel producers, "
>
> The trigger price mechanism "can be looked upon as the notable first step forward," Mr. Abe said, adding that some loopholes and drawbacks remain.
>
> Higher U.S. prices under controls, steel men argue, will help the U.S. industry generate the revenues needed to carry out much needed large-scale replacement and improvement of plant and equipment. In the long run, the Japanese say this will benefit consumers even though they are now complaining bitterly about the high steel price. At the same time, the Japanese chide the U.S. industry for not having taken full advantage of previous periods of Japanese self-restraint to strengthen its position in the late 1960's and early 1970's.[18]

In addition to the export of steel products, the Japanese policy has also been to export steelmaking technology, particularly to less developed countries. In this regard the following statement by T. Dahlby is of considerable interest:

> In the steel industry, the guiding philosophy now is to beef up divisions handling design and to build integrated steel works for developing countries by offering package deals, including technology licensing, feasibility studies, construction and engineering advice. By selling experience gained in building their own highly-efficient industry, Japan's Big Six steelmaker are hoping to makeup for the expected low levels of crude steel demand in the coming years . . . .
>
> Restrictions now in effect on exports to the U.S. and Europe, as well as the strengthening of the yen, have cut deeply into steel companies' earnings. Severe price competition from South Korean and Australian producers has registered an additional blow, though Japanese makers feel safe in the short term since the capacity of these rivals is still relatively small.

'financial Times of London, "Steel Japan No. 1 and Still Gaining, " vol. 2, No. 17, Apr. .30-May 6, 1979.

> "At times of recession, " says Hisao Kuzuoka, general manager of Kawasaki steel's international department, "competition naturally intensifies, but we also realise that we cannot continue to export large amounts of crude steel. Therefore, the industry is putting emphasis on exports of technology to countries like China, Brazil and those in Southeast Asia, "[19]

This drive for technology export, conducted by several Japanese firms working in consortium and with significant assistance from MITI and other government agencies, has achieved considerable success.

Regulatory Policies

From 1971 to 1977, Japanese capital costs for environmental compliance were 65 percent higher than U.S. levels. These higher investments were closely linked to capacity expansion taking place during that time; more recent expenditures have been below U.S. levels.[20] As is the case in Europe, Japanese steelmaker also benefit from favorable fiscal and loan policies for industrial equipment in general, and pollution abatement equipment in particular.

Third World and Developing Countries

The two principal policy tools of the developing countries are long-range planning and direct government assistance. Mexico, for example, has established a Steel Coordinating Commission to organize and advise both private and public companies engaged in the production of iron, coal, coke, and steel. The commission includes representatives from the Council of Non-Renewable Resources, the Ministry of Industry and Commerce, the Ministry of Finance, and the Office of the Presidency. The commission has helped plan two large steel plants, including the development of raw material supplies, transportation facilities, and housing. Significantly, the capacity of these and other steel facilities, when completed, will exceed the present demand for steel products within Mexico, and it is expected that much of it will be earmarked for export markets.

Brazil's Conselho Nacional de Nav Ferrosos e de Siderurgia coordinates and supervises the national steel plan, which aims to increase steel capacity to 20 million tonne/yr by 1978-79. To reach this goal the Brazilian Government is expanding its holdings into the remainder of the private steel sector and is involving itself extensively in raw materials through the National Department of Mineral Production,

Venezuela, Peru, India, Iran, South Korea, Turkey, and Egypt have all developed 5-year plans aimed at expanding steel productions. Most of these plans are initiated, monitored, and implemented by the governments.

Financing

Mexico provides an excellent example of how developing countries use government-financed assistance in support of their steel industries. Both national and international financing organizations invest in Mexican steel. Siderurgica Lazaro Cardenas—Las Truchas SA (SICARTSA), a Mexican public-sector enterprise established in 1969, is building a steel plant with a first-stage production capacity of 1.2 million tonnes. Financial arrangements include a World Bank loan and a long-term loan, guaranteed by the Mexican Government, from a group of industrial nations. Related facilities, such as a railroad spur, enlargement of port facilities, and housing for workers, will be financed directly by the government. SICARTSA is 51-percent controlled by the government, 25 percent by National Financier (a government financing agency), 12 percent by Altos Hornos de Mexico SA (71.5 percent of which is government controlled), and 12 percent by private capital sources,

Specialty steel production in Mexico is being expanded by the same type of financing arrangements. Mexinox SA, a joint French-Mexican venture to establish Mexico's first integrated stainless steel complex, has ob-

"Tracy Dahlby, "Japan Seeks a Long-Term Strategy for Prosperity," For Eastern Economic Review, Aug. 25, 1978,

'('Hans Mueller and K.E. Kawahito, op. cit., p. 27.

tained financial assistance from the International Finance Corporation (IFC), a World Bank affiliate, and the National Financier.

Brazil has initiated a broad program to increase its raw steel production capacity from 7.2 million to 20.2 million tonnes by 1980. The program will be carried out by three government-owned mills. Participants in the financing of these projects include the World Bank, the Inter-American Development Bank, the Agencia Especial de Financiamento Industrial (a Brazilian government agency), other local sources, and (by credits) certain foreign governments. Loans are guaranteed by the Federal Republic of Brazil.