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Energy, Ecology, and the Steel Industry--
An Industrial Relations Perspective
by
Jack Fiorito
November 1977

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Energy, Ecology, and the Steel Industry --
An Industrial Relations Perspective

by

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Urbana, IL. 61801

November 1977

ABSTRACT

The relationships between energy, ecology, and economics has received much attention in recent years. In this paper, the author attempts to clarify the issues by examining a single industry (steel). John T. Dunlop's industrial relations system framework is applied. Changes in energy-related and ecological circumstances are treated as contextual changes which, in turn, impact the processes and outcomes of the system. Outcomes such as employment and income are considered. OSHA is discussed as the author notes that "ecologists" often neglect the human ecology of the workplace. Recognizing that the actors in the system have capacities to modify the contexts, their attitudes are highlighted. Results of the author's survey of Steel-workers local union officials attitudes are interspersed in the text. Complete survey results are presented in an appendix.

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Introduction

A substantial body of literature concerning interrelations between energy, ecology, and economy has appeared in recent years. Much, if not most, of this literature has devoted attention to aggregate phenomena, and very general observations and analyses. A few studies have examined the impact of changing ecological or energetic contextual variables on employment and industrial relations, or, the attitudes of the actors and their potential impact on policy choices made in response to ecological or energetic factors.

The present study is an attempt to clarify the issues by focusing upon a single industry; steel, with particular attention to the impact on and role of steel industry employees. Original survey results of local steelworkers officials' opinions about energy and ecology issues are interspersed in the discussion. (Complete results are presented in the appendix.) To speak of "steel" as an industry may be somewhat misleading. It should be made clear from the outset that manageability rather than precision is the definitional concern. One can surely expect that diversity of products and conditions within the "industry" will result in diverse interrelations and attitudes. For example, attitudes toward the "bottle bill" would certainly depend on whether one worked in a beverage container plant or a bottle crown stamping plant, while both are steel products.

Energy and Ecology in Steel -- Overview

The steel industry is a major forum in the debate and discussion over environmental and energy policy goals. The reasons for steel's central position are numerous.

Steel is conventionally thought of as a key industry. The industry employs about a half-million persons, and its products are substantial inputs to many other sectors of the economy. The average automobile contains about one ton of steel and each mile of highway requires about 55 tons of steel reinforcement.¹ Collectively bargaining agreements and pricing decisions in steel often set the pace for much of the economy as a result of the industry's size and the importance of its products as intermediate goods for other industries. The economic scale of steel manufacturing makes steel plants dominant institutions in many communities.

The industry consumes approximately 16% of all energy used in U.S. manufacturing, about 4-6% of all U.S. consumption. Thus, the steel industry is a prime target for conservation policies. A study by Battelle Columbus Laboratories estimates the potential savings at 15%. Saving 10% of the energy consumed would provide enough energy for all U.S. manufacturing of aluminum, copper, zinc, and lead.²

The steel industry also accounts for substantial proportions of environmental degradation. In 1968 steel production accounted for some 20% of all industrial particulate pollution, more than twice the contribution of any other single manufacturing indus-

try. Production also requires annual use of 4.4×10^{12} gallons of water, most becoming contaminated with solids, acids, heat and deadly poisons like arsenic, cadmium, and cyanide before discharge. Solid wastes in the form of slag and mine tailings and discarded steel products are also serious problems. Approximately 7% of all garbage is composed of steel products.³

The workplace environment is also a controversial area. Steel manufacturing provides some of the most dangerous occupations in the economy. All major sectors of steel production have recordable injury and illness rates in excess of total private economy rates. Typically, injury rates in a given product-line are three or four times the rates for the rest of the economy.⁴

Labor certainly has a direct interest in these issues. Employment, wages, working conditions, and non-work environment are all likely to be affected by changes in this context. The vested interests of the industry will also determine, to some degree, the nature of the context. Thus far, few persons outside the industry have been seriously concerned with these issues. Further, little is known of how those in the industry view them, aside from official statements in the news media or industry publications. For example, the aforementioned Battelle report on energy conservation in the steel industry (a document about three-fourths of an inch thick) includes one-half page on the "Viewpoint of Organized Labor," including: "Apparently the energy-conservation actions of the steel companies to date have drawn little attention from union officials... . It is likely, however, that there will be situations where the energy-

conservation actions of specific steel companies may draw the attention of organized labor."5

Applying the Industrial Relations Framework

Professor John T. Dunlop has constructed the most widely accepted framework or conceptual model of industrial relations systems, emphasizing rules. Three abstract contexts (technological characteristics, market constraints, and the locus and distribution of power in the larger society) are described as "... decisive in shaping the rules established by the actors... ."6 This typology is generally useful in studying the system and its outcomes, but like any abstraction, it creates problems as a by-product. One can envision neat categories of technological and market factors, but reality does not generally accommodate itself so well. John R. Commons' classic case-study of labor organization emphasized how technology determined the extent of markets. Yet it is market factors that largely determine the technology to be employed and the research efforts that lead to new technologies. To further complicate the (chicken and egg) problem, the actors are often able to unilaterally or jointly determine contextual factors to varying degrees. Work rules are often explicit modifiers of the technological context, etc.

The point of this discussion is not to attack the Dunlop context concept, but simply to note its limitations prior to implementing the contextual framework in subsequent analysis. Example: It is not obvious whether the issue of energy/labor sub-

stitution should be considered a technological factor or a market factor. Market factors drive employer decisions as to the optimal combination of product factors -- increases in the price of energy relative to labor should lead to substitution of labor for energy. Technology still determines the short run substitution possibilities to a large extent. Human labor is not a very good substitute for the massive quantities of process heat required in steel-making. This and other issues will be treated as one or another type of contextual factor, but the categorical decision will necessarily be somewhat arbitrary. Most of the energetic and ecological issues in the steel industry can be treated as contextual matters, but the appropriate distribution of issues among contexts is uncertain.

The Technological Context and OSHA

"The technical context orients or places workers and managers in a specific place of work in which they perform certain particular operations and functions."⁷ The technology of steel production, like mining, logging and longshoring, has traditionally resulted in some of the deadliest occupations in American industry. The massive machinery and hot, polluting, processes utilized probably account for the horrendous statistics shown below:

Injuries and Illness -- Incidence per 100 full time workers⁸

| | Total Recordable Injuries | Lost Workday Cases | Total Recordable Illnesses | Lost Workday Cases |
|--|---------------------------------|--------------------------|----------------------------------|--------------------------|
| Total Private Non-farm Economy ... | 10.5 | 3.2 | .4 | .1 |
| Blast Furnaces and Basic Steel ... | 16.7 | 3.8 | .7 | .1 |
| Iron and Steel Foundries ... | 31.6 | 9.0 | .6 | .2 |

Industry certainly doesn't desire to subject its employees to illness and injury, but all other goals, including the social responsibility to provide pleasant and safe working conditions are subordinate to the organizations' drives for survival, growth, and profit. Workmans' compensation laws have indirectly given employers incentives to improve safety and health conditions by basing insurance rates on employer experience. But just as the earlier common-law remedies were found inadequate, the statistics above indicate the preventative effects of workman's compensation have been insufficient. The theory of prevention through disincentive (workman's compensation) seems sound, but should not allow the very high injury and illness rates evidenced in steel and some other industries. Thus, the National Safety and Health Act of 1970 was passed to create a safer work environment by directly prescribing numerous aspects of working conditions, to prevent injury and illness rather than ensure after-the-fact compensation.

OSHA has been widely criticized since its inception. Labor, and particularly management charge the Act's administrators with being petty, bureaucratic, and ineffective. Field administrators find the law too unrealistic to be enforceable. While employers complain most loudly of how OSHA's red tape ties their hands and burdens them with unnecessary costs, labor's chief complaint is that OSHA isn't doing enough. In a recent survey of Steelworkers local union officials, 91% of the respondents said that OSHA was not doing enough to improve the workplace environment. Can labor and management be talking about the same thing? Obviously they are, and perhaps Labor Secretary Marshall's recent announcement that the efforts of OSHA would be redirected away from its comprehensive approach to one of concentrating on the most dangerous industries will appease the criticism of both sides to some degree. This redirection coupled with experience may move OSHA "in practice" closer to its intended purpose.

The steel industry, due to its hazardous employment conditions, has been and will continue to be a major battleground of occupational ecology. Safety equipment has been a major issue. I.W. Abel asserted in 1976, that "despite long known evidence, OSHA has consciously chosen to take no action by inspection, no action through new standards for safety equipment and no testing or certification program. OSHA, in effect, condones blatant lawlessness."⁹ Mr. Abel is referring particularly to National Institute for Safety and Health (NIOSH) tests which revealed widespread failure of safety equipment to meet OSHA standards as advertized. Some of the NIOSH results include:

- Twenty of 21 models of randomly selected Class B hard hats are deficient in one or more ways.
- One-third of the models of safety shoes fail.
- Of 22 models of glass goggles, 11 fail the impact test their makers advertise as meeting the OSHA-required test.¹⁰

The most controversial of health issues in steel has been that of coke oven emission standards. An extensive 10-year study concluded in 1971 found that coke plant workers had twice the lung cancer rate of all steelworkers, and that those with five or more years duty on the "topside" of coke ovens had lung cancer rates ten times as high as all steelworkers.¹¹ This setting led to a bitter debate over appropriate standards in 1975 and 1976. Typically, the industry acknowledged that emission standards needed to be set, but that OSHA's advisory committee recommendations were unrealistic and too expensive. J. Munson, U.S. Steel Company and industry member of the advisory committee, criticized the standards as "beyond the stated capability" of the steel industry.¹² The United Steelworkers of America gave the recommended standards complete support. OSHA diluted the advised standards and issued its own proposals. I.W. Abel blasted the proposed standards, saying they were "based on political considerations."¹³ (The Deputy Assistant Secretary of Labor for OSHA at the time was a former member of a law firm retained by two steel companies.) Abel also claimed that the industry had accessed

draft regulations two weeks before they were issued and had pushed through desired changes. The Cost of Living Council became concerned about inflationary impacts in 1976, finding OSHA impact statements inadequate. The Council estimated the annualized total cost of OSHA's proposed standards at 241 million dollars, and deduced that by a cost-benefit criteria the minimum value OSHA was placing on a human life was \$4.5 million, far in excess of values conventionally used. Abel charged the Council had "flagrantly abused its authority."¹⁴ OSHA issued its final emission standards in 1976, and estimated their annualized cost at \$200 million. The Steelworkers' legislative director said the union "feels very good" about the final standards.¹⁵ The steel companies have subsequently challenged the standards in court.

Coke ovens are probably the outstanding example of hazardous working conditions in steel. Safety equipment may be second or high on the list. However, the small number of steelworkers employed on coke ovens and the limited coverage of the best safety equipment suggests that many other areas will become battlegrounds before the record of the industry appreciably improves.

Much of the impending debate will revolve around costs versus benefits. Employers will probably attempt to convince labor that the costs will mean lost jobs. Local Steelworkers union officials reject this argument by a 2 1/2 to 1 margin. Employers will also emphasize the inflationary impact of safety and health, but the public is skeptical of such arguments and dislikes having to make tradeoffs between dollars and lives. At any rate, the

policy choices will not be easy. They are likely to be decided with mandatory standards set by government with input from labor and management. (Collective bargaining has long dealt with safety, and arbitration was implemented to decide coke oven standards at U.S. Steel's Clairton Works.¹⁷) However, a major principle of a "Just Wage" is that wages should not be used to offset hazardous conditions.¹⁶ (Yet it has been empirically demonstrated that climate and other "quality of life" factors like air pollution do substitute for wage rates.)¹⁸ Collective bargaining, and the inherent horse-trading of intraorganizational bargaining is likely to downplay the interests of minorities like coke oven workers. Thus, the labor movement is most likely to continue to emphasize the legislative route to occupational health and safety.

The Market Context and Energy

The allocation of this issue is motivated primarily by the expectation that the steel industry and the rest of the economy will adjust to the changing energy situation (voluntarily or not) through reactions to market mechanisms. Conservation is a response to factor market price increases (and perhaps altruism). The decision to substitute one factor of production for another, while limited by technology, is based on relative factor prices.

The issue of energy-use is almost inseparable from that of environment: The consumption of energy creates pollution -- almost by definition -- and its major uses, in "heat engines" (autos, homes, power plants, and industry) must yield pollution by

the Second Law of Thermodynamics. The artificial separation used here is not recommended for general consumption.

The steel industry's interest in energy issues is clearly enormous. In addition to using 5-6% of all U.S. energy, direct energy costs (not including the energy embodied in purchased goods and services) are about 10% of total costs, including profit and taxes. Employment cost forms about 35% of the total. Though economic theory predicts no strong relation between an industry's magnitude of consumption and cost-sensitivity, it certainly does predict that the proportion of total cost directly affects price sensitivity. Due to their unique importance, an examination of energy-related issues in steel may overstate their relevance to the economy. At the same time, in these matters the industry may be a bellwether for other industries.

A. Conservation

The steel industry has two major concerns with energy conservation. First, the enormous quantities of energy used (more than any other industry) have made the industry extremely sensitive to possible savings, and steel began its own conservation policies long before October, 1973 (the "embargo-crisis"). Energy use per ton of steel dropped from 47×10^6 Btu's per ton in 1950 to 35×10^6 Btu's per ton in 1973.¹⁹ Even after intra-industry policies, energy consumption by steel is conspicuous enough for government policy-makers to take a hard look at additional potential savings. Second, conservation aimed directly at

some other targets will have substantial impacts on steel. For example, attempts to increase auto's mileage per gallon is a committant attempt to eliminate high-density materials, i.e. -- conventional steel.

Returning to the first category, the Federal Energy Administration (FEA) commissioned a major study of the "Potential for Energy Conservation in the Steel Industry." The (Battelle study concluded the potential savings are on the order of 15%, almost 1% of U.S. consumption.²⁰

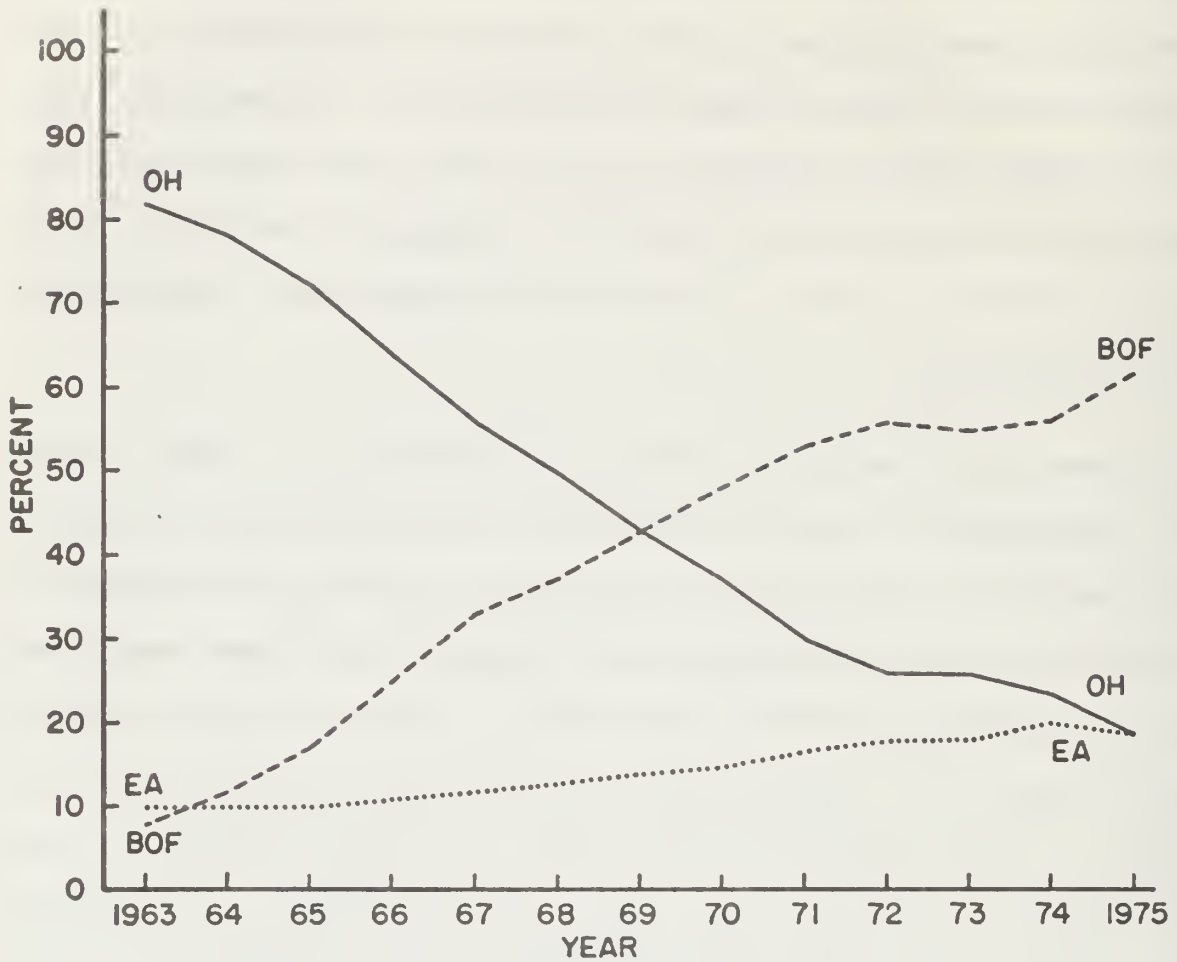
The Battelle report also identified several important related issues. An important possible trade-off is noted: One and one-half to 2 percent of steel's total energy is consumed for environmental control equipment. Increasing steel imports also reduces energy consumption, but each percentage point of the U.S. market lost to imports costs about 7,500 U.S. jobs in steel.

A study by the American Iron and Steel Institute identifies specific energy-saving technical proposals illustrating the micro-economic relation between conservation and jobs. One of the conserving proposals is to use water heated in the cooling of furnaces to supply other plant steam requirements. In an illustrative calculation of costs and benefits labor constitutes 80% of annual costs. The net benefit/cost ratio of the project is over 3 to 1.²¹ Another project, installing radiant heat recuperators in flues yields a 40.2% rate of return. Labor comprises almost 20% of the initial capital and installation cost for this project.²² Thus, it is clear that energy conservation by the

steel industry can create jobs in the industry. Conservation does not mean eliminating jobs.

A University of Illinois study of alternative steel-making processes and their respective energy-intensities found steelmakers shifting away from more energy-intensive open-hearth technology and toward basic oxygen and electric arc technology. This shift is illustrated in Figure 1. The study concludes that the trend would result in a 2 1/2 to 5% (roughly) reduction in the energy-intensity of steel.²³ Employment effects are anticipated but not estimated.

Conservation measures outside the industry will also affect steel employment. Lighter autos are only one example. The so-called "bottle bills" are aimed at energy conservation as well as to reduce litter. Returnable bottles require far less energy per beverage unit than one-way containers. Thomas Wilson, Senior Vice-President of the American Iron and Steel Institute (AISI), pointed out the implications for steel: "if steel can-makers lose this market, it could mean the loss of 50% of our tinplate sales."²⁴ Several studies have found net employment would increase substantially (by over 100,000 jobs, nationally) as a result of bottle bills, but they usually acknowledge steel industry jobs would decrease. Not surprisingly, the Steelworkers' Union has been one of the strongest opponents of these bills.



OH - OPEN HEARTH
 BOF - BASIC OXYGEN FURNACE
 EA - ELECTRIC ARC

Figure 1. PERCENTAGE OF TOTAL STEEL PRODUCTION BY WEIGHT
 FOR EACH PROCESS, 1963 - 1975.

Source: Center for Advanced Computation
 University of Illinois²⁵

Many of steels' competitors require larger requirements of energy to produce. Aluminum and cement are prime examples and prime substitutes for steel.²⁶ Increases in energy prices will likely enhance steels' competitive position. A recent study of the impact of energy prices on the economy and employment of certain occupations found steel output increases as energy prices rise.²⁷ Specifically, a price of \$11 per barrel of oil (1973 dollars), compared to a price of \$7 would result in an estimated 10% increase in the demand for steel in 1985. The same higher price results in an estimated decrease in demand for aluminum of 10% in 1985. The corresponding employment estimates, however, show lower steel employment for the occupations studied. This does not mean total employment would fall, and the magnitude of the decrease for those occupations is easily within a margin of error -- less than 2% of projected employment.

B. Energy-Labor Substitution

The issue of factor substitution has unavoidably been raised in the discussion of energy conservation. The two conservation investment examples would yield less attractive returns with lower energy prices or higher labor costs. However, the substitution issue by itself raises such fundamental questions that it must be explicitly examined.

The conventional production function utilizes two conceptual factors of production: labor and capital. Land has been dropped from most non-agricultural analyses. Theoretically,

these functions should depict every input required to produce a unit of output. The purpose of this discussion only requires that energy be identified as one such factor. (Raw materials constitute a fifth major class of inputs, in addition to land, labor, capital and energy.) The unique role of energy results from its non-renewable nature. With enough energy, the other factors can be recycled within a closed system.

The profit maximization condition for factor utilization requires that each input be rewarded according to its contribution to production. In effect, each factor is used increasingly to the point where the marginal revenue derived by its use (marginal revenue product) equals the input's price (actually, marginal cost). Different input proportions are utilized to produce identical outputs where the relative factor prices vary. Where labor is cheap, labor-intensive production processes are used, etc.

It has been argued, from this framework, that the long-term decline in the price of energy relative to wages has induced employers to substitute energy for labor in the production process.²⁸ In this reasoning it is important to distinguish the short-run from the long-run. Obviously a given technology places the factors in a complementary juxtaposition. Last winter's natural gas shortages resulted in layoffs rather than increased hiring. (Interestingly, the AFL-CIO's legislative report of January, 1977 attacked the gas industry and the Administration for "what were later proved to be groundless charges of forthcoming winter shortages of natural gas, causing thousands of lost

jobs ..."²⁹) Demand-depressing short-run impacts of higher energy prices also reduce employment. The longer term (and less than Keynes' morbid long-run) provides substantial substitution possibilities. A thorough empirical study of a four-factor (land excluded) production function for all U.S. manufacturing, 1947-71 found;

- i) labor and energy are substitutable,
- ii) labor and capital are substitutable,
- iii) energy and capital are complementary.³⁰

Figure 2 charts the relative prices of energy, labor, and capital in the steel industry for the years 1947-75. (This graphic analysis is adapted from Bruce Hannon's work. See note 28.) While this graph does not indicate the extent to which substitution has occurred, the long-term rising trend of the wage/energy-price ratio suggests that employers have been required to increase the marginal revenue product of labor in order to maintain the profit-maximizing condition that equates a factor's cost to its contribution. This has been done by using less labor and more energy. One study claims that steel industry "employment declined from 450,000 to 100,000" from 1959 to 1969 "as production increased 45% and energy use increased."³¹ While the direction of this assertion is probably correct -- employment would have increased more with higher energy prices -- this author was unable to locate data substantiating the magnitude of

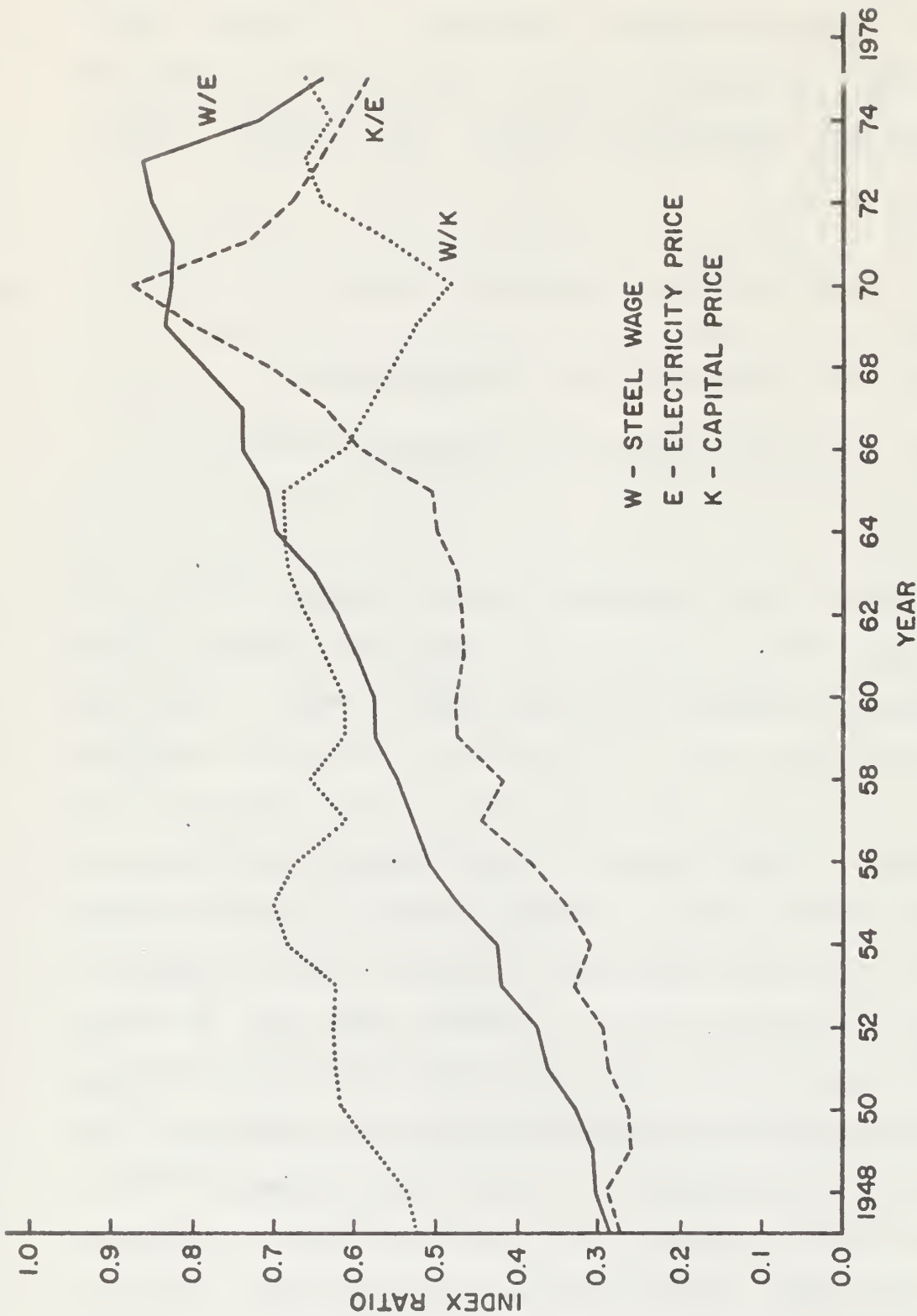


Figure 2. RELATIVE PRICES OF ELECTRICITY, LABOR AND CAPITAL, 1947-1975

Source: Wages, Bureau of Labor Statistics;

Electricity Prices, Edison Electric Institute;

Capital Prices, Moody's Industrial Manual^{33, 34, 35}

this claim. The Bureau of Labor Statistics pegs basic steel (including rolling and drawing) employment at 510,000 in 1976. For primary metal industries as a group, employment rose from 1,182.6 thousands in 1959 to 1,360.8 thousands in 1969.³²

One of the notable features of Figure 2 is the turnaround in relative price ratios since 1973. Wage increase no longer lead energy price increases. The implication is for employers to reverse their historical trend of substituting energy for labor.

This reversal will certainly be favorably received by labor, or will it? The Steelworkers have been very concerned about employment security,³⁶ and it was reported to be a major bargaining goal in the recent steel negotiations. Yet, the Steelworkers have consistently advocated lower energy prices and have been one of the strongest lobby groups opposed to deregulation of fossil fuel prices. Most local Steelworkers officials believe inexpensive energy is needed to reach and maintain full employment, although 34% do not. More than 85% do not believe that higher energy prices mean more jobs in the steel industry. The superficial paradox is dispelled by re-examination of the production function. Assuming a two-factor function simplifies, but does not distort, the essential point:

$$(1) \quad Q = AL^\alpha E^\beta, \quad 0 < \alpha, \beta < 1 \quad (\text{positive productivities and constant returns to scale})$$

where: Q is output,
L is labor,
E is energy, and
A is some constant.

Dividing both sides by labor (L) yields output/per unit of labor, or productivity, on the left.

$$(2) \quad Q/L = AL^{\alpha} \frac{E^{\beta}}{L} = L^{-1} (AL^{\alpha} E^{\beta}) = AL^{\alpha-1} E^{\beta}$$

The effect of increasing the quantity of labor on productivity is given by the partial derivative of productivity with respect to labor:

$$(3) \quad \frac{\delta Q/L}{\delta L} = (\alpha-1)AL^{\alpha-2} E^{\beta} < 0$$

or, with very plausible assumptions about the production function, productivity falls.

Economic theory thus predicts that increasing the quantity of labor would result in lower wages. From an institutional perspective productivity is a key bargaining issue and is often used to justify (or attack) wages increases. Thus the Steelworkers' efforts to keep energy prices low may reflect a rational decision to forego increased employment to maintain high labor productivity and high wages. Without knowing the exact nature of Steelworkers' preferences between employment security and wages, and the exact nature of the production function, it is not possible

to determine at what point the Steelworkers would no longer advocate lower energy prices.

About 3 of 4 local Steelworkers' officials believe the union should take an active role in obtaining an energy policy that is best for steelworkers (those with employment security?), but of those who perceive an energy problem (66%), only 33% advocate lower energy prices to solve the problem. The same percentage advocate higher energy prices.

An Empirical Note

The year 1967 marks the beginning of a sharp decline in the ratio of steel wages to coal prices. Since about 60%³⁷ of the energy used directly by the steel industry is from coal, one might conclude that labor has since been substituted for (coal) energy. If this is so, it is not evident that productivity has suffered as a result. Productivity rose rapidly from 1967 to 1973 (over 23%) in the steel industry, and has only recently stalled.³⁸ The only obvious conclusion the data support is that the aforementioned relation between energy prices and productivity is not clear and decisive. Of course, numerous other influences may have obscured a strong relation. Capacity utilization and the industry is productivity committees are two such factors. The mere existence of the committees suggest the importance of the productivity issue to both parties, and thus the importance of potential energy/labor substitution.

Concluding Note on Energy and Steel

To the extent that energy prices are exogeneously determined, they will probably increase, resulting in more steel industry jobs from: 1) substitution of labor for energy; 2) the positive elasticity of demand for steel with respect to energy cost; and 3) an enhanced competitive position relative to imports. The net effect on the Steelworkers' bargaining power is uncertain. While product demand influences will increase their relative power, factor market effects will probably slow productivity gains while increasing employment. If the latter effects dominate, the contribution-compensation nexus (marginal productivity theory) may be increasingly attacked, and/or the scope of bargaining may be widened to accommodate more non-compensation issues.

The Community Context and Ecology

The issues surrounding environmental degradation are, in at least one sense, appropriately considered in the community context. Many if not most ecological issues are inherently community issues, for the environment is the ultimate example of what Garrett Hardin calls "the tragedy of the commons."³⁹ Briefly, the tragedy develops as follows: A resource is owned by the community rather than private interests (air, water, etc.). As rational beings each individual attempts to maximize personal gain. This is accomplished by utilizing the community resource to the greatest extent possible, while the cost of utilization to the

user is only a fraction of the cost to the community. (The pollution from steel mills accrues largely to those downriver and downwind rather than the mills themselves.) The community resource is exploited by private self-interest until its value is destroyed by over-use.

Thus far we have only approached the conclusion of the Tragedy in most cases. A few horror stories, such as those of rivers catching fire, suggest that we have come very close to individual Tragedies, while the system on the whole may have successfully made the crucial turn in the late 1960's. As a result of the Environmental Protection Agency (EPA), state and local government, and community awareness, some "commons" have actually been upgraded in recent years.

A more conventional basis for this contextual classification, and perhaps more relevant to steel, can be derived directly from the Industrial Relations framework: The extent to which a community is dominated by an employer or industry is decisive for defining the roles of the actors. Steel industry locational requirements have resulted in industry-dominated communities in Pittsburgh, Gary, Youngstown, and Steubenville, to name a few. This domination has a tremendous impact on the actors' roles concerning environmental issues, especially at local levels.

Finally, certain environmental issues' strongest influences on the industrial relations system will be those for diversity of interest within the labor movement. The "Bottle Bill" and possible energy policies (both, as mentioned before, are intertwined

with ecological issues) have differential impacts for very specific factions of labor, creating diversity between unions within unions, and between regions, as well as between labor and other groups.

The Steel Industry, Commons and Labor

The enormity of the steel industry's contribution to environmental pollution is undeniable. Steel accounts for roughly twice the contribution of any other manufacturing industry and 20% of all industrial particulate pollution. U.S. Steel's (U.S.S.) Gary Works alone dumps as much as 7,000 pounds of cyanide into the Grand Calumet River, a Lake Michigan tributary, every day.⁴⁰

The obvious obstacle to industry clean-up is cost. Limited amounts of internal and external capital are available. Stewart Cort, former Chairman of AISI estimates that steel companies are spending more than 12% of their total capital outlays on environmental controls.⁴¹ A study by A.D. Little, Inc., puts the figures at \$12 billion by 1983, raising the percentage of total capital expenditures close to 25%.⁴² Cort and other industry representatives are quick to point out progress made thus far, and that the diversion of funds away from capacity expansion may cause shortages. In 1973, a year of high steel demand, pollution control equipment makers complained of steel shortages.⁴³ A possible energy-environment tradeoff adds another complication. F. Jaicks, 1976 AISI Chairman claims that EPA regulations reduce en-

ergy conservation potential by 50%: Scrubbers and precipitators require electricity.⁴⁴ Cort urges: "[The Government] should separate environmental goals that are critically important from those which are only cosmetic...".⁴⁵

The Gary works example suggest that the industry has a long way to go before it approaches "cosmetics" questions. Gary works officials are still seeking extension for standards that were to take effect in October, 1974. In upholding the current July, 1977 deadline, the judges cited a Supreme Court ruling that, "litigation ... is carried out on the polluter's time, not the public's."⁴⁶

The labor movement has traditionally been a "progressive" environmental force. The most recent AFL-CIO Legislative Report shows labor at the national level supporting recycling (except for a "bottle bill" amendment), extension and improvement of the Clean Air Act of 1970, ("with compromise language allowing industry and auto manufacturers unable to meet emission standards until 1979 to come into compliance") and tough federal strip-mining controls (which would promise continued demand for organized eastern underground miners).⁴⁷ The non-profit group, Environmentalists for Full Employment (EFFE), was organized in 1975 "to publicize the fact that it is possible simultaneously to create jobs, conserve energy and natural resource, and protect the environment."⁴⁸ There are certainly many instances where these simultaneous possibilities can be exploited: Sheetmetal workers are understandably strong proponents of solar heating development; displaced aerospace workers could apply their technical ex-

pertise to energy and environmental problems; an insulation retrofit program would give construction workers increased employment, reduce energy demand, and slow environmental degradation, etc. But without questioning the validity of this simultaneity assertion, it is apparent that short-run self-interest provides a consistent accounting of labor's political behavior, perhaps more so than altruism.

Clearly, organized labor reflects its members' desire for quality of life improvements. However, these desires often quickly dissipate when jobs are put on the line. Leonard Woodcock explained: "Philosophically, there is no reason to see any conflict between jobs and environmental protection" ... "Philosophy aside, there can be no question that there is a sometimes delicate relationship between working people and environmentalists."⁴⁹ Woodcock later noted, in discussing a double standard of environmentalists, that concern about highly toxic PCB's did not arise until the chemical showed up in birds and fish after 1966, while the hazards it created in the workplace were discovered in 1933. The AFL-CIO's Tom Donahue, Executive Assistant to George Meany, notes that the primary function of the labor movement is to provide jobs for its members, and unions can get involved in "social unionism ... only as long as that primary function is carried out."⁵⁰

The Community Level: Examples

At the community level the conflicts are far more apparent. The EPA still rates Steubenville, Ohio one of the dirtiest cities

in the nation.⁵¹ In 1971 the EPA declared it the dirtiest. The area death rate is 15% higher than the rest of the state. The steel industry directly provides 15,000 jobs for the area's population of 160,000. The North Ohio Valley Air Authority has granted postponements for compliance with air pollution standards. City officials admit that cleanup progress is very slow, but some say that pollution is such a sensitive issue, they fear loss of their own jobs if they crusade for clean air.

In Youngstown, Ohio, on the Mahoning River, a Steelworkers Union official asks: "What good is a clean river if you've got no jobs?"⁵² In what has been called a "classic confrontation" between the environment and jobs, the companies that own Mahoning Valley's eight steel mills have threatened to close their plants rather than install more pollution control equipment. (The eight mills owned by U.S. Steel, Republic Steel, and Youngstown Sheet and Tube daily dump 158 tons of oil, grease, cyanide, and metal particles in the Mahoning River.) A resultant labor-industry alliance persuaded the EPA to grant the Valley a reprieve from water pollution standards. An EPA official stated "... The Mahoning Valley was one place where jobs were on the line, and relief from our time frame for pollution control was needed."⁵³ The EPA reported that as many as 50,000 jobs might have been jeopardized by applying the legislated discharge standards. The State of Pennsylvania has appealed the Mahoning exemption on behalf of downstream Pennsylvania residents.

A taconite mine in Silver Bay, Minnesota was ordered closed as a result of water pollution standards.⁵⁴ The mine supplies 15%

of U.S. - produced iron ore. Before the mine was reopened upon appeal, 3,100 workers had been laid-off.

Visitor Charles Dickens described 19th Century Pittsburgh as "hell with the lid lifted."⁵⁵ Recently, a steel industry publication claims the city has been transformed from the "smokey city" into the "renaissance city." While the claims are probably exaggerated, it seems the city, with much steel industry support, has made substantial progress in its cleanup efforts. The article includes no mention of jobs lost as a result of the cleanup.

The contrast between the last example and those of Steubenville, the Mahoning River Valley, and Silver Bay, results from the centralization of most steel industry corporate functions in Pittsburgh. Works Manager Gene Lane of Jones and Laughlin's Cleveland Works thinks that steel companies could go a long way towards improving their community standings if they "fully delegated social responsibility as well as business responsibilities to those in charge of non-hometown plants."⁵⁶ Mr. Lane makes the point that headquarters operations are putting on a facade and getting the gravy. This certainly seems to depict the Pittsburgh situation. U.S. Steel's Gary Works generates more pollution than any other entire steel company and 40% of the City of Gary's particulate pollution, yet, United State Steel's new 64 story triangular corporate headquarters building is lauded in the aforementioned industry article as part of the "new" Pittsburgh.

Returning to the jobs-environment conflict, conspicuously absent from the industry propaganda piece, it is only jobs in

"old, marginal" non-hometown facilities that seem threatened. Environmentalists might ask, "Didn't these old marginal facilities help finance the 64-story United States Steel triangle and the Pittsburgh cleanup?" A more objective study of Oregon's Willamette River cleanup reports: "Initially, Oregon lost industry because of its tight waste-discharge standards. But now such regulations are enforced elsewhere as well, and other areas have the same problems at higher costs."⁵⁷ (The Willamette cleanup dates back to 1938.) Federal standards will tend to negate the cost-impact of environmental controls, just as the NLRA aimed (indirectly) at taking wages out of competition. The Council on Economic Priorities' study of over forty individual mills concludes "no steel mill operated by a major steel producer will be closed in the next few years solely because pollution control costs have rendered it unprofitable."⁵⁸

Organized labor does not unquestionably support industry's attempts to evade environmental standards. Its support of the Clean Air Act (even with compromises) evidences this. Environmentalists and Steelworkers joined forces in proposing legislation to end what they call "environmental blackmail" -- the threat of job losses to prevent enforcement of pollution standards. This three-part proposal would: 1) make it illegal for employers to fire or otherwise discriminate against employees who aid in implementing environmental standards; 2) prevent the use of job-loss threats by giving the affected employees the right to call a public hearing and have the EPA subpoena corporate records (an extension of present Water Pollution Control Act provisions);

and 3) special assistance to affected workers in instances where there is a genuine job loss due to environmental controls.⁵⁹ (The proposals were defeated in Congress.) Local Steelworkers officials reject the idea that environmental controls on steel companies reduce steel industry employment by a nearly 3 to 1 margin.

A recent newspaper article captioned, "Despite Backers, Ecology Bills Losing," explains that, "The big reason is that a former ally, labor, is frequently joining up with an old enemy, industry."⁶⁰ In a notable and recent defection, the UAW successfully led a lobbying effort against tougher auto emission controls. Environmentalists have apparently been unsuccessful in their efforts to convince labor that the ecology - jobs conflict issue is a phony. There are several likely reasons for this failure. First, environmentalists have not been completely honest. While eager to point to ecology-sound jobs gains, environmentalists are slow to acknowledge that the employment gains are very likely to result in lower paying, less prestigious jobs. For example, bottle bills increase employment, but the gains occur largely in retailing while the losses occur in high-paying container manufacturing. Environmentalists are also usually (but not always) ready to ignore short-run dislocations that mean lifestyles and bread and butter to the dislocated. Second, as EFFE coordinator Richard Grossman acknowledges, environmental groups largely represent the white middle-class and are run by the sort of youth George Meany hated when they opposed the Viet Nam War. "They haven't been sensitive enough to the fears and problems of

workers and the unemployed." Leonard Woodcock's reference to a "double standard" (mentioned earlier) of environmentalists reflects labor's perception of their insensitivity. Finally, the Carter Administration's early conflicts with labor make it difficult for labor to be sympathetic to Carter-backed energy and ecology efforts. If the proposed ecology/energy policies contained some clear and substantial benefits for workers and unemployed, such as a massive insulation retrofitting program rather than tax credits to consumers, labor might find it easier to resist the temptation that nuclear power plants, dams, and big cars provide -- jobs now.

Conclusion

The preceding discussion, evidence and analysis has identified and, hopefully, clarified some of the energy and ecology issues' potential and actual impacts on Steel's industrial relations system. There are probably many interrelations which have been overlooked. Quantitative estimates of various impacts should be developed, as should estimates of the net impact of various counter-influences. (The Council on Wage and Price Stability is currently conducting a 2-year study of regulation's impact on the steel industry. The Conference Board will begin a similar study of OPEC, OSHA, EPA, and FEA impacts late in 1977.)

The central economic role of the industry, and its distinguishing energetic and ecological characteristics guarantee that it will continue to be a central forum in the accommodation of

industry and employment to public policy, or vice-versa. Making OSHA work, the energy situation and energy policy impacts, and ecology-jobs conflicts will all provide decisive influences and fundamental challenges to the system's actors and the rules they develop. The outcomes in Steel may foretell the likely impacts of energetic and ecological influences, and the future course of events in the broader industrial relations system.

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APPENDIX

LOCAL STEELWORKERS' UNION OFFICIALS' OPINIONS
ON ENERGY, ECOLOGY, AND THE STEEL INDUSTRY

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APPENDIX

I. INTRODUCTION

In late April, 1977, approximately 130 officials of local Steelworkers unions (USWA) attended a conference on safety and health sponsored by the University of Illinois' Institute of Labor and Industrial Relations' Labor Extension Division. Most of the attendees were presidents, vice-presidents, stewards and grievors, etc., of Illinois and Indiana locals. During the conference a voluntary opinion survey on energy and environmental issues was distributed to approximately 70 of those present. The survey was voluntary and in no way related to the Labor Extension program, and potential respondents were so advised when the surveys were distributed. Forty surveys (57%) were completed and returned.

The survey contained sections on respondents' general characteristics, perceptions about the energy and environment problems, possible solutions, and various sources of energy. The typical respondent (mean or mode scores as appropriate) was 47 years old, had completed 12.5 years of school, a machinist or skilled tradesman, local union official, and had worked in the rod and wire products sector of the steel industry for 22 years. No attempt was made to assess characteristics of nonrespondents.

Responses to substantive questions were restricted to agreement, disagreement, or no opinion. Space was provided in the instrument for remarks to elaborate or clarify responses. Several respondents offered interesting comments.

II. NOTE ON METHODOLOGY

The results for each of the opinion questions and statements are presented individually. An attempt has been made to examine the major

interrelationships between various responses. This effort has been limited primarily to these relationships exhibiting statistical significance to avoid inundating the reader and thus obscuring the most important and certain relations. This limitation also raises the prospect that a relation which was not statistically significant at the confidence level adopted here, but nonetheless important, has been omitted from the analysis. Also, the observation that two phenomena are associated statistically does not indicate, necessarily, whether they move together most at low values or high values. This for example, does not allow easy differentiation between the case where respondents favor two statements strongly or oppose two statements strongly, and the case where both are true. Finally, the two-dimensional analysis does not reveal more complex multi-dimensional relations and thus may lead to erroneous interpretations.

III. RESULTS

The first question was "Do you think there is an energy problem?" This question was followed by several possible choices of actions that the respondent could agree or disagree should be taken to solve the problem. Sixty-six percent of the officials think there is an energy problem while 3% had no opinion. (Interestingly, a recent (June) Gallup poll found that 52% of the general public think that the U.S. imports oil.) An occasional explanation offered by those who don't perceive a problem attributed the energy situation to "monopoly," but most offered no comment. Younger and more educated officials tended to perceive that the U.S. has an energy problem. This direct relation between education and the recognition of an energy problem was statistically significant (95% confidence level). The possible solutions and the percentages associated with each are shown in Table 1.

TABLE 1. Actions to Solve Energy Problem
Favored by Respondents (Percent)

| | AGREE | NO OPINION | DISAGREE |
|-----------------------------------|-------|---------------|----------|
| *Develop domestic energy supplies | 96.4% | 0 % | 3.6% |
| *Conserve energy | 84.0 | 4.0 | 12.0 |
| Lower energy prices | 33.3 | 4.8 | 61.9 |
| Raise energy prices | 33.3 | 5.6 | 61.1 |
| *No action needed | 6.3 | 0 | 93.8 |
| Rationing energy | 36.4 | 18.2 | 45.5 |
| Other | 12.5 | NA | NA |

NA: Not applicable

* : The "average opinion" is significantly different from neutral
(95% confidence level).

Domestic development is the obvious choice. The close second for conservation is slightly surprising, considering that our national policy response to the energy crisis first emphasized independence and only recently began to emphasize the elimination of waste. Another interesting result is the response to the price questions. Price manipulation in either direction is equally disfavored by nearly 2 to 1 margins. Further, equal proportions favored lowering or raising energy prices. This last result suggests a substantial number of respondents think of the energy problem as more than higher energy prices.

*[NOTE: President Carter's first energy policy address was given approximately ten days prior to the survey.]

The only significant relation between these actions and age or education occurred between age and lower energy prices. This may reflect the fact that the elder respondents face the prospect of fixed incomes in the near future, and are thus more sensitive to inflation. Younger workers tended to favor raising prices as did the more educated, but these relations were not statistically significant.

Those who favored domestic development also tended to favor conservation. Those who favored conservation opposed lowering prices and favored rationing. Opponents of raising prices also opposed inaction and rationing. (These are the only statistically significant relations between the choices of actions.)

The comments offered in this section concerning the energy situation included:

- Sell our products to other countries for oil and other energy.
- Wipe out energy eaters.
- Improve the way we use it.
- Use foreign energy, conserve our own. Time is on our side
- Government should get after manufacturers... so you can get 25 to 30 miles a gallon... foreign cars do...Oil companies don't want that. All they want is big profits.
- Develop hydrogen technology.

The second question was "Do you think there is an environmental problem?" Like the first question, those who answered in the affirmative were asked to indicate whether they agreed or disagreed with possible courses of action aimed at solving the problem. Ninety-seven percent of the respondents think that there is an environmental problem, and only 3% think there is not. The difference in environmental and energy problem perceivers is somewhat surprising. Perhaps the degree of agreement on the environment question can be explained by the fact that the Steelworker's officials and their constituents live in steel-producing areas, or by the fact that the environmental crisis was widely recognized a few years earlier than the energy crisis. The candidate solutions and the percentage distributions associated with each are shown in Table 2.

TABLE 2. Actions to Solve Environmental Problem
Favored by Respondents (Percent)

| | AGREE | NO OPINION | DISAGREE |
|---------------------------------------|-------|---------------|----------|
| *Fine polluters | 87.5% | 9.4% | 3.1% |
| *Set tougher pollution standards | 84.8 | 12.1 | 3.0 |
| *No action is necessary | 12.5 | 0 | 87.5 |
| *Government should clean up pollution | 63.0 | 14.8 | 22.2 |
| Other | 15.0 | NA | NA |

NA: Not applicable

* : The "average opinion" is significantly different from neutral (95% confidence level).

The results show a fairly hard-line attitude towards polluters. Again, it is very likely that the issue is "close to home" for these officials and their constituents. The bulk of opinion seems to be that pollution costs should be paid by those responsible, but a substantial number of respondents think it is governments' responsibility. The only significant relation between age or education and these solutions is between age and the fining of polluters. Older workers tended to favor fines. The only significant relation between solutions is that between the fining of polluters and setting tougher standards. Comments concerning the environmental situation under the "other" category include:

- - All clean up pollution.
- - Hire unemployed to clean highways and streams.
- - Subsidize. Example: The steel industry for anti-pollution devices through tax credits.
- - Don't pollute air and water.
- - Those who create the pollution should clean it up.
- - Set standards, but let people do the job.

The third question was "Do you think OSHA is doing enough to improve your workplace environment?" Only 8% of the respondents answered in the affirmative, while the remainder thought OSHA is not doing enough. Some of the comments on this question include:

- - Safety should be improved.
- - Congress doesn't support or fund OSHA sufficiently.
- - To do enough, better enforcement is needed.
- - Set more rigid standards. Enforce the standards now set more rigidly.
- - I would like to be able to refuse to work in an unsafe area and be able to shutdown a piece of equipment if it is unsafe.

The next section of the survey instrument consisted of eleven statements with which respondents were asked to agree, disagree, or indicate no opinion. The results for this section are shown in Table 3.

TABLE 3. Respondents Opinions on Statements Concerning Energy and Environment Issues (Percent)

| STATEMENT | AGREE | NO OPINION | DISAGREE |
|--|-------|---------------|----------|
| 1. Inexpensive energy is necessary to reach and maintain full employment..... | 57.1% | 8.6% | 34.3% |
| 2. *Higher energy prices mean more jobs in the steel industry..... | 2.9 | 11.8 | 85.3 |
| 3. *Higher energy prices may mean more jobs in the steel industry but they wouldn't pay as well as present jobs..... | 5.9 | 20.6 | 73.5 |
| 4. *Environmental controls on the steel companies reduce employment in the industry..... | 25.7 | 2.9 | 71.4 |
| 5. *The union should take an active role in obtaining an energy policy that is best for steelworkers..... | 76.3 | 7.9 | 15.8 |
| 6. Pollution control equipment requires large amounts of steel..... | 28.1 | 28.1 | 43.8 |
| 7. Electric power plants require large amounts of steel..... | 30.3 | 21.2 | 48.5 |
| 8. *Inflation is a more important problem than unemployment..... | 28.6 | 8.6 | 62.9 |
| 9. *OSHA costs employers money and causes them to eliminate jobs..... | 25.0 | 19.4 | 55.6 |

TABLE 3. Continued

| STATEMENT | AGREE | NO OPINION | DISAGREE |
|--|-------|---------------|----------|
| 10. *Conservation is an important source of additional energy supplies..... | 85.3% | 2.9% | 11.8% |
| 11. The energy policy that is best for the nation is probably the best for the steelworkers..... | 61.3 | 6.5 | 32.3 |

*: The "average opinion is significantly different from neutral (95% confidence level).

The first statement ("Inexpensive energy is necessary to reach and maintain full employment.") represents a rather common piece of "conventional wisdom". Its validity is questionable for at least two reasons. First, economic theory of firms predicts that energy and labor are substitutes in the production function.¹ Second, international comparisons show that some industrialized countries pay more for energy and have lower unemployment and higher living standards. On the other hand, it is true that in the short run higher energy prices soak up consumer demand and thus worsen unemployment--as occurred after the October 1973 embargo and price hikes.² It is also apparent to the employee that natural gas shortages, perhaps erroneously associated with expensive energy, cause layoffs. Perhaps the most interesting feature of this tabulation is the divergence of opinion.

Older and more educated respondents tended to agree with this statement, although neither relation was statistically significant. Those who agreed with this cheap-energy/full employment relation also tended to

advocate fining polluters in the earlier question on environment. While this relation is statistically significant, there is no obvious basis for interpretation.

The second statement ("Higher energy prices mean more jobs in the steel industry.") was strongly rejected by the Steelworkers' officials. The negative consensus may result from a belief that there is no relation between energy prices and steel industry employment, but it is probably due to the post-embargo experience, where insufficient demand and higher gasoline prices depressed auto sales and other consumer durable purchases and thus steel demand. This is however, a short-run relation, and it may be that over a longer period of time higher energy prices lead to greater demand for steel. A recent study of energy prices' impact on the economy found that the demand for steel did increase as energy prices rose.³ This result is quite reasonable when the substitutes for steel are considered. Aluminum is such a product. Steel production requires only about 10% of the energy per ton that aluminum production requires.⁴ Thus it is not difficult to imagine that after the initial impact higher energy prices would result in more steel production and less aluminum production. Also, higher energy prices erode the competitive position of foreign producers in U.S. markets since energy is such a high proportion of transportation cost.

The third statement ("Higher energy prices may mean more jobs in the steel industry, but they wouldn't pay as well as present jobs.") was also strongly rejected, but the results are not easily interpreted. In retrospect, the statement is poorly worded--the first part can be rejected without consideration of the second, and therefore only agreement is

readily interpretable. The similarity of response to that of the previous statement's suggests that it may have been only the first part of the present (third) statement which was considered.

The fourth statement ("Environmental controls on the steel companies reduce employment in the industry.") was rejected by a significant margin. Employers often complain that excessive controls prevent other investment projects from being undertaken.⁵ Certainly investment in pollution control devices creates employment, and it is not clear which type of investment results in more net steel industry jobs.

The majority of respondent opinion rejects the notion that steel companies are likely to close down otherwise profitable operations because of environmental restrictions. While employers have occasionally enlisted organized labor's support against environmental restrictions (environmentalists have charged some employers with blackmailing labor by threatening closings⁶), the response on this item seems to indicate these local union officials will not easily be blackmailed.

More educated respondents tended to reject this (fourth) statement more often than less educated respondents. Industry-specific responses were also strong. Officials in the can and container industries unanimously agreed with the statement, while those in railroad equipment, bottle mold and crown manufacturing and basic steel unanimously rejected that statement, which may have been strongly associated with controversial "bottle bills." Those who rejected the earlier notion that no action is needed to solve the energy problem also rejected this statement, as did those who think

there is an environmental problem. Both of these relations were statistically significant.

Statement five ("The union should take an active role in obtaining an energy policy that is best for steelworkers") was strongly endorsed by the local officials (approximately 5 to 1). It is not clear whether those rejecting the statement thought the union should not be involved in energy policy or that they were opposed to the policy they expect the union to advocate. Those endorsing this statement also tended to advocate lower energy prices as a solution to the energy problem and rejected the earlier (third) statement to the effect that higher energy prices mean more low paying jobs in the steel industry.

Statements six and seven ("Pollution control equipment and electric power plants [respectively] require large amounts of steel") were both rejected by similar insignificant margins. Neither statement can be attributed any precise meaning since the term "large" is not defined. One very crude way of evaluating the statement is to define "large" to mean the dollar value of steel needed to produce a dollar's worth of electricity or pollution control equipment. Unfortunately, there does not seem to be any good data on the steel requirements of pollution control equipment. However, much of this equipment is manufactured in the blower and fan industry. Using this as a proxy for a true pollution control equipment "industry" yields the results shown in Table 4.

TABLE 4. Value of Steel per Dollar of Two Industries' Output

| | | BLOWERS AND FANS (SIC 3569) | ELECTRIC POWER (SIC 491) |
|---------------------|---|--------------------------------|-----------------------------|
| ⁺ S.I.C. | STEEL INDUSTRY | | |
| 331 | Blast furnaces and basic steel products | 12.7¢ | .9¢ |
| 332 | Iron and steel foundries | 1.9¢ | .1¢ |
| 3391 | Iron and steel forgings | .3¢ | less than .1¢ |
| 3399 | Primary metal products, n.e.c. | 1.0¢ | less than .1¢ |

⁺Standard Industrial Classification number

Source: U.S. Dept. of Commerce, Bureau of Economic Analysis, (data rounded to nearest 1/10 cents)⁷

Those who rejected either statement tended to reject the other. Younger and more educated respondents tended to agree with both statements, but of these only the relation between youth and agreement with the statement about electric power plants was statistically significant. Those with more industry experience also tended to endorse this statement (number seven), while those in the rod and wire products industry tended to reject it. Respondents who favored tougher pollution standards tended to disagree with the statement to the effect that large amounts of steel were required for pollution control equipment. Those who rejected the notion that no action was necessary to solve the environment problem also tended to reject this statement. Both these relations seem counter-intuitive, but like any interrelation between questions, may result from observing complex relations in only two dimensions. (This caution must be applied to those relations that make sense as well as those that don't of course.)

Statement eight ("Inflation is a more important problem than unemployment.") was rejected by a significant margin (approximately 2 to 1). Older respondents, perhaps more concerned with fixed pensions than job opportunities, tended to reject the statement less often, but this relation was not significant. The response to this statement appeared to be very neutral with respect to respondent characteristics and other opinions.

Statement nine ("OSHA costs employers money and causes them to eliminate jobs".) was rejected by a significant margin (over 2 to 1). Higher level local officials and those with most experience in the industry tended to reject this statement most strongly. One of those rejecting this statement explained: "OSHA saves workers' life or limb which in return saves the employer money."

Statement ten ("Conservation is an important source of additional energy supplies.") was endorsed by a significant margin (almost 8 to 1). This was the most popular of all the statements (but it was not as unpopular as the notion that higher energy prices mean more steel industry jobs). Those who agreed with the conservation statement also tended to reject rationing to solve the energy problem and the statement to the effect that inexpensive energy was needed for full employment. They also rejected the previous statement about OSHA costing jobs.

Most respondents endorsed statement 11 ("The energy policy that is best for the nation is probably the best for the steelworkers."), but not by a statistically significant margin. A substantial minority expect national and steelworkers' interests to diverge over energy policy. More educated respondents tended to reject this statement most often. Those who

endorsed this statement (believe steelworkers' and national interests coincide) also endorsed the previous statement that conservation is an important energy source, and rejected the notion that inexpensive energy is required for full employment. The relation between this statement (number 11) and the role of the union on energy policy (statement 5) was not statistically significant at the statistical confidence level used throughout this text. The negative relation was still fairly strong (significant at 88% confidence level). This suggests that those who thought the union should take an active role on energy policy for steelworkers didn't necessarily think that role would be in behalf of the national interest as well.

The final section of the survey instrument asked respondents to rate the importance of various energy sources for the nation's and government's emphasis on development, i.e.--which sources should be emphasized. The percentage distribution for each source and its ratings are shown in Table 5. Respondents were asked to rate each source. Thus if all respondents thought all sources were "most important" each source would have 100% of the response under "most important".

TABLE 5. Percentage Distribution of Response to the Statement: "The Nation and the Government Should Emphasize the Development of....."

| | MOST IMPORTANT | IMPORTANT | NO OPINION | NOT VERY IMPORTANT | LEAST IMPORTANT |
|--------------------|-------------------|-----------|---------------|-----------------------|--------------------|
| *Oil | 61.8% | 29.4% | 0% | 8.8% | 0% |
| *Natural gas | 69.7 | 27.3 | 3.0 | 0 | 0 |
| *Coal | 54.8 | 32.3 | 0 | 9.7 | 3.2 |
| *Nuclear energy | 62.1 | 31.0 | 3.4 | 3.4 | 0 |
| *Solar energy | 68.8 | 21.9 | 3.1 | 3.1 | 3.1 |
| *Wind energy | 38.7 | 29.0 | 12.9 | 12.9 | 6.5 |
| *Conservation | 50.0 | 28.1 | 6.3 | 12.5 | 3.1 |
| Other | 12.5 | 2.5 | 82.5 | 0 | 2.5 |

*The average opinion is significantly different from neutral (95% confidence level)

The striking feature of these results is apparently equal importance attached to all the candidate sources. The highest ranking, for natural gas, probably stems from the closings of plants during recent gas shortages. The close second for solar energy is somewhat surprising. The rankings of Table 5 contrast sharply with the proposed Energy Research and Development Administration (ERDA) budget for fiscal year 1978:

TABLE 6. Proposed ERDA Budget by Technology

| | MILLIONS OF DOLLARS | PERCENT OF BUDGET |
|---------------|---------------------|-------------------|
| Conservation | 244 | 7.8% |
| Fossil Fuels | 522 | 16.7 |
| Solar | 250 | 8.0 |
| Nuclear Power | 2107 | 67.5 |

Source: National Resources Defense Council⁸

Those favoring the development of oil energy sources also favored domestic development as a solution to the energy problem and tougher pollution standards to solve the environmental problem. These respondents also thought the Nation's and the steelworkers interests in energy policy coincide.

Respondents favoring emphasis on natural gas development tended to be less educated than those opposing it, and also favored tougher pollution standards to solve the environmental problem. They tended to disagree with the statements that higher energy prices meant more low-paying steel industry jobs and that the union should pursue the best energy policy for the steelworkers. They also favored the development of oil energy sources.

Respondents favoring emphasis on coal development were generally less educated and thought development of domestic supplies and conservation were important solutions to the energy problem. They also favored tougher pollution standards and thought that the best energy policy for the nation was the best for steelworkers.

Proponents of nuclear power disagreed with the notion that no action was necessary to solve the environmental problem. They also favored the development of coal energy sources.

The respondents who favored the development of solar energy sources thought there was an energy problem, and that domestic development, conservation, and higher energy prices were needed to solve the problem. Solar proponents also favored tougher pollution standards, nuclear energy development and coal energy development.

Wind energy proponents thought there was an energy problem, and disagreed with the notion that no action was needed to solve the environmental problem. They also agreed with the statements that higher energy price mean more jobs in the steel industry, that the union should advocate an energy policy that is best for steel workers and that electric power plants require large amounts of steel. Other energy sources they favored were nuclear power and solar.

Proponents of conservation as an energy source disagreed with the idea that the environmental problem required no action, and disagreed that the union should take an active role in obtaining an energy policy that is best for steelworkers. These respondents also favored nuclear power development and wind energy development.

Those favoring "other" sources disagreed with the idea that no action was needed to solve the environmental problem. They disagreed with the statement to the effect that environmental controls on steel companies reduced steel industry employment, and agreed with the statement that electric power plants require large amounts of steel. These respondents also favored wind and nuclear energy development.

IV. CONCLUDING REMARKS

The preceding results clearly demonstrate the danger of sweeping conclusions. Though these local union officials occasionally expressed virtual unanimity, the diversity of opinion was extensive. The results hardly evidence a stereotypical respondent. Age, education, and other identifying characteristics were often instrumental in explaining observed differences of opinion.

From a policy perspective, the results suggest substantial room for common ground between these labor leaders and energy or ecology-conscious interest groups. Like these latter interest groups, these respondents are highly skeptical of "employer economics"--a doctrine which almost invariably concludes that any attempt to improve environmental quality or use energy more carefully will destroy the American economic system and eliminate jobs. At the same time, the response indicates areas where the mutual interests of environmentalists, the energy-conscious, and organized labor remain to be explored.

FOOTNOTES

- [1] For an empirical treatment of energy/labor substitution, see: E. Berndt and D. Wood, "Technology, Prices, and the Derived Demand for Energy," FEA Office of the Assistant Administrator for Economic and Data Analysis and Strategic Planning (xerox), May, 1974.; and for discussion: H. Daly, "Electric Power, Employment and Economic Growth", in Towards a Steady State Economy, San Francisco: W. H. Freeman & Co., 1972.
- [2] G. Perry, "The United States", in E. Fried and C. Schultze (eds.), Higher Oil Prices and the World Economy, Washington, D.C.: Brookings Institution, 1975, p. 88.
- [3] H. Folk et al., "Scientific and Technical Personnel in Energy-related Activities: Current Situation and Future Requirements", Champaign: Center for Advanced Computation, 1977, p. 135.
- [4] Battelle Columbus Laboratories, "Potential for Energy Conservation in the Steel Industry", Columbus: BLC, 1975.
- [5] S. Cort, "We Must Review our Environmental Goals", Steel Facts, Washington, D.C.: American Iron and Steel Institute, January, 1974, p. 2.
- [6] "Employee Protection from Environmental Blackmail Proposed", Environmentalists for Full Employment (EFFE newsletter), Washington, D.C.: E.F.F.E., November, 1975, p. 5.
- [7] U.S. Department of Commerce, Bureau of Economic Analysis, Input-Output Structure of the U.S. Economy: 1967-Vol. 3, Washington, D.C.: 1974, from Table 3.
- [8] T. Cochran, An Analysis of the Carter Administration FY 1978 Budget, Washington, D.C.: National Resources Defense Council, February 25, 1977.



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