It has been calculated that based on BTU's of mineral fuel being consumed in this country, it would take fifteen to thirty times more land than we presently have in crops simply to grow the feed necessary for the animals, if we still used horses. The process of substituting mechanical and electrical power equipment for work animals is an example of substitution -- substitution of mineral fuel calories for agricultural feed.

Another example of substitution involving minerals is found in the use of mineral fertilizers to increase crop productivity. The same process of substituting minerals for cropland is found in the use of insecticides and fungicides.

The examples are all about us, and the process is constant. The most dramatic changes, or perhaps visible would be a better word, are found in the displacement of forest products by mineral-based products.

The process is not uni-directional. Coal, as you all know, was a technological victim right after World War II, with the dieselization of the trains and the loss of an export market. Now coal has not only recovered all its lost ground, but looks forward to a great future, possibly as the instrumentality for saving the natural gas industry. Only a short time ago a natural gas man predicted that in
the decade of the 70's major scale gasification of coal will begin, and that by the year 2000, coal may be supplying a third or more of all gaseous energy.

Substitution may be involved when industry migrates to take advantage of cheaper raw materials or cheaper energy. Technology of transportation or of energy utilization can reverse well established trends with great suddenness. If LNG should be developed as a jet fuel, the results would be dramatic.

An example recently thoroughly discussed in the trade journals is the competition which has developed between steel and plastic pipe, the latter being scarcely heard of ten years ago. A related displacement situation is found when plastic coatings displace cellulose from forests as coatings on steel pipe.

Not one of these changes is unattended by problems, ranging from human to bureaucratic. In the matter of the pipe, for example, a decision-maker must grapple with the interrelationships of initial cost, upkeep, compatibility with existing systems, lack of durability information, differences in equipment requirements for corrosion control, code problems, and union problems, to name only a few.

Each of you can add his own set of examples from his own experience. Each of you knows that this conference's
three subjects - Research, Utilization, and Marketing -- all involve the competitive interaction of materials, fuels, labor costs, regulatory policies, and a host of other factors.

It is my intention this morning to suggest to you that your horizons as gas manufacturers and distributors may have to be broadened, if you are to realize all your growth opportunities. Although you have sharply upgraded your research activities, including basic research, and although you are aggressively reaching for new markets, and for a revival of old ones, it seems to me that until quite recently your interests have not ranged very far into the production area, or into some of the developing trends such as environmental quality.

President Morton Jacobs of AGA signaled a broadening of horizons when he recently asked the Federal Power Commission to establish prices and policies adequate to bring forth sufficient exploration, drilling and development to meet expanding interstate gas requirements. Expressing a concern for the maintenance of utility service, Mr. Jacobs outlined difficulties now being experienced to support his view that a critical gas supply availability situation is imminent.

This step, and the recent filing by the American Gas
Association in Docket No. RI69-470, opened a new front of Association activity. It is true that the American Gas Association has been an active and cooperating part of the Future Requirements Committee, making a nationwide survey of future natural gas requirements under the guidance of the Future Requirements Agency, the Denver Research Institute, and the Potential Gas Committee, making the same attack on supply questions using the Colorado School of Mines as the Committee agency. But these have been long range kinds of activity.

Whether there is disagreement or agreement with the premises expressed by President Jacobs, it is undeniable that dealing the American Gas Association into the broad question of the function of price as an incentive to exploration is a big step, and one which may well bring new light to the subject, and new insights to the Association.

The horizontal segmentation of the natural gas industry finds producers, transporters, and distributors seeing their own phases of natural gas problems. Courts and government agencies, too, have emphasized this segmentation. In this context, the alignment in the past has often been for the distributors to be on one side of the table, the producers on the other, and the pipeliners in the middle.

This has been a workable arrangement in the era of gas
surplus, the era before the completion of the major interstate lines to the population centers of the country.

Apparently the time has now come for questioning some of the basic premises. It is appropriate now to examine more thoroughly the forces which lead to materials substitution, the forces which lead to industry migration, the relationship of competition to regulation, and all the rest. Interfuel competition has to be revisited in the light of present realities.

The questions posed in such an inquiry are really fundamental. The present pattern of regulation controls price, and allocates resources. Neither function is adequately understood.

The price control function ordinarily gets the most attention, sometimes without recognizing that price control itself allocates resources. Fixing a price too low for a product or service may cause an artificially high demand, while at the same time depressing the incentive for further investment. One has only to look to the history of rent control to see how the phenomenon operates.

We are witnessing, in this effort by the American Gas Association, a growing awareness of the complexity of the natural gas business, which does not permit any segment to isolate itself from the total problem. Just as the individual
manufacturer, as he expands and broadens his business, must undergo a learning process about the problems of new suppliers, new competitors, and new customers, so must the manufacturers, the distributors, and every segment of the industry, lift his sights above the old ways and old problems.

I believe that it is possible and desirable for you to upgrade your capability to deal with the complexities of our age. This may well mean new activities, either on a company or an association basis, as far-reaching in their implications as your big research and development program.

What would it involve?

One general subject has already been identified, namely broader understanding of the economics of the petroleum industry. Forecasters have projected both demand and supply without reference to price, and seemingly without reference to each other. In this week's Oil and Gas Journal there is a review of a very valuable book on "Economic Aspects of Oil Conservation Regulation." (Lovejoy and Homan, RFF). The reviewer notes that many previous books of this sort were couched in the terminology of theoretical economists which caused oilmen to denounce them as being unworthy of serious notice. It is also noted that one of the objectives of the book is to lay to rest the idea that economists and
oil producers are natural enemies, with no common ground. In the same issue, there is a feature about an oil company executive whose company has moved into the coal business, and the article deals almost entirely with economics.

I hold no particular brief for the dismal science as such, but I do believe that particularly in the natural gas business there is a woeful failure of communication between those who understand what is going on, and those who ought to know but don't. Development of a skill in communicating these relationships at all levels of management will pay great dividends. It should contribute to the fund of knowledge necessary to make better decisions.

Another area, having many of the same aspects, is political science or government. If you think about it for a moment, you will be appalled at the complexity of the regulatory scheme under which you operate if you are in or near the gas business. You have federal, state, and local regulations; price control and production control; taxation and conservation controls -- the list is endless. Too often you have simply abdicated the function to a few professional experts, and have never really made the effort to see that your key personnel understand more about the whys and wherefores of these regulations.

Sociology is ordinarily not a required subject in
preparation for the gas business, but many a gas executive is finding out that if he wants to continue to do business in some areas he must grasp the complexities of this social science. A recent speech to a federal bar association briefing conference contained a recommendation by a federal judge that rates be designed to benefit the residents of the inner city ghetto, and that more attention be given to the poor and disadvantaged, not as potential workers but as utility users. The Administrative Conference's Assembly in December, 1968, received a Committee Report which advocated that provision be made by regulatory agencies for participation by the poor in rulemaking proceedings, even at government expense.

Environment quality is a concern of the whole country, and utilities who seek rights of way are experiencing difficulties entirely without precedent. To succeed in this area, the companies have to get themselves somewhat in phase with the drive for environmental quality, which many companies are doing very well indeed. The skill is learnable and teachable.

In summary, it seems to me that research programs might well move into some of these areas, with profit for yourselves, and benefit for the country.