KEYNOTE ADDRESS

Martin Goland
President
Southwest Research Institute

REMARKS ON NATIONAL PLANNING FOR FUTURE TRANSPORTATION SYNFUELS

Martin Goland, President
Southwest Research Institute
San Antonio, Texas

National planning in a democratic society faced with the complexity of the modern world is a turbulent and often seemingly chaotic process. Simple truths are hard to find, as are national goals agreed to by all. The pressures brought to bear by special interest groups, each with its own legitimate viewpoint, makes the exercise of sound judgment by our legislators and policy administrators an almost daily Solomon-like trial.

Nowhere is this difficult process more evident than in the current formulation of a national energy policy. Although farsighted members of the technical profession had warned for many years that a dramatic readjustment of our energy resources was in the offing, another characteristic of democratic societies is their relative inability to respond to major issues until crisis looms; in this case, the crisis took the form of the Middle East embargo and the financial shock of a sudden and dramatic rise in the world price for petroleum and natural gas. All at once, issues which could have been resolved more rationally on an evolutionary schedule had to be decided almost overnight. It is small wonder that the formulation of a national energy plan has defied quick solution. And yet, as engineers and scientists, we are acutely aware of the need for urgent action; in the area of major energy decisions, the time lag between deciding policy and implementing the delivery of energy to the marketplace is on the order of decades, and world events are moving too swiftly to make this a comfortable time scale.

The purpose of this meeting is to examine the present status of synfuels as a means of satisfying a significant portion of our future transportation energy needs, and in particular to identify the further research and development needed to achieve this goal. There can be no doubt in any of our minds that this is a possible direction which must receive our most diligent attention, for it holds the promise of a fuel supply based on the use of domestic natural resources with relatively enormous proven reserves. The concept of a sovereign nation living independently of all others is only a fanciful dream in today's world, but because energy supply strikes so directly at our national security as well as our national well-being, decisions regarding synfuels must be dealt with as one of the truly critical technological issues facing our nation.

The current paradox of the synfuels issue can be summarized quite simply. A well-developed synfuels industry guarantees the United States an assured domestic fuels supply for centuries to come. The principal concern of this conference is with hydrocarbon synfuels, and these can be derived from various sources; including coal, oil shale, and tar sands; more futuristic concepts involve processes employing biomass. The technologies needed to convert the primary sources to crude liquids (syncrudes), although certainly capable of further improvement, are well-established on a pilot-scale basis and, in the case of coal, by the German experience of nationwide use during the Second World War. An accurate estimate of the costs of synfuels production on a large-scale basis employing modern technology is not yet available (although preliminary estimates indicate a relatively high cost), and must await the results obtained from experience with demonstration plants. Even less certain is information on the optimum use of syncrudes; whether they should be handled as a conventional feed stock or in some more selective fashion, and whether there are unsuspected technological barriers which limit the choices available for its use in various refined states.

The best current estimates are that there are no insurmountable obstacles to the more or less conventional processing of hydrocarbon syncrudes, and no seemingly insurmountable warning signals have been raised in the areas of utilization. The paradox which is preventing the development of an aggressive synfuels industry is that knowledgeable estimates of the costs of producing a barrel of syncrude range from two to three times the world price of a barrel of natural petroleum. (Environmental questions are also present, but for purposes of simplification I am relegating them to

Preceding Page Blank

a role of secondary importance). With these cost projections in mind, it is impossible for private enterprise, the prime mover of American technological strength, to invest the many billions of dollars required to develop and build the synfuels capability our nation will ultimately need. Financial risk projections into the future are further confused by the recognition that the world's largest oil producers establish their price on an essentially artificial basis, giving them the potential power to encourage or discourage innovative new energy initiatives which tend toward higher price levels.

A government role in synfuels development is thus essential, but the character and extent of government involvement is still a matter for debate, and the lack of decision in this regard is one of the glaring deficiencies in our stumbling efforts to arrive at a national energy plan.

Suggestions as to the proper role for government are numerous. The range from special tax concessions to developers, outright governmental subsidies to make up the difference between synfuels production costs and the existing price of natural petroleum, and the simple mandating by government that after some future date fuels sold in the United States must incorporate a certain percentage of synthetic product. In this last instance, the higher probable costs of the synthetic component will be borne by the consumer, but this may be an acceptable price to pay for our future energy security and independence.

As we are all aware, current government policy is a conservative one. In addition to subsidizing research, the government is joining with industry in the construction of selected demonstration plants. When the technology and costs are better defined, future decisions will presumably be made in the light of the economic and political circumstances which then prevail.

It should be noted in passing that the industry-government relationship is not without its pitfalls even after the economic commitments are made. Questions of management prerogatives and responsibilities in joint efforts have not been easily resolved in the past. The Clinch River Breeder Reactor program is a splendid example of a harmonious beginning of a government-industry partnership with an acrimonious and unsatisfactory ending. The original plan was for industry to bear the management responsibility; this was to take advantage of industry's more accurate understanding of marketplace requirements. When the project costs escalated far beyond the original estimates, and when the extent of governmental financial involvement became predominant, management responsibility shifted from industry to the government. Differences in development philosophy between industry and government then became substantial, and industry disenchantment became widespread. The final cancellation of the program by the President for political reasons ended an unsatisfactory episode in government-industry technical cooperation. It is to be hoped that future collaborations will profit from past experience and will lead to happier results.

Everything I have said up to now is, of course, well known to those of you in the audience. I have taken the liberty of repeating these perspectives only to serve as a backdrop for the more specific objectives of this conference, which is to exchange ideas and information on the current status of synfuels technology, to review the Alternate Fuels Utilization Program of the Department of Energy, and to make recommendations on how the program can be optimized in terms of effectiveness.

When I was a freshman mechanical engineering student, one of the hurdles I had to overcome was to pass the minimal course requirements in chemistry. One of the earliest laboratory assignments given us was to demonstrate the capability to make smooth bends in glass tubing. Perhaps it was my clumsiness in carrying out this simple task which set me off on the wrong foot, but I must admit that the field of chemistry gained little from my subsequent participation. All of which is a circuitous way of absolving myself from pretension of chemical expertise, and certainly from any depth of knowledge in the area of fuel chemistry. Nevertheless, having had many years of overview association with research and development relating to engines and fuels, I shall try your patience by making a few observations which may be relevant to the topic at hand.

One of the curiosities which strikes me is the relatively independent paths taken in the past by those who develop engines and those who develop fuels. It is perhaps not unfair to say that in most instances the engine hardware people seized the initiative and designed engines which required certain fuel characteristics, always with the supreme confidence that the fuels community would be creative enough to meet their demands. This did in fact happen, leading to the remarkable development of our current family of engines and fuels which afford the user an extraordinary degree of reliability, economy, and durability. While lip service in learned discussions was sometimes given to viewing the engine and the fuel as parts of an integral system, concepts of system optimization were not given very serious attention. In an era of plentiful petroleum supplies and low crude prices, this attitude was probably justifiable. What is often insufficiently emphasized is that today's engines, particularly reciprocating engines, demand fuels with highly specialized performance characteristics which must be maintained within relatively narrow tolerance limits.

Recent events have, however, made it imperative that we face squarely the need to adopt the engine-fuel system viewpoint. Fuel availability and cost are now critical issues, and every effort must be made to optimize the effectiveness with which we use each barrel of crude product. The question thus arises as to whether current fuel specifications are consistent with the goal of obtaining the maximum possible yield from each barrel of crude. On the engine side, fuel economy and low emissions have become prime and essential targets. In order to achieve the necessary goals, advanced closed-loop engine control systems directed by sophisticated microprocessors will be the future trend, and this will in fact permit some greater degree of fuel tolerance during engine operations. The advantage to be gained from the point of view of the fuel supplier will not, however, be large, and may be counteracted by renewed emphasis on achieving higher octane ratings and tighter controls on fuel impurities.

One of the positive, long-range benefits of the synfuels program may be that it will encourage a more careful examination of the engine-fuel system. Reciprocating engine types which can accommodate fuels different from the conventional blends are currently the subject of research in numerous engine research and development laboratories; examples are the direct-injected, open-chamber stratified charge engine and the spark-assisted diesel engine. While still in the experimental stage, these engines afford the promise of a much greater degree of fuel insensitivity over conventional designs. The "adiabatic" engine, which operates at extremely high temperatures with a minimum of heat loss, is a challenging concept which can be thought of seriously on the basis of modern advances in material technology.

On the fuels side, it can be argued that today's refineries, using natural crude as the feedstock, operate at such high efficiencies that only marginal gains can be expected from variations in the output characteristics. Even if this is the case, it should be pointed out that we have no assurance that the same kinds of output will offer the most efficient utilization of syncrudes. It should be kept in mind that synfuels will probably be derived from several different source materials (coal, oil shale, tar sands), and that these sources will be variable among themselves, depending on the deposit location. The question of what kinds of fuels should be introduced into the national transportation system so as to optimize the utilization of the totality of our natural resources is thus a real one.

One thing is certain. New fuel types will not be compatible with existing engine types. The system perspective will thus be essential to future progress along these lines. As we look to the future, we can anticipate that new fuels, burning in new engine designs, will become a growing part of our transportation energy picture.

In the near term, of course, we must have as a first objective the conversion of syncrudes into fuels capable of being utilized in conventional engines. Introducing new kinds of powerplants and establishing new lines of fuel supply are goals which must be thought of in the time scale of decades. Much of the discussion at this conference will accordingly be concerned with this more immediate objective and to providing answers which are so important to our national energy security and independence.

It is a pleasure for me to have this opportunity to talk with you, and I hope I have been able to set the stage for this timely and significant meeting.