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## Energy and National Security

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## ENERGY AND NATIONAL SECURITY

Rear Admiral William A. Myers, III, USN

Director for Energy  
Department of Defense

Remarks presented at the Fourth Annual UMR-DNR Conference on Energy at the University of Missouri-Rolla, Rolla, Missouri on October 12, 1977.

On April 18 of this year, the President of the United States made a television address to the American people on the subject of energy. It was a somber talk. He described the energy situation facing this nation as "the greatest challenge that our country will face during our lifetimes" with the exception of preventing war. He went on to say that our efforts to deal with the energy crisis must be the "moral equivalent of war", and that the alternative to those efforts "may be a national catastrophe."

President Carter's talk was not the first Presidential energy message. There have been at least six earlier energy messages going back to June 1971. Unfortunately, those earlier messages did not convey the sense of urgency that the energy crisis really merits. Nor were they heeded by the nation to any significant degree. Those in government and the private sector who have been close to the energy problem have been painfully aware of the lack of general interest, comprehension or belief in the impending danger facing the United States and the world. Many of us have held that no program or series of programs would have any real prospect of contributing meaningfully to the solution of the energy crisis until the majority of the American people become absolutely convinced that the crisis is fundamental and

real, and not the product of the Arabs, the oil companies, the environmentalists, or any other group or interest.

My purpose here today is to talk about the energy crisis and the threats it poses to national security, the economic well-being of the American populace, the future of this nation, and indeed to the future of the whole family of nations - to world order and progress. Perhaps many in this audience are already persuaded that the energy crisis is real, and that it confronts us today, not in some relatively remote future time. If so, these words are not for you, but for those others who are not yet fully convinced, or worse, who put no credence whatever in the matter.

Let me begin by making several dogmatic statements: There is no shortage of oil in the world today. A surplus oil production capacity greater than the world has previously known now exists, and will probably continue to exist through the 1970's. There is no shortage of fossil fuel energy resources in the world. Even with sustained significant rates of growth in world energy consumption, world fossil energy resources could be expected to meet all demands for energy for another century, even without significant contributions from nuclear or solar power. Certainly, in a hundred years, science will find practical means to obtain energy from the virtually



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Remarks

Luncheon  
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limitless resources of fusion and the truly unlimited resource of the sun!

If these statements are even approximately correct, "What," you may ask, "is the problem?" The answer to that question starts with oil. It also finishes with oil. For the energy crisis is really an oil crisis. Had liquid petroleum not been found to exist in great quantity there would today be no energy crisis because the vast recent expansion of the world economy which creates such enormous and growing demands for fuel would not have occurred. Without liquid petroleum the world as we in the United States and those in other developed and developing

nations know it today would simply not exist. Instead we would have a slowly growing economy based on coal and steam, just as we did in the late years of the 19th century and the early decades of the 20th. There would be no internal combustion engine, and therefore little in the way of powered personal vehicles, or the trucking industry, the road system and the recreation industry which we now know. There would be no air travel, no automated agriculture and little in the way of a petrochemical industry with all its marvelous synthetic products. Nations without abundant coal reserves (most of the world) would have progressed little if

at all from the purely agricultural subsistence societies which were predominant throughout the history of man until the industrial revolution of the 19th century.

Geologists tell us that it was about 600 million years ago that oil and gas began to form from organic matter deposited in sedimentary basins. Coal came on the scene about 250 million years later, and both have been in continuous development ever since. In a sense, oil, gas and coal represent banked solar energy - the minuscule fraction of the total solar energy falling on the earth over all those years which was captured in living matter, then deposited in the earth for mankind to withdraw. What it has taken nature hundreds of millions of years to create, man bids fair to consume in a time sequence that is hardly more than a minor blip on the calendar of human existence, and which could not be detected on a graph of the earth's total existence.

Over most of the 5,000 years of recorded human history man made little progress because he had the energy only of his own muscles and his domestic animals to devote to his purposes. With the exception of the use of wind to move primitive vessels on the water, and fire for cooking and heating, energy equated to the efficiency of food conversion in the stomachs of man and his animals. Through five millenia, from ancient Egypt thru the 18th century the condition of man changed but little. In the 12th century coal had been discovered in England, but for more than 700 years it served little purpose but for cooking and heating, to some small degree replacing wood. It was not until development of the steam engine early in the 19th century that man was able to begin to apply this new

energy resource to his own needs. It is sobering to realize that just a century ago most of the world's people lived little differently than their ancestors had for so many prior centuries. During the first 700 years following its discovery, total coal consumption equalled only the equivalent of about nine months of current world energy use. Oil was in its infancy 100 years ago, and wood still made the greatest contribution to national and world energy needs. The first practical use of electricity was still five years in the future and electric transmission was not to become reality until 1895.

The world as we know it today is vastly different. It has been recently and rapidly built on the unlimited availability of inexpensive energy, largely in the form of oil. This world has not been around very long, and its future is in grave doubt. Its recent origin, perhaps 50 years ago in the United States and 25 years or so in other developed nations, is illustrated by these facts: More than half of all the coal used in the world since the 12th century has been consumed in the last 35 years. Two-thirds of all the oil ever used has been consumed since 1960, in just 16 years, and virtually all the world's consumption of natural gas has taken place since the end of World War II.

It has been oil that has really made the developed world what it is today, and it is oil which has until recently seemed to offer the chief hope of advancement for the undeveloped nations of the world. Alone among all energy sources, oil does everything easily and inexpensively. It can be burned in stationary or movable engines, turbines and boilers. It is the feedstock for the marvels of chemistry. It fertilizes and powers our farms. It

lubricates our machinery. It is liquid, easily transportable over land or water and easy to produce. In short it is all things to all mankind's energy needs. Unfortunately, it is also, next to natural gas, the most limited of fossil fuels. Given present trends and forecasts the fossil fuel era should span two or three centuries. But the oil era will span less than sixty years. The exploitation of a depletable resource such as oil will represent a bell curve, with the first and last ten percentile of production representing the lip or flair of the bell and the middle 80 percent representing the main body or height of the bell. That 80 percent will reflect the rapid growth in use of the resource, the leveling of production as total consumption nears 50 percent of the finite resource and costs of additional production increments begin to rise, and finally a rapid decline as the remaining resource base is depleted.

A consensus of the best and most recent estimates of the probable total recoverable world oil resource puts it at 2,000 billion barrels. Only ten percent of that was produced through 1968, during the first 110 years following discovery of oil in 1859. In the last eight years, another 7 1/2 percent was consumed. Unless the growth in world demand is soon sharply curtailed, it is likely that total consumption by 1990 will approximate 40 percent of the probable resource, which by then would be unable to support significant further increase in output. That would effectively terminate additional world economic growth unless alternatives to oil are then available in large quantity. Shortly thereafter the oil supply would go into sharp decline, falling steadily until 90 percent of the total resource had been consumed, probably by the year 2025.

The problem is of course much closer than the date when the oil will largely be gone. By then we would surely have developed alternatives, or as the President has warned, we would long since have endured world catastrophe. The real crunch will come when energy suppliers and consumers collectively come to the realization that an oil supply/demand imbalance is clearly discernible, say within two or three years of the time at which that collective judgement is made. That's when the price of oil will begin to rise to the point where it inhibits demand by pricing many customers out of the market. And that is also the point when the poor nations of the world will begin to lose their hopes for a brighter future for their people, and the more affluent nations will begin to suffer grave economic distress as they compete against each other for the remaining oil resources at ever increasing prices.

By assuming higher or lower quantities for the world's total oil resource, and varying rates of growth in oil demand in coming years, the year when production of oil will peak and go into decline can be moved forward or backward in time. No one of course can be really certain when that peak will occur, but the significant thing about all such number juggling is that it doesn't really make very much difference in the longer run. Last year the world consumed about 21 billion barrels of oil. Even at a highly implausible world oil demand growth rate of only 2 percent annually (it averaged 7 1/2 percent in the 13 years before the oil embargo) by the end of this century consumption would have risen to more than 34 billion barrels per

year and in the intervening years some 600 billion additional barrels would have been consumed. The world would have reached a point where merely sustaining annual consumption with no further increase would require discovery of 34 billion barrels of new reserves per year from a steadily shrinking "undiscovered" resource by then down to less than 500 billion barrels. In short, even a minuscule 2 percent growth rate will be almost certain to result in the peaking of world oil supply within 24 years.

What are the more valid and less comforting probabilities? The explosion in world economic growth in the 1950's and the 1960's was, as I have said, largely fueled by oil. Up to 1940 oil consumption had approximately doubled in each decade since 1890, but until the post-war years the quantities involved were small. By the 1960's however, exponential growth in oil supply finally made its impression on the world energy scene. Between 1960 and 1975 total world energy consumption doubled - but oil consumption grew by 162 percent in that period and provided 70% of the additional energy that fueled the world's economic growth. And natural gas, which has a smaller potential resource base than oil, contributed much of the remaining growth. I know of no one who believes that return of such energy demand growth rates are likely in the future, or could be sustained for as much as a decade if they did occur. But, as I have attempted to show, almost any reasonable rate of economic expansion which continues to depend predominantly on oil is destined for a very short life-span indeed.

If we look at a national world oil demand growth rate of 5.5 percent per year, a theoretical supply/demand imbalance

would occur no later than 1990, and probably sooner. In the real world however I believe a 5.5 percent growth would find oil supply peaking out no later than 1985, not because of physical production limitations but because there is little likelihood that either the oil producing nations or the consumers will invest the huge amounts of capital needed to produce, refine and distribute the theoretical peak capacity of 40 billion barrels of oil per year once it becomes clear to all that 40 billion is the peak and can be sustained for only a year or two. Facilities which require a decade or more to amortize will not be built, in my opinion, to handle peak theoretical capacities for a few brief years. It seems most likely therefore that at a 5.5 percent growth rate, expansion of production and processing capacity would begin to slow in the early 1980's and put an effective cap on the world's use of oil in the mid-1980's, several years before theoretical physical capacity would be reached. The result would be an earlier, but more sustained peak, without the sharp rise and decline which would characterize the attainment of full physical capacity to produce.

The peaking of world oil production, whenever it occurs, must be accompanied by the growing availability of other energy resources to meet continued need for ever larger energy supplies to fuel continued world economic expansion. Soon thereafter, these alternate resources must take on the added mission of replacing a declining oil supply, as well as providing for continued overall economic growth. Some idea of the magnitude of that undertaking can be gained when one realizes that the 2 percent energy consumption growth rate which is the U.S. goal for 1985, would if applied to the entire

world energy requirement estimated for that year, require an annual increase in the energy supply equivalent to more than half the coal already being mined each year in the United States or, expressed another way, twice the total nuclear power produced in the world in 1975.

If the United States and the world fail to come to grips with this problem and take the enormous and costly measures necessary to overcome it, the consequences truly promise to be catastrophic. In the absence of an expanding energy supply general world economic growth will cease. The underprivileged of the world will see their dreams of a better future disappear as their weak economies regress. The richer nations will continue for a time to get the oil they need, but at a prohibitive cost in money and disintegration of the world financial, economic and social orders. It is not inconceivable that international disorder may become endemic as oil-dependent nations, like addicts deprived of drugs, go to extreme lengths to obtain the oil they need. The dismal scene would become even more ominous if, as some now believe, the Soviet Union, too, becomes increasingly dependent on imported oil by the early 1980's.

Apart from the resource depletion threat posed to the world by overdependence on oil, there are other contingencies, perhaps of lesser magnitude, yet important enough to warrant serious attention. We are all aware of the possibility of a renewed oil embargo, which would be far more serious today than was the one in 1973, because of our far greater dependence on imported oil. That possibility will be with us for a long time, for even if we are successful in bringing alternative fuels on line as the oil supply peaks and wanes, we will still be importing very sizeable quantities

of oil, probably through the balance of this century. Our NATO allies and other free world nations, already far more dependent on imported oil than we, and lacking our alternative coal and shale oil, will remain heavily dependent on imported oil as long as it remains available in any meaningful quantity.

During the remaining years of the world oil era then, we must continue to anticipate and plan for potential political and economic interruptions of oil supply. There is yet another threat which has not been given the same degree of attention. For, in the event of some future confrontation or war the Soviet Union might be able to restrict access of the Western world to essential oil supplies to a degree of severity and duration greater than any embargo by the oil producing states. In a statement to the House Ad Hoc Committee on Energy in May 1977 the Secretary of Defense said, "The USSR might attempt to deny access to the oil of the Persian Gulf by direct attack on the facilities of the major oil loading ports which lie near to Soviet territory." That possibility takes on added significance when we contemplate that well over 60 percent of all free world oil reserves lie in a narrow arc around the Persian Gulf, within 900 miles of the nearest Soviet territory.

To guard against the possibility of major oil supply interdictions during the years in which we will be attempting to move through transition from an oil-based economy, the free world in general and the United States in particular must develop insurance policies. These will be in the form of strategic oil reserves designed to absorb the shock of large interruptions in imports for extensive periods of time, in which the root causes of the interruption,

whether political, economic or military, can be dealt with. Many of the industrialized nations already have large and growing oil stockpiles and we too are now building a one billion barrel reserve. Such reserves are very expensive. Ours will cost, in one way or another, something like \$15 billion by the time it is complete. But good insurance is always expensive, and the strategic reserve will, just by its existence, mitigate temptations to tamper with the world oil supply. In the actual event of supply interruption the strategic reserve will buy time for measured response, avoiding the need to take hasty and perhaps ill-conceived actions, or on the other hand ruling out the possibility that our freedom of action might be circumscribed by the threat to our economy.

The world energy situation is not a subject for pleasant or relaxed discussion. The tiny cloud, no bigger than a man's fist on the distant horizon, which caught the attention of only a few a decade ago, has now swelled to a vast storm looming almost directly overhead. Only the most optimistic (or foolhardy) can still believe that it will not strike - that it will somehow yet be diverted. We will ignore it at our grave peril.

Five years ago I wrote a public statement on this matter which said that the time remaining to deal with the energy problem was growing very short. It is five years shorter now, and in truth not much has been done outside of rhetoric and regulation. Had it not been for the Arab oil embargo, higher oil prices and the resultant temporary arresting of oil consumption growth in 1974 and 1975 we would now be several years closer than we are to the critical year when the developed world resource base will no longer be

capable of meeting the increasing demand for oil. The embargo gave us time - but we have taken but little advantage of it. In 1976, driven by a one million barrel per day increase in U.S. oil demand, world oil production rose 6 1/2 percent to an all time high of 57 million barrels per day. The world cannot stand many more years like that if it hopes to buy adequate time to resolve its energy problems. Time is very short indeed.

Carl Sagan, the noted astronomer at Cornell University has an article in the October Reader's Digest condensed from his book "The Dragons of Eden." He compressed the 15 billion year lifetime of the universe into a single year; January through December. Earth does not appear until mid September, dinosaurs emerge Christmas Eve; men and women emerge at 10:30p.m. New Year's Eve; all of recorded history occupies the last ten seconds; and the waning of the Middle Ages to the present occupies little more than one second. The article concludes - I'll quote - "yet, despite the insignificance of the instant we humans have so far occupied in cosmic time, it is clear that what happens on and near Earth at the beginning of the second cosmic year will depend very much on the scientific wisdom and the distinctly human sensitivity of mankind."