ENERGY AND THE ENVIRONMENT: A SECOND LOOK*

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For as long as most people can remember, the basis for our national energy policy was abundant low-cost energy. In the beginning, the country was self-sufficient; it enjoyed seemingly unlimited reserves of coal, oil, natural gas and hydroelectric power. After World War II, vast and easy to develop reserves of oil from Venezuela and the Middle East served as a yardstick to continue to hold prices down. Natural gas pipelines were constructed from the Gulf of Mexico and West Texas to the urban and industrial centers and the availability of that valuable fuel confirmed the nation's perception of limitless supplies. The result, which is now history, was that consumption increased at tremendous rates, doubling every ten years for natural gas and electricity and doubling every fifteen years for all energy. Coal development lagged and research in coal stagnated. The promise of unlimited clean energy from nuclear fission persuaded the country that coal was to all intents an obsolete fuel.

In a setting of energy abundance, patterns of energy consumption evolved that paid little or no regard to conserving the depletable resource. To mention just a few, the interstate highway system, which in turn led to the design of inefficient, oversized automobiles; dispersed living patterns, dependent on the private automobile for commutation and communication; the design of glass-walled poorly insulated buildings together with the expansion in the use of central air-conditioning; the shift from surface transportation to jet flying; and the introduction in new housing of electric space-heating.

The rapidity and scale with which energy development was being required to meet the ever-increasing demand, inevitably encroached on other values of the society. Conflicts with environmental interests — originally called preservationists — began to occur with greater and greater frequency in the 1960's. The first serious conflicts to become the subject of national debate were the threats posed to unique wilderness areas by dam builders, the Army Corps of Engineers and the U. S. Bureau of Reclamation. The most famous of these struggles was provoked by the proposal of the Bureau of Reclamation to build two hydroelectric dams, "cash-register dams," as the Bureau itself called them, in the Grand Canyon. There

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had been other projects, but none were as successful in mobilizing opposition as this one. Among other things, it brought the Sierra Club to national prominence and it politicized the environmental movement. It is typical in that this first generation of conflicts between environmentalists and energy developers was over specific locations. The effort focused on finding a mutually acceptable substitute, usually a different site, sometimes a different approach. Increasing pressure caused by the high growth rate soon exhausted the number of viable alternatives, and the issue necessarily became the more underlying one: the high rate of growth itself.

At the height of the Grand Canyon debate, the Sierra Club proposed strip-mined coal in the Southwest as a preferred alternative to the dams in the Canyon. Just at that time, however, the Four Corners Power Plant, in northwestern New Mexico, went into full operation, emitting its now famous cloud of black smoke visible for miles around, into the pristine desert sky. When, soon thereafter, plans were proposed to develop an additional 30,000 megawatts of electric generating capacity in the southwest, all fueled by locally-mined coal, a major national debate ensued. The concern prompted a study by The Department of the Interior that made clear that no satisfactory supply alternative for the coal development existed.[1] In fact, less than one year later, an additional 60,000 megawatts of coal-fired electric generating equipment was being proposed for the Northern Great Plains.

The issue was clearly not one of siting, but whether indeed the environmental consequences were worth the power benefits. The question of demand itself had to be broached, and this in turn meant reassessing the way in which prices for energy were set since it now seemed probable that much of the energy-growth was due to the low price.

The first major warning signs that there was going to be a shortage in supply come from the declining natural gas reserve-to-production ratio. The gas industry needed higher prices to justify the investment in exploration for new reserves, but Federal Power Commission under pressure from consumers kept the price so low that our most valuable fuel was and still is — paradoxically — our cheapest; therefore it was not husbanded as it would have been had it been priced at its true market value. Unable to obtain the supplies they needed, users were forced to seek substitutes, and they turned for the most part to oil, boosting the demand beyond what

[1] *Southwest Energy Study. An Evaluation of Coal-Fired Electric Power Generation in the Southwest.* Summary Report U. S. Department of the Interior, Washington. D.C. November 1972.

the traditional sources of supply could satisfy. The result was that from the late sixties on we were importing an ever-increasing percentage of our oil needs either directly or indirectly via European refiners who, in turn, imported from the Middle East. In fact, virtually the entire growth in United States energy demand, since 1970, has been met from Middle Eastern oil.

Historically, imported oil was so cheap that the domestic industry needed protection in the form of import quotas. The gasoline shortage of the summer of 1972 (prior to the Embargo) was the first real disruption of the historic pattern of abundant supplies. That summer the big debate in Congress was over the Alaska pipeline and what enviromental protection should be afforded the Alaskan wilderness. The shortages of that summer raised sufficient political pressure that the Congress approved the pipeline. All the while, projections by government and industry showed demand continuing to rise at historic rates through the remainder of the century and imports in excess of 50% of our total needs (all from Middle East Sources) were being officially predicted. It was assumed that the price would gradually rise to between $4 and $5 per barrel by the mid-1980's. Within a year of these projections, the price of oil was $12 per barrel and likely to go even higher, and the President was proclaiming that the country would be energy self-sufficient by 1980.

The focus of Project Independence was originally almost entirely on increasing energy supplies from domestic sources, primarily coal and nuclear. However, it soon became apparent that without reducing the growth in energy demand, the goal of national self-sufficiency was simply unattainable. The nation appears to have given up its earlier confidence that a technical solution could be found in time to enable the consumption to continue on its former course. Thus, it has taken a while longer for the advantages of conservation to be accepted but it now appears as though a reduction in the rate of growth, perhaps even an absolute reduction in energy consumption, is considered a serious option. As part of this shift, attention is now being given to alternatives such as solar and other natural energy sources.

In its search for energy independence, the United States is caught in a classic double bind. On the one hand, the high international price for oil is considered a prime cause of the country's economic problems, inflation and unemployment; and pressure is being placed on the oil producing and exporting countries, OPEC, to lower prices. This, to date, has been unsuccessful and prospects are not improving. On the other hand, it is only with the assurance of continued *high* prices that the domestic alternatives can hope to become economically viable. Though a reduction in price would give us a short-term benefit, it would, at the same time, render the energy alternatives such as coal liquefaction and oil shale economically infeasible. It is now certain that if OPEC were to reduce its price to us, our response would have to be to counter the reduction through an import duty. OPEC is aware of this and is therefore unlikely to lower its prices. In fact, the very imposition of an import tax would indicate to OPEC that it can afford to raise the price even further, since U.S. consumers are obviously willing to pay even more. This is precisely the action they are talking in response to President Ford's $3 per barrel import tax, their reasoning being that *they* should be the beneficiaries of any surplus revenues to be had.

All the energy alternatives available to the country are capital intensive which means that investors will have to commit large sums of money well in advance of receiving any income, and naturally enough, investors require some form of assurance that there be a reasonable likelihood of eventually recouping their money and that the rate of return be commensurate with the earnings they could have had by investing elsewhere in the economy. A classic example of this appeared recently when on the same day that OPEC announced that it was considering a reduction in the price of oil, Colony Oil Shale Company, the firm with the most experience in the oil shale venture, announced that it was withdrawing from its previously planned $400 million oil shale program. The company was obviously unwilling to take the risk. The linkage between these two items on that one day is obvious. Not only oil shale but also the development of tar sands, oil from coal, and coal gassification, are all extremely capital intensive, and the investors need some form of guarantee similar to that normally given public utilities that they will receive a fair return on their investment over its useful life.

In addition to the risk of low-priced foreign competition, these technologies have yet to prove themselves even at the prototype stage. The technical and economic difficulties are far from resolved. A coal-gassification plant, being built in northern New Mexico, was originally projected to produce gas for 90¢ per thousand cubic feet, but by the time construction was underway, this had risen to $1.40, and the most recent figure of $2.40 has put the project in jeopardy. Similarly, at a time when foreign oil was $2 per barrel, it was said that oil shale could be produced for $7 per barrel. Now, with the world price of oil at $12 a barrel, oil from shale is being projected for near $20 per barrel. The nuclear power program has also been plagued by inflation and technical uncertainties. The fast-breeder reactor, our major national research effort for the past several years, is now being reassessed, the costs having climbed from an original $600 million for the first 500 megawatt prototype to over $1.8 billion, at the last count.

Capturing natural energy sources will also require capital intensive equipment, and it is a fallacy to reason that solar energy, for example, will be "free." Capital is a resource of limited availability just as much as oil or coal. Because of the capital cost, it is likely that solar-heated homes will be at least as well insulated as all-electric homes, otherwise the cost for the solar collector and the energy storage facilities will raise the total cost unreasonably. Nevertheless, for space heating and cooling, solar energy appears to be one of the most attractive options open to us. Granted there are technical problems to be overcome, in particular reducing the installed cost of the components; nevertheless these problems are nowhere near as complex as the fast-breeder reactor.

Until now, the argument in favor of conservation has been countered by the hope that technical solutions — the "tech-fix" — might be available in time to permit growth to continue. Such solutions have for the most part been oversold by eager proponents, usually the researchers and industrial organizations most directly involved. Over-selling takes the form of playing down any technical and environmental uncertainties, foreshortening of the lead-time to commercial use, and the underestimating of development and deployment costs. The "Plowshare Program" of the Atomic Energy Commission, the peaceful uses of nuclear explosives, was supposed to yield at least one trillion cubic feet of natural gas annually (or 5% of the nation's requirements), starting in 1977, by using underground nuclear explosions to shatter gas-bearing strata. This program was shelved within two years of this promise. A combination of poor yields in the three experiments conducted and mounting public resistance to the widespread use of nuclear explosives led to its elimination from the 1975 energy budget. Another example, for which a commercial prototype is promised by 1981 and full commercial deployment by 1985 is the OTEC (Ocean-Thermal-Energy-Conversion) scheme, which would utilize the temperature difference between the warm surface waters of the ocean and the cold depths 1,000 feet beneath the surface to drive a turbine, using ammonia or propane as the working fluid. The principle is tantilizingly attractive because of the vast quantity of energy potentially available. In the tropics, the ocean surface serves as a giant solar collector, while the cold depths are fed by water from the artic. Further investigation, however, reveals a number of problems: the very low overall efficiency of such a machine, of the order of 2-3% net; the problem of mooring or locating the device in deep water; and the problem of moving the power from its ocean generating site to the national network. Further, the scale of the heat-exchanger is far greater than any ever designed before, and its sensitivity to any degradation in thermal conductivity caused by the growth of marine organisms, poses unique problems which should temper some of the optimism for imminent deployment.

In sum, the problems with the supply and the probability that it will be increasingly difficult if not impossible to meet the projected growth, makes it important to take a hard look at the way in which energy is being used and the potential impact of conservation. Conservation will take two forms: the one involves a technical shift in the way in which energy is used through redesign and improvements in equipment and buildings. This will of course involve the expenditure of capital in order to accomplish reductions in operating costs. Building insulation, more efficient furnaces and solar collectors would fall into this category. The other form of conservation requires more basic social adjustments, such as the use of mass transit, less motorized recreation and a revamping of pricing structures for energy, especially electric and natural gas rates, to eliminate consumption incentives and to reward thrift.

It is probable that the long-term potential for conservation will be far more significant than acknowledged up to now and that a more modest energy appetite may be beneficial both for the economy, the environment and for the national goal of energy independence.