Oil: the omnipotent energy source

Between now and 1985, an adequate petroleum supply will be the 'hinge of fate' for the U.S. economy

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As early as 1970, Libyan President Muammar el-Qaddafi threatened to withhold oil from the U.S. in order to punish the U.S. Government for its Middle East policy. For some time, it has been apparent to Qaddafi that the future of the Middle East might be drastically altered in favor of the Arab states if only the oil-producing nations would unite behind a concerted policy tantamount to economic blackmail of the United States.

Until recently, however, there was no indication that Saudi Arabia, long the most conservative of the Arab governments and, significantly, the oil-richest of the Arab states, would participate in such a policy. Then, in an interview given in April in the U.S., the Saudi Arabian Minister of Petroleum Affairs, Sheik Ahmed Zaki al-Yamani said in no uncertain terms, "We are in the 'driver's' seat and can dictate prices; further, we shall become richer than ever before." Since his government is already accumulating revenues at the rate of $2.3 billion a year from its oil exports, it was no empty threat when he further warned that Saudi Arabia might not increase oil production "unless there was a change in the political climate."

Whether oil will be used as a "weapon" or "club" to force a reappraisal by the U.S. of its attitudes and political relationships toward other nations, time alone will tell. But in Western Europe, and especially in France and Italy where there is a heavy dependence on oil imports from Libya and the Middle East, the situation has already influenced the political climate and has been reflected by increased shipments of military arms to Arab nations. As one European oil company official commented bitterly, "when a handful of Bedouins in Libya can, by withholding their oil, paralyze the economy of an industrialized European country such as Italy, that is an absurd situation—but it is also a reality."

And since that statement, what amounts to the first test case of a potential Arab monopoly was effected. In Beirut, Lebanon, on May 15, four Arab countries (Libya, Iraq, Kuwait, and Algeria) got together to announce a temporary halt of their westward oil flow as a symbolic protest against the continued Western approbation (as they see it) of Israel's existence. Although the stoppage was to last only one hour (Libya shut her pumps for 24 hours), the possible future significance of the tactic is clear.

Since 1960, the domination of the world's oil supply has been shifting from the affluent oil-consuming industrial nations to the "underdeveloped" oil-producing countries. Since 1970, this dramatic shift was accelerated as increasing nationalism and threats of expropriation of foreign oil interests in the Middle East have forced a 60–70 percent increase of oil prices to the consumer nations over the past three years.

In the U.S., since oil will be the predominant energy fuel during the next 12 years (in fact, the only fuel capable of meeting our escalating energy requirements), the potentially adverse effects of Middle East manipulation of the oil flow on the balance-of-payments deficit, alone, are staggering.

The wealth of the Middle East

Figure 1 is a map of the seven major oil-producing nations of the Middle East. The callouts contain the populations of these countries (all relatively small compared with the huge populations of the industrial oil-consuming nations), and their oil revenues reported as of 1972. The expected revenues for 1973 will show marked increases in these figures. The table contained in the illustration indicates the proven reserves of each country and the present production in millions of barrels per day. Saudi Arabia has, by far, the largest underground reserves—some 145 billion barrels—which represents more petroleum than is contained in the United States and Latin America combined. And the "desert Kingdom" probably has much more oil still to be discovered.

Although the present Saudi production is set at about 6 million barrels per day, this quantity could be pushed upward to 20 to 30 million barrels per day by 1980. And, oddly enough, the latter figures represent the projected import requirements of the U.S. and Japan (combined) as of that date.

The new order

The advantageous position of the Middle East's oil producers did not evolve overnight; slowly, but steadily, they are recovering control over their resources from Western nations. Historically, over the past 40 years, control was wielded by the major European and U.S. companies under long-term leasing concessions. Under the terms of these tradional concessions, the *companies* decided how much oil to produce, where it was to be sold, and for how much. Generally, the "host" government received a fixed royalty of about 12½ percent of the sale price, plus a tax that was set at about 50 percent of the net sales price (after the deduction of royalty and production costs).

It was almost predictable that such an arrangement would eventually lead to trouble—and it did, in 1960. Because oil supplies to the consuming nations were relatively plentiful at that time, small independent companies in the U.S. and elsewhere began a "price war" and sold petroleum products below the prices established by the major firms. The big companies reacted by also declaring a price reduction. Because the taxes of the Middle East nations were based on the posted prices, the price war resulted in a reduction of government revenues for the host countries. Although the producing nations protested the action, the foreign oil concessionaires insisted on their prerogative and right to set prices. The reaction to this was that Saudi Arabia, Iraq, Iran, Kuwait, and Venezuela established the Organization of Petroleum-Exporting Countries in 1960. At first, they tried to reinstate the 1960 posted prices, but their organization proved ineffective. It was not until the Arab-Israeli war of 1967, which resulted in the closing of the Suez Canal, that the bargaining position of the host nations improved.*

Thus, by 1969, the five-nation organization began a concerted attack on the concession system and established the right of the producing countries to fix prices and regain partial or full ownership of petroleum resources by means of participation agreements or expropriation.

Deep water or deep trouble?

The immediate problem confronting the U.S. is in part a matter of logistics; it must develop new oil sources, construct refineries within its continental borders, and establish conservation policies that will mitigate the coming crunch. But, at the present time, it does not seem likely that such a large order can be filled.

As of now, (for reasons indicated in our introductory article—see the May issue of *IEEE Spectrum*), not a single new oil refinery is being built in the U.S. But in addition to the lack of sufficient oil-refining capacity in the U.S., there is a major impediment that is blocking bulk imports of petroleum: lack of deep-water facilities. Since the closing of the Suez Canal in 1967, oil tankers have grown in size from about 50 000 deadweight tonnes to 250 000 tonnes (and Japanese builders are constructing vessels of up to 500 000 deadweight tonnes). Unfortunately, however, there is not one port in the U.S. that can accommodate a loaded tanker of more than 120 000 tonnes. (A proposed offshore loading facility off the coast of Maine has run into heavy flak from conservationists.)

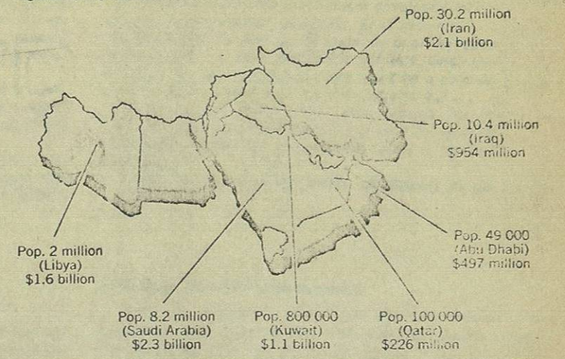
The cascading shortages

In the introductory article in the series (May), we discussed the dwindling supplies of petroleum distillate and natural gas that beset much of the U.S. heartland this past winter. Since that writing, we have been warned of an impending dearth of gasoline this summer, that those vacationing by automobile may be in for some unpleasant surprises at filling stations whose supplies are exhausted, and that gasoline rationing in some form may be the next unpalatable measure. Already many independent stations have been literally forced out of business. Meanwhile, automobile production and sales are at a record high, and the industry reports indicate that more than 9 million motor vehicles came off the assembly lines in the past year.

Furthermore, U.S. autos are getting less economical to operate, with more power options, higher horsepower, lower compression ratios (and hence decreased efficiency), while gas consumption in these outsized jalopies has increased markedly. So the day may not be far off when John Q. Public buys his gleaming Jazzmobile Super-8, with a $6000 price tag, and then finds he cannot fill his 30-gallon tank with that stuff

*The closing of the Suez Canal led to the construction of the "supertankers"—vessels of 200 000–500 000 deadweight tonnes—that bypass the canal and deliver many times the amounts of oil that could be carried in conventional smaller tankers. Thus, the value of the Suez Canal as a strategic waterway has been greatly diminished and, today, is largely obsolete; the supertankers are too large and too deep of draft to negotiate that waterway. Also, the 1967 war spurred the consideration of more pipelines directly to Mediterranean and Red Sea ports for trans-shipment by sea.

[1] Oil in the Middle East. In an area of relatively small populations, huge oil reserves are found. The oil production figures (in quantities and revenues) are based on 1972.



Oil production and reserves in area

	Millions of barrels a day	Proven reserves (in billions of barrels)
Saudi Arabia	6.0	145.0
Kuwait	3.3	66.0
Iran	5.0	55.5
Iraq	1.4	36.0
Libya	2.2	25.0
Abu Dhabi	1.0	18.9
Qatar	0.48	6.0

Keeping the 'energy' peace

Last February 8, Thornton F. Bradshaw, president of the Atlantic Richfield Company, presented his philosophy (under the title of the above subhead) on the energy crisis at the European Investment Seminar in Paris. The following are pertinent excerpts from his speech—

As inhabitants of . . . earth, we face together a far broader challenge: how do we ensure a flow of vital energy, to all nations . . . without sowing the seeds of discord; without pitting producing nations against developing nations. I do believe that an inadequate flow of energy . . . can provide more discord among nations than all the ideological struggles of the past and present.

The supply of hydrocarbons—oil, gas, coal—is limited . . . and the hydrocarbon age . . . is finite in time [but] we are bound to hydrocarbons for the next 30 or 40 years.

The major deposits of hydrocarbons are concentrated in a few, relatively underdeveloped nations. The large industrialized nations, whose life depends upon a flow of hydrocarbons . . . do not have adequate sources of supply within their own borders.

The one exception to this imbalanced situation has been the United States. For many years, the U.S. was a surplus nation. Not only did it have oil to fuel the appetite of its industrial society—and the appetite has been voracious—but in times of crisis it was able to come to the support of other nations. The presence of surplus oil in the U.S. provided a balance of power which served to maintain an "energy peace." This is no longer so. The U.S. is now a "have not" nation in energy. It can no longer keep the energy peace. It must now queue up for energy supplies along with other industrialized nations . . .

In 1965, the U.S. consumed nearly 12 million barrels of oil a day; produced 9 million barrels; imported 2½ million barrels—and had 3 million barrels a day spare producing capacity.

In 1972, the U.S. consumed more than 16 million barrels a day; produced over 11 million barrels, and imported about 4½ million barrels a day. There was no spare capacity.

By 1985, we anticipate [the] U.S. demand will be more than 25 million barrels a day; productive capacity will be less than 12 million barrels, and we probably will be importing . . . 13 to 14 million barrels a day.

What happened? Have we run out of hydrocarbon resources? The answer is no, but we have run out of the ability to produce these resources now and for a significant span of time in the future . . .

Does this sound like a nation which has run out of energy resources? Not at all. It is a nation, however, which made a series of ad hoc policy decisions [that] has created an untenable situation—energy riches beneath the ground, energy poverty above the ground . . .

Environmental conflicts have delayed the building of refineries. Refineries are now operating near capacity, and there are none being built. Attempts have been made to build refineries on the East Coast of the U.S.; all have been blocked by action of environmentally oriented groups and by inadequate market prices. We estimate that seven new refineries will be needed on the East Coast by 1975. They will not be there.

There is a solution to all this, and I am hopeful that [it] will be forthcoming shortly. I am hopeful that the events of this past winter—the oil shortages in the U.S.; the actions of the Middle Eastern nations, which . . . will pass control of most of the world's oil to those nations during this decade; the realization of the . . . changed position of the U.S.; that all these things—will spur our government to create an effective national energy policy . . .

I recognize that the President has to call upon experts from all parts of the government to provide him with the material for an effective national energy policy. I have been carrying around the elements of such a policy in my head for a long time. If he wished to save time and expense he could call on me. This would be my energy policy:

1. Remove constraints from gas pricing. This would permit the price of [natural] gas to reflect its high value as a clean, attractive fuel. Such a price would discourage uneconomic use . . . [and] would also bring forth the risk capital . . . to search out and bring to the surface the 700 trillion cubic feet, which geologists say are waiting to be discovered.

2. Permit the price of crude oil and products to rise to the point that capital would . . . provide the means of finding and tapping the 100 billion barrels which still await us.

3. For many reasons of security and national economic interest, an energy policy should include incentives to prevent exporting refineries to offshore sites . . .

4. There should be a mechanism developed for resolving environmental conflicts. Environmental . . . points of view should be brought to bear on each major project . . . for a finite period of time. Once this process has run its course, there must be a mechanism for making a decision in the public interest . . .

5. An energy policy must also provide for increased long-range R&D directed at both the uses of hydrocarbons and the [alternative] forms of energy to come . . .

6. Get the North Slope crude oil flowing to the market . . . .

the British, quite logically, call "petrol."

The United States evolved into a superstate on a diet of inexpensive and bountiful indigenous energy resources, and nobody in the country (until recently) has winced at the fact that, with 6 percent of the world's population, his nation accounts for one third of the world's energy consumption. Unhappily, affluence, and the expectation of abundance in everything breed complacency and a taken-for-granted self assurance. Thus, a traumatic and near-term *future shock* will probably occur when the long-term Cadillac customer is suddenly informed that there will be hardly enough gas available for him to drive a VW, and that he *really* should rely more on mass transit.

Of supply, demand, and reserves

John G. McLean, chairman of Continental Oil Company and head of the National Petroleum Council contends that, in terms of supply, "the U.S. has basic energy materials to meet its needs—at present rates of consumption—for a minimum of 200 years." However, there is a quantum jump between exploiting potential reserves and what is currently available in fuels. Bridging that gap requires time, lots of money, and the development of new technologies. And that is the primary reason why the short-term projections (up to 1985) may not be quite as rosy as the administration has indicated.

In the presentation made to the National Petrole-

The U.S. energy outlook

John G. McLean, chairman and chief executive officer of Continental Oil Company, gave his views on the energy crisis at the World Affairs Council in Pittsburgh, Pa., on September 21, 1972. Some highlights from McLean's speech, entitled "The U.S. energy outlook," follow—

Let me begin with the facts. The U.S. energy problems lie primarily in the medium-term future through the mid-1980s. From a long-term standpoint our basic energy position is reasonably sound. Our country is liberally endowed with energy materials. To meet our long-term energy requirements, we have large potential resources of crude oil, natural gas, coal, uranium and shale oil. Based on recent estimates of the National Petroleum Council, we have:

- *Potentially recoverable oil reserves sufficient to meet present demands for more than 65 years.*
- *Potentially recoverable gas reserves sufficient to meet present demands for more than 50 years.*
- *Measured and indicated coal reserves . . . equivalent to nearly 300 years' supply.*
- *Potential uranium resources sufficient to meet our present total electric power needs for 25 years.*
- *Recoverable shale oil reserves sufficient to meet our oil needs . . . for about 35 years after our natural oil reserves are exhausted.*

Taken in aggregate, our basic potential energy resources have a [thermal] content sufficient to meet our needs for at least 200 years, at present consumption rates. Long before the end of that period, advances in technology should bring us new energy sources, such as nuclear fusion and solar power [that] will greatly diminish the drain upon our . . . energy materials. As time goes along, additional supplies of energy will be forthcoming only at significantly higher costs, but nonetheless we have the basic materials and technology to meet our long-term energy goals.

In the medium term—through about 1985—our situation is quite different because if . . . we do not act wisely and promptly, we may [have] domestic energy shortages of major proportions . . .

The critical "balance wheel" in this whole situation will be the volume of foreign oil imports, because this will be the element which will adjust for our failures or successes in other energy areas . . . Most of the oil [must] come from the 11 Organization of Petroleum Exporting Countries (OPEC) . . .

Dependence upon a small number of distant foreign countries . . . suggests that we will need to take a new look at all our foreign policies with respect to the Middle East and attach to them a much higher priority than they have thus far been accorded . . . Our domestic economy will be vitally dependent upon peace in that troubled area . . .

Our growing requirements for oil and gas imports provide a large and growing deficit in the United States balance of trade in fuels. By the early 1980s, this deficit could be in the $20 to $30 billion range, as compared [with] a current deficit of less than $3 billion.

To pay for our imports of fuel, we will need . . . additional exports of other goods and services . . . What will we sell and to whom? . . . The industrialized countries of Western Europe and Japan . . . will be struggling to increase their own net exports to pay for growing fuel imports. Ultimately, the situation can come to equilibrium on a worldwide basis only when the oil exporting countries are able to absorb greatly increased imports from us and the other oil importing countries.

At the present time, the composite wholesale cost of energy consumed in the U.S. is about 35 cents per million BTUs. By 1985, it could easily be 50 to 100 percent higher . . . .

um Council by McLean and Warren B. Davis, director of economics, Gulf Oil Corporation, entitled "Guide to National Petroleum Council Report on United States Energy Outlook" (released on December 11, 1972), the first paragraph is intriguing:

"The National Petroleum Council's studies reveal that U.S. requirements for energy will approximately double between now and 1985. During this period, we shall have to rely upon oil, gas, coal, and nuclear power to meet over 95 percent of our requirements. New domestic supplies of these four basic energy sources are not being developed fast enough to meet our needs."

In its summary, the report lists three options:

- The U.S. could depend upon increased overseas imports of oil and gas to meet national requirements; but this would impair national security and trigger an awesome deficit in our balance of trade in fuels.
- Through imposed restrictions, the U.S. could reduce the growth in energy consumption and demand the more efficient use of energy. But such impositions could impair the nation's life style and trigger an even more onerous deficit in its balance of trade in fuels.
- The U.S. can accelerate the development of its domestic energy resources. (This option is strongly recommended by the council.)

The thrust of the NPC's summary, however, may be found in the observation: "Fortunately, [the U.S. has] an adequate energy resource base. Action taken now would markedly improve [its] energy situation in future years. To attract the vast capital requirements to develop [its] indigenous resources, [the U.S.] will need higher prices and appropriate national energy policies."

Some NPC remedies. The council's summary concludes with a nine-point list of recommendations urging

1. Coordination of energy policies at the national level.
2. Development of realistic, graduated approaches to environmental goals.
3. Accelerated leasing of federal lands for exploration—particularly the outer continental shelf.
4. Continuation of tax incentives to encourage the finding and development of all energy supplies.
5. Maintenance of oil and uranium import controls.
6. Greater usage of electricity generated from domestic coal and uranium.
7. Relaxation of wellhead price controls so that natural gas prices may reach a competitive market level.
8. Expanded research in certain carefully selected areas (alternative methods of electrical generation, for example).
9. Reliance upon private enterprise as the best and lowest cost method of meeting energy needs.