PIRINC

Telephone: (212) 867-0052

Petroleum Industry Research Foundation, Inc.

122 EAST 42nd STREET

New York, N. Y. 10168

U.S. ENERGY-THE NEXT SEVEN YEARS

By

John H. Lichtblau, President

A Paper delivered at the
Fourth International Conference
"Oil and Money in the Eighties",
Sponsored by the International Herald Tribune
and The Oil Daily

London, December 8, 1983

In making a base line forecast of the energy sector of the U.S. economy to 1990 it is useful to start with the initial assumption that the sector will be essentially surprise-free during this period. This assumption does not necessarily reflect a low probability of major surprises but rather the definitional inability to forecast the type and magnitude of such surprises. The only comment I would like to make in this connection is that the two energy disruptions of the last ten years have created the assumption among some analysts and policy makers that we must expect such disruptions to occur again. Obviously, this is entirely possible. But one must also keep in mind that prior to 1973 the U.S. energy sector proceeded for several decades without any major disruption. The possibility that it will do so again over the next 7-8 years rather than repeat the disruptive scenarios of the 1973-80 period should not be dismissed as naive or unrealistic.

Let me begin my analysis with the broad conclusions we have reached: Between now and the early 1990's energy supplies will be available to the U.S. economy in sufficient quantities and at low enough prices not to put any constraint on "normal" economic growth. At the same time, energy prices will remain substantially higher relative to other goods and services than they were in the 1970's. Regarding supplies, the decline in U.S. dependence on energy imports which has been under way since 1978 will reverse itself throughout the remainder of the 1980's. Since U.S. energy exports will also increase during this period, the U.S. will be a substantially more important participant in world energy trade in 1990 than it is in 1983.

Now to our actual forecast. The underlying growth rate of the U.S. economy for the period under analysis (1983-1990) is expected to be around 3% annually. This is significantly, but not drastically, below the 3.9% growth rate of America's great boom period of 1965-1973 and it is well above the stagnant but apparently not intolerable 2% growth rate of the last 10 years (1973-83). It would also provide for a substantial per capita improvement since the U.S. population growth rate is expected to remain below 1%.

The key to our energy market forecast is of course the relationship between energy growth and GNP growth. Prior to 1973, as has been pointed out innumerable times, the ratio was slightly above 1. From 1973 to 1979 it was 0.32. Since then U.S. energy demand has been steadily declining, while the GNP this year will be somewhat higher than in 1979.

What the U.S. energy/GNP ratio will be during the next 7 years depends primarily on our assumptions for energy prices during this period. This in turn, depends chiefly on the world price of oil, since U.S. oil prices will be determined by foreign prices during this period. Similarly, the ceilings for U.S. gas prices and, to a lesser extent, coal prices will be set by the parity levels of these fuels with oil. Thus, the key to U.S. energy costs will continue to be foreign oil prices. This paper is not the appropriate place for a lengthy discussion of the factors which will determine these prices. We have done this in other studies. Briefly, our view is that over the next 2-3 years world oil prices will continue to decline in real dollar terms but not in nominal dollars. In the second half of the 1980's

prices will be approximately maintained in real dollars. Thus by 1990, real (1983) oil prices will be some 10% below this year's level. We are aware that this scenario has become the consensus view of forecasters. But while we share most forecasters' suspicion of consensus views, in this case we believe it represents a plausible price path from here to 1990, even if everyone else agrees.

Under this oil price assumption we expect the energy/GNP ratio for the period 1983-90 to be slightly higher than that of the period 1973-79: an 0.4% increase in primary energy will be required for each 1% increase in GNP. In part the higher ratio reflects the expected energy recovery in 1984-85 from the depressed level of 1983. In the second half of the 1980's the ratio is likely to fall again below 0.4. Aside from the cyclical recovery factor the energy/GNP ratio will be affected on the one hand by the assumed absence of any oil price shock during the 1980's and the fall in real energy prices during the next several years. On the other hand, energy conservation will continue because it will still be economically attractive, because most new energy consuming equipment is designed to use energy more efficiently than the existing equipment and because there is a general shift in U.S. industrial output from high-energy to low-energy products. The 8% increase over last year in U.S. industrial output during the period April - September 1983 without any accompanying increase in industrial energy consumption is indicative that these developments are continuing.

How will the various energy sources supply this volume by 1990? Paradoxically, the fastest growing energy source will be

the one most in trouble in the U.S. -- nuclear energy. Despite the cumulative effect of plant cancellations and construction delays, a conservative count puts the total capacity of operating plants in 1990 at somewhat above 100,000 megawatts, compared to 63,000 in 1983. Assuming a slight improvement in operating efficiency, nuclear power will generate 19-20% of total electricity in 1990, compared to 13% this year. A number of other industrial countries expect to have substantially higher shares of nuclear power generated electricity by then. The discrepancy between the U.S. and these countries is likely to increase during the 1990's as additional U.S. projects are cancelled. But for the next seven years the U.S. growth rate is more or less locked in under our surprise-free assumptions.

The second fastest growth will be registered by the U.S. coal industry. Total domestic coal demand (including non-fuel uses) is expected to rise at an annual rate of just under 3% during the next seven years. Over 80% of the growth will go to the electric power sector. Coal exports which dropped significantly this year, due partly to the return of Polish coal exports and partly to the depressed level of industrial activity in Europe, will rise again from next year on and should almost double to 135-140 million short tons by 1990.

The projected rapid increase in nuclear power and domestic coal demand will be due much more to the expected expansion in electric power generation than to any further displacement of oil and gas as power generating fuels. By contrast, in the last five years displacement was the main factor in the growth of coal and nuclear power. The growth rate in electric power generation is

expected to be more than twice that of total energy demand. Thus, the electrification of the energy sector will continue in the U.S., as it will in most other industrial countries. But oil and gas will not participate in this development.

Now let us turn to our own industry and look first at natural gas and then at oil. Briefly, we expect U.S. gas demand this year to decline substantially from last year to about 17 trillion cubic feet (TCF) and approximately remain there throughout the remainder of the 1980's. The reason for the levelling off is not physical supply constraints but commercial demand limitations at our assumed parity price with the appropriate oil product (mainly residual fuel oil). It should be pointed out in this connection that with gas moving towards parity with oil, U.S. gas prices have risen very steeply in the last 3 years, giving gas consumers added incentives to conserve.

The present domestic gas surplus which is estimated at 2-3 TCF will therefore not be eliminated by rising demand but only by declining supplies. We believe over the next few years supplies will indeed decline because gross reserve additions are likely to fall significantly below annual production levels. In all probability this has already been the case in 1983. In 1982 reserves were approximately maintained but only because production dropped by about 1.2 TCF. How fast the gas surplus will disappear depends on how fast and how far the reserve/production ratio will fall from its current level of about 10* (i.e., reserves equal 10 years of production). If the

*Excludes 26 TCF of North Slope Alaskan gas for which no delivery system exists or is contemplated in this decade.

first signs of a real decline in the reserve/production ratio should bring forth a substantial increase in gas drilling activities and a flurry of reserves purchases by pipeline companies, the surplus could stretch out to the late 1980's. But eventually the underlying decline in the replacement of conventional domestic gas reserves will end it.

This will not lead to another gas shortage, as in 1976-78, both because fuel oil should be readily available to meet any demand not supplied by domestic gas at fuel oil parity prices and because substantial additional volumes of gas can be readily imported from Canada. As to the first, it should be pointed out that almost half of the 10 TCF of gas used by industry and electric utilities in 1982 could have been replaced by alternate fuels -- primarily residual fuel oil -- on a relatively quick basis. Regarding Canadian gas, this year's exports to the U.S. of about 0.8 TCF are less than half of the export volume authorized by the Canadian government. Given the export underlifting of the last few years and probably also the next few years, Canadian gas exports to the U.S. could reach at least 1.5 TCF by the late 1980's and stay there until the early 1990's. By then, new export authorizations, based on new appraisals of Canadian reserves and future domestic requirements, could well raise exports above that level.

Currently, the bulk of Canadian gas exports is priced above fuel oil parity. But since Canadian domestic gas prices are kept substantially below parity by government controls, Canadian producers can be expected to prefer exporting their excess supplies at oil parity prices to keeping them in the ground for

eventual domestic sale at probably lower prices. Sooner or later the Canadian government is likely to permit exports on that basis. It is already moving in that direction.

Now let us look at our swing fuel, oil. U.S. oil demand peaked in 1978 and has dropped in every year since. This year's drop to 15.1 million B/D will be the smallest. In fact, since June oil demand has increased in every month, relative to last year. We therefore now expect demand in the second half of 1983 to be about 2% above the comparable 1982 level. This would be the first semi-annual increase in 5 years. Part of it is due to colder weather than last year in the 4th quarter, part of it to the general economic recovery and part of it to this year's decline in gasoline, heating and diesel oil prices. We expect the demand increase to continue in 1984 for the same general reasons. Beyond 1984 demand should level off in the 15.5-15.7 million B/D range and stay there to 1990. During that period growth in the demand for diesel fuel, jet fuel, petrochemical feedstocks and speciality products will be offset by declines in gasoline and heating oil. Residual fuel oil which dropped by 50% from 1978 to 1983 is expected to approximately maintain a demand level of 1.5-1.6 million B/D during the remainder of the 1980's. The reason for these trends are fairly obvious and have been under way for the past several years, except for the levelling off in residual fuel oil demand which would represent a trend change.

On the oil supply side, domestic crude production which, to the surprise of some forecasters, has maintained itself at the 8.6-8.7 million B/D level since 1978 can be expected to finally

start falling in the second half of the 1980's. The unrelieved annual decline in proved reserves since 1970 is bound to bring this about. Last year's 5.3% decline lowered the reserve/production ratio for crude oil to 9.4. Five years ago it was still 11.1.

Similarly, natural gas liquids (NGL) production which has been maintained at 1.5-1.6 million B/D in the last six years can be expected to start declining in line with domestic gas production of which it is a function. By 1990 U.S. crude and NGL production may be 0.8 milion B/D below this year's level of 10.2 million B/D.

The combination of a somewhat higher demand level in the second half of the 1980's and a lower domestic production level will of course require an increase in U.S. oil imports. This year's net import level of about 4 million B/D (excluding government purchases for the SPR) is the lowest in 12 years. From now on the trend will again be upwards. If next year's domestic production is fractionally lower and demand 0.5 million B/D higher, as we expect, imports should be up by 0.4-0.6 million B/D, depending on the change in inventory levels. By 1990 the net import level is likely to be in the 5.3-5.8 million B/D range, about where it was in 1975. This will of course increase our dependency on foreign oil. But since we are supposed to have a Strategic Petroleum Reserve of 750 million Bbls. by then -- enough to offset any likely oil import interruption for nearly a year -- and since oil's share in total U.S. energy supply will continue to shrink, the political and economic implications of

this new import dependency should be far less threatening than was the case in the 1970's.

TABLE I

PRIMARY ENERGY CONSUMPTION PER DOLLAR OF GNP 1973-1985

	ENERGY CONSUMPTION (Quadrillion BTU's)	GNP (Bil.1972 $'s)	ENERGY/GNP (000 BTU's Per $)
1973	74.5	1,254	59.4
1979	78.9	1,479	53.2
1981	73.9	1,514	48.8
1982	70.8	1,485	47.7
1983	70.4	1,535	45.9
1984	72.7	1,605	45.3
1985	73.9	1,669	44.3

TABLE II

U.S. ENERGY DEMAND BY PRIMARY SOURCE, 1973-1995

(MILLION B/D OIL EQUIVALENT)

	1973	1979	1982	1985	1990
Oil	17.3	18.5	15.3	15.7	15.6
Gas	11.2	10.3	9.2	8.7	8.5
Coal	6.6	7.5	7.6	8.7	9.8
Nuclear	0.5	1.3	1.5	2.0	3.0
Other	1.5	1.6	1.8	1.8	1.9
	37.1	39.2	35.4	36.7	38.6

(PERCENTAGE DISTRIBUTION)

Oil	46.6	47.2	43.2	42.8	40.4
Gas	30.2	26.3	26.0	23.7	22.0
Coal	17.9	19.1	21.5	23.7	25.4
Nuclear	1.3	3.3	4.2	5.4	7.8
Other	4.0	4.1	5.1	4.9	4.9
	100.0	100.0	100.0	100.0	100.0

NOTE: May not sum to totals owing to rounding.

TABLE III

U.S. PETROLEUM PRODUCTS DEMAND, 1978-1995

(MILLION BARRELS DAILY)

	1978	1982	1983	1985	1990
Motor Gasoline	7.4	6.5	6.6	6.4	5.8
Distillate Fuel Oil	3.4	2.7	2.7	2.9	3.1
Residual Fuel Oil	3.0	1.7	1.4	1.6	1.6
Aviation Fuels	1.1	1.0	1.0	1.1	1.2
Other	3.9	3.4	3.4	3.7	4.0
Total	18.8	15.3	15.1	15.7	15.6

TABLE IV

U.S. GAS BALANCES, 1981-1995

(Trillion Cubic Feet)

	1981	1982	1983	1985	1990
Demand (a)	19.40	18.00	17.04	17.13	16.76
Unacct. For Supply	0.50	0.47	0.46	0.46	0.43
Storage Additions	0.30	0.31	-0.30	-	-
Supply Sources:					
Marketed Production (b)	19.18	17.76	16.23	16.69	15.84
Net Imports	0.84	0.88	0.82	0.75	1.15
SNG, etc.	0.18	01.4	0.15	0.15	0.20
Total Supply	20.20	18.78	17.20	17.59	17.19

(a) Includes lease and plant fuel.

(b) After deducting extraction losses and non-hydrocarbon gases.

TABLE V

U.S. OIL BALANCE, 1982-1990

(Million B/D)

	1982	1983	1985	1990
Supplies				
Domestic Crude Oil	8.6	8.7	8.5	8.0
Domestic NGL	1.6	1.5	1.5	1.4
	10.2	10.2	10.0	9.4
Processing Gains and Other	0.6	0.7	0.7	0.7
Stock Changes	-0.1	-0.1	-	-
Total Supplies	10.9	11.0	10.7	10.1
Domestic Demand	15.3	15.1	15.7	15.6
Required Net Imports	4.4	4.1	5.0	5.5