working paper
department
of economics

"Security of Eastern
Hemisphere Fuel Supply"

by

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Number 6 -- December 1967

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Security of fuel supply for Europe, Japan, and the rest of the non-Communist Eastern Hemisphere (hereafter called "the Area") can be had, not only without additional cost, but at a large net saving. Indeed, the 1967 crisis will be a blessing if it forces a hard look at some facts that governments have not been able to recognize or act upon because of domestic political pressures and fixed positions.

I

What is the security problem? There have been two sudden reductions of supply ten years apart, and there can be more at any time on short notice. One way, these crises are like fires or accidents--we want assurance against being struck without warning. But assurance of fuel supply actually reduces the chances of "fire." For if the Area is secure, the threat to deprive it of fuel is empty, and the attempt is unlikely.

Supply was reduced by the Suez Canal closure, and the cost of being unprepared will not finally be paid for some years. But by 1969-70, the Canal will be only a minor instrument and its closure a minor nuisance, since large tankers will in any case be carrying most of the load, and west-of-Suez productive capacity will be much increased. It was largely a happy accident. Contrary to the fable which will be agreed upon as future history, no statesman's foresight provided those tankers. On the contrary, they were built by Japanese (and Swedes) and bought by shipowners and oil companies for the sake of profit and in the teeth of accusations of unfair competition and unpatriotic conduct. The shipbuilding capacity is in place, however, and the 1967 shut-down will keep it going harder and longer.

Our concern now must be with production. The worst possible is a shutdown by the concerted action of all or nearly all producing countries. No single producing country matters. Even in 1951-54, Iraq, Kuwait, and Saudi Arabia moved quickly to fill the 35 percent gap left by the Iranian shutdown. In the winter of 1966-67, when the Syrians stopped the flow from Kirkuk in Iraq to the Mediterranean, there was not a ripple in the slightly changed flow pattern. Yet the loss of Iranian output was 250,000 barrels daily, that of northern Iraq nearly 900,000. It is a measure of the growth and maturation of the industry in the fifteen years' interval.

Loss of two of the Big Five of the Eastern Hemisphere (Iran, Iraq, Saudi Arabia, Kuwait, Lybia) would be at least a minor nuisance; three might be serious, at least for a year to eighteen months. Within that time, the lost capcity could if need be be replaced by the rest of the oil producing nations. But as it became apparent that the producing country was risking a permanent loss of its chief or only source of revenue, either the government would allow production to resume, or else it would be overthrown by those who wanted the revenue.

Hence the extreme of the security problem is clear enough: <u>be prepared for a total cessation for a limited period.</u>

II

Diversified supply of oil, and domestic coal production, have been the favored means to security, but diversification has been the accidental result of oil companies seeking oil. Policy had nothing to do with it. The widespread impression that the 1957 Suez crisis led to exploration in North and West Africa is not true; Nigeria had been explored for years, and its first major field had already been brought in.[1] Libya acreage had been taken up in 1955; and in Algeria two major fields (Hassi Messaoud and Edjele) had been found after decades of search and some minor finds dating back to 1918 in what was then French North Africa.[2] Diversification has been rather a disappointment, though not altogether useless. Of course it has helped to establish substantial new oil-producing countries since 1957, for the more such countries the harder to plan and enforce a total shutdown. But anything which makes cooperation likely, or non-conformity difficult, makes diversification less effective. The opening of great new areas in North Africa threatened to be no help and has been of limited help, since these areas joined in the temporary embargo, such as it was. The quarrel of one nation in the Middle East-North African area has a good chance of being the quarrel of all. The Libyan oil workers' union headquarters in Cairo delayed resumption elsewhere. Only the Nigerian shutdown could be called an unlucky accident, unrelated to the Middle East crisis. Venezuela, Iran, and Indonesia, unaffected by the embargo, are all oldtimers in oil. Any search for diversification due to the 1956-57 crisis, which would not otherwise have come about, has been a waste.

But while a new petroleum area may add to security once it has large-scale production, there is no advance assurance that any particular exploration effort in a new area, or even several taken together, will be anything but a dead loss. The odds are always against finding anything, and they are very long against finding anything worth finding. Hence the feverish discussion of crash exploration programs in new areas "to diversify supply sources" is foolish. If money is spent in new untried areas, it will probably be lost. On the other hand, if the exploration is in areas now producing, there may (possibly) be a commercial profit, but there can be no gain in security. And even the improbable combination of large new discoveries in new areas will not give any security until many years are past and the need may have passed. Oil exploration for security is precisely like a man trying to provide for his old age by going to the race track to wager his hard earned pay.

Another kind of diversification is altogether worthless: for a consuming country to import from more than one of the existing producing countries. Any sacrifice or higher cost incurred this way is a deadweight loss because it does not in the least diminish the threat of a concerted shutdown.

A nationally owned company (wholly or partly) like BP in Great Britain, or CFP or ERAP in France, or ENI in Italy cannot provide security of supply any more than a privately owned company. Indeed, it is a more tempting target. But public or private ownership is simply irrelevant to the chances of a concerted shutdown. Nor does a

private company owned by nationals of a given country make that country any more secure than if the company were owned by foreigners.

Unfortunately, in every security crisis a cry goes up to "diversify" within or without the established areas by subsidizing local companies to explore. Suppliers and contractors will be kept busy, and some private concerns will take long risks with public money. Some may become rich. Nobody else will gain.

But this is not quite the story--indeed it may be the lesser half. For there is a perfectly sincere belief, particularly in Continental Europe, that oil is somehow special. Oil is not a vulgar commodity like the others, but must be the stuff of high strategy and national policy. One must not be "at the mercy of the companies"--whatever that means--especially since they are huge companies, huge international companies, huge "Anglo-Saxon" companies. To many Continental Europeans this is the security problem. Their politeness in rarely saying this publicly has not served them well, nor anybody else. For if the fear were voiced and freely discussed, it would be seen to be groundless. "The companies" can only cut off or threaten or exploit a given country if they can act together as a unit. But even the loose cartel of the 1930's has been dead nearly thirty years; like John Brown's body, it is moldering in the grave, but the myth goes marching on. Like other delusions, it harms those who believe it.

Perhaps forty years ago or more the handful of Anglo-American companies who were then the international industry could have been used as the tool of British and American policy. Hence there may have been sense in laws like the French act of 1928. But to imagine the companies as tools of Anglo-American policy today is far-fetched. The producing countries would not permit it, and they have the physical force on the spot. Indeed, the Anglo-Americans were singled out during the brief 1967 boycott. Fear of "dependence on the oil companies" is just another distressing example of prejudice against big business, and against foreigners. Xenophobia is not only "wrong" but, like most prejudices, expensive.

III

Domestic coal production obviously gives permanent assurance of a part of the fuel supply, which is badly out of joint with the need of temporary assurance of all or nearly all its fuel supply. What is the price of this limited security? We can make some approximate calculations for Western Europe.

The cheapest grade of coal in the European Coal and Steel Community is priced about $16 per metric ton at the mine.[1] Subsidies come to over $5, so the total cost to the economy can be no less than $21.[2] A metric ton of fuel oil has nearly 1.5 times the heat value of a metric ton of coal, and hence would be no more or less expensive than if it cost $31.[3]

Since 1958, heavy fuel oil has been freely available at the Channel ports at about $12 per metric ton, varying perhaps 10 percent

up or down. Past mid-1966, up to the outbreak of war, it was steady
around $10.50.[1] The loss to the E.E.C. Countries' economy is $20-
$21 per metric ton of oil equivalent. British costs seem much low-
er, in the neighborhood of $14.75 per metric ton. Taken together,
the weighted average cost is $18.30 per ton, $27/ton oil equivalent,
and average loss to O.E.C.D. Europe is about $16.35/t.o.e.[2]

So bruising is this simple fact to so many commercial, polit-
ical, and intellectual egotisms that many ingenious explanations
are offered and eagerly accepted why oil prices are "abnormally"
and "temporarily" [sic!] low. By confusion over "marginal cost,"
the "depressed" prices are seriously ascribed to a surplus of refin-
ing capacity, which in fact was so chronically short of demand that
it doubled in the six years 1960-66. But truth like cheerfulness
will break through. The experts of the European Communities, who
in 1962 had projected a long-term value for heavy fuel oil of $18
per metric ton, revised it in early 1966--showing a commendable in-
dependence of spirit--to $12.50, thus wiping out most of the wishful
reckoning.[3]

To be sure, the coal cost is an aggregate or average. Some
mines cost much less than others to operate, and indeed the refus-
al of governments to let the whole range of cost be calculated and
published, their insistence on average costing and on prices to cov-
er average costs, deserves more attention than it has received. But
retrenchment is too little too late. Lord Robens of the British
National Coal Board is sufficient authority. His cheapest pits, he
avers, can produce at 3 pence per therm (35 cents per million btu)
or $14.50 per metric ton oil-equivalent. If we only give him more
time and much more money, he can some day produce much more coal at
this rock-bottom figure.[4] Unfortunately, it is many years since oil
was this high at the Channel ports.

In 1966 coal production in the O.E.C.D. countries of Europe was
about 212 million tons oil-equivalent, excluding coking coal.[5] Their
total replacement by oil would have saved $3.5 [£1.25] billion per
year. That was the dead weight loss to Western Europe.

The figure may seem too bad to be true. As a near-term projec-
tion, it is an underestimate. First, coal costs are increasing ev-
ery year. Second, heavy oil costs less in Southern Europe ($1 per
ton less in Italy). Third, if coal were phased out to be replaced
by oil, the price of oil would almost certainly decrease. For the
Middle East reserves are so vast that additional capacity can be cre-
ated to produce several times the current output, and at a cost so
low that it would be vastly profitable to do so.[6] Freedom by Euro-
pean buyers to buy in the cheapest market would send oil company
salesmen rushing to every electricity company as the first step in
expanding sales, and the resulting competition would send prices
down. The lessons of recent experience are plain: in those coun-
tries where trade in fuel is freest, and sales most buoyant, prices
are lowest.

Fourth and perhaps in the long run most important: the price

of coal is being used as a reference price or standard by which to judge new energy sources, such as nuclear power. In Britain, the Dungeness B power station will produce electric power, according to the original estimates, at $15.60 [£5.6] per metric ton oil-equivalent.[1] It is painful to see the near-euphoria which this produces among British observers who simply pay no attention to oil because it is excluded by hypothesis--it is some kind of odd stuff which, as everyone knows, sells at a temporarily abnormally low price. Late in 1966 the estimated Dungeness B cost was further increased.[2] Even looking beyond to the next generation of reactors, and assuming the best, Sir William Penney estimates that if the later A.G.R. stations perform as hoped for, generating costs will by the mid-1970's equate to fossil fuel at 2.25 d/therm [25.3 cents/mbtu], heavy fuel oil at $10.90, which is not even as good as what is available right now, and takes no account of advancing technology in fossil fuel use (which Sir William, like all observers, considers as very impressive in the recent past).[3] But with fictitious coal prices as a standard, huge amounts of scarce capital may be wasted on uneconomic nuclear power stations to match the near quarter of a billion dollars [£89 million] which the National Coal Board pours annually down holes in the ground.[4] The E.E.C. is even more wasteful because their coal is even more expensive.

Of course one cannot tolerate the abrupt dismissal of close to a million mine employees. Once this is understood, the whole problem of fuel cheapness and security is bathed in light: European coal production is no longer an industry, it is only a means of social insurance. Awkward and wasteful, it can be abolished to the immense gain of the miners themselves before anyone else. To see why, we should first reckon the costs of an adequate security program by stockpiling crude oil.

IV

The cheapest and best place to store crude oil is at the ocean terminals where it arrives. These are imposing enough today, but not compared with the terminals for supertankers of 300,000 tons, the first of which is going up at Bantry Bay in Ireland, others in Japan. Storage and oil to fill it should be provided at government expense, but for the sake of economy, private enterprise should manage the facilities and commingle oil freely with theirs. For additional capacity is a valuable right to an oil company. The reason in brief is that larger tankers are much cheaper than small ones, but require much more storage capacity ashore. The interval between tanker arrivals increases in strict proportion to the increased size of the ships. But the amount of inventory needed increases somewhat more than proportionately. In effect, many small tankers are a spreading of risk, and fewer large tankers a concentration. Therefore, if an oil company managing a given amount of oil in storage were permitted to draw upon the government stock within a range of, say, 10 percent, provided only that replacement was made within a short period, it might be worth their while to bid for the right to manage the inventory.

In any case, the operating storage cost would be very low, but the capital outlay on the facilities and of the oil to fill them would be heavy, and the annual expense would essentially be the interest on the capital employed. The writer's calculations of storage cost, made some years ago, seem to have been taken seriously by other observers,[1] but the new conditions have made them obsolete. Today storage facilities[2] can be provided at a big ocean terminal for about $1.25 per barrel. Oil can be purchased f.o.b. the Persian Gulf today by big credit-worthy buyers for less than $1.25 (the coincidence of the two figures is purely accidental, of course) and shipped, emphasizing the cheaper summer seasons, at 43 cents per barrel to Rotterdam and 37 cents to Marseille or Northern Italy. (Under the usual method of rate quotation, this would be INTAscale less 65 percent through Suez, less 67.5 around the Cape.) An average delivered cost to Europe would then be about $1.65, North and South taken together. There should be no undignified hassle over this price. The oil companies are selling for less to some buyers and realizing less from crude devoted to their refining-marketing operations. The value of a barrel of products sold in Europe, less marketing and refining costs (which must include a market rate of return on the capital employed) does not return them as much as $1.25 today.[3]

Thus the capital outlay needed to store a barrel is about $1.25 + $1.65 = $2.90. The notional interest rate should not be mere interest cost to the government, but rather the return that the funds would fetch in private industry. Or, what comes to the same thing, the burden should be reckoned as the amount that would be needed to pay the holders of debt securities and equity securities to advance the money to a private low-risk enterprise--including also that part of the profit enjoyed by government as tax receiver. By this standard, the 4.5 percent used to reckon atomic power projects in the United States, or coal in the United Kingdom, is nonsensical, and even the 7.5 percent used in the United Kingdom is too low. We will use 10 percent discount, and an allowance for the limited life of the facilities (25 years) would raise the effective annual capital charge to nearly 11 percent. Then the annual capital cost of storing a barrel of oil is 30 cents, and adding 5 cents for operating costs, the total is 35 cents. In other words, if we had to keep in stock a whole year's supply, the cost would be 35 cents per barrel; six months would cost half.

How many months' supply do we need? The French Minister of Industry in November 1966, estimated six months' because the economies of the producing nations could not support a longer shutdown.[4] If M. Marcellin meant that none of the supplying countries could hold out any longer, he was surely wrong; but if he meant that not all of them could hold out even that long and that the chain was as strong as the weakest link, he was right. The producing nations involved in the 1967 crisis never were able to close ranks even at the start, and their embargo began crumbling almost as soon as it began. Hence six months seems much longer than necessary, but it will serve as the upper end of the range. Six months' special storage costing 18 cents per barrel plus the normal commercial stock of about 45 days, plus at least one month by stretching the stock

through rationing, gives Europe nearly nine months.

The government of South Africa has had to make similar calcula-
tions, but their danger is of course much greater since they could
conceivably find both producing countries and consuming countries
lined up against them, and as a relatively small market, they could
not count on the producing nations being subject to unbearable pres-
sure because of lost revenues. There are no official estimates, but
the Rand Daily Mail of Johannesburg has reported that the government
was providing eighteen months' supply,[1] and I believe the report has
not been denied.

Although six months' inventory atop the normal two seems ade-
quate, we can backstop it very cheaply with two years' supply for
the electric power industry. Dual-firing is cheap to install when
going from coal to oil, but not the reverse. Henceforth all new
power stations should be oil, but as a security measure they should
either be made double-firing from the outset (as are coastal stations
in the United States and Scandinavia) or at least required to provide
the stoker space needed in case of a later conversion to dual-firing.
Coal production can then make a last contribution to the welfare of
Europe. The coal itself is costless, for it will in any case be pro-
duced as the industry is phased out. The problem is only the cheap-
est and least unsightly place to store it, taking due account of
where it will be eventually used. The electric power industry of
O.E.C.D. Europe used 153 million metric tons oil-equivalent in 1964,
or 240 million short tons of coal.[2] In the United States, ground
storage is provided, and profitably, for private companies at 15 cents
per short ton during the peak December-July period, with a movement in
and out; so 20 cents per short ton per year of dead storage seems more
than adequate.[3] Two years' supply under 1964 conditions would mean a
full year's supply in 1974 since the industry has been approximately
doubling every decade and would cost $96 million.

Thus Europe could be assured of from one to two years' electricity
supply and well over nine months' supply of oil (for some, though not
all, of the heavy fuel oil could be diverted to non-electricity con-
sumption, and to a significant extent the slack would be transmitted
to the lighter fuels) at an annual cost under 1965 conditions of about
$872 [£312] million. (This is 17.5 cents per barrel multiplied by
4.4 billion barrels of oil-equivalent of total oil and coal energy
used excluding coking coal and adding the $96 million for coal stor-
age.) Since the annual cost of supporting a superfluous coal indus-
try was in 1964 $3.5 [£1.25] billion, the substitution of adequate
security for inadequate security actually saves Europe $2.6 billion
[£9.30 million] per year.

If, as now seems more likely, only three months' special supply
need be stored, the cost would be $484 [£176] million and annual sav-
ings over $3 [£1.07] billion.

V

Once we turn from where we should be going to how to get there,

the academic researcher's knowledge runs into sharply diminishing returns. But three problems are worth a quick glance: the time period, the coal miners, and the balance of payments.

Even if storage for security were accepted tomorrow as a policy of objective, it would take at least a year to perfect actual programs, to find likely sites, etc. Indeed, the size of the stockpile would have to be carefully reckoned. The estimates made in this paper have taken no account, for example, of European natural gas as part of the energy supply. Yet within a short time it will not be negligible. It might also be worth a last effort to inquire into American coal, which would be only slightly more expensive to buy (and much cheaper to store) if the high United States railraod freight rate, discriminatory against export sales, were lowered. Chances of success do not look too good. The writer had occasion to warn, on the basis of data ending in 1963, that if the discrimination did not cease, steam coal exports to Western Europe would dwindle.[1] They have in fact dropped by over 30 percent in three years, at a time when total E.E.C. fuel consumption is up 11 percent.[2] But the official optimism about a big market for United States steam coal at only slightly less than current prices remains unshaken and based on the same comfortable illusion that oil prices are temporarily, abnormally low.

If it takes two to three years before plans are drawn up and storage built, no time is lost because it will take that long for prices to come back to mid-1967 levels. At the time of writing (beginning October 1967) there is no sign of an early reopening of the Suez Canal. Mr. George Brown was apparently unsuccessful in trying to get Norwegian support for his proposal to have clearing work done at the expense of the maritime nations, but with all receipts going to the United Arab Republic and taking no notice of the problem of the naviagation of Israeli ships in the Canal.[3]

Probably the Canal will some day be reopened under circumstances not foreseeable today. But its importance will be much less, and even the absolute volume of shipments may never regain the mid-1967 level. There has already been much silting, and a decrease in maximum permissible draft from 38 to 34 feet means that the largest ship acceptable drops from about 60,000 to abut 34,000 dead weight tons, which in view of the distribution of ship sizes is drastic indeed. Hence a new equilibrium must wait on the addition of enough large tankers (175,000 tons and upward) to round the Cape at total costs somewhat lower than the old Canal transit by smaller ships.

The time needed to perfect plans and build facilities could also be used for the redeployment of mine labor. By the end of 1967, Western European underground and surface workers taken together will number about 900,000,[4] and their average wage is around $2500 [₤893] per year. Hence, even to pay them all their current wages for their lifetime would cost about $2.2 billion [₤785 million] a year, leaving a clear economic gain, which would increase rapidly over time. In practice, coal employees age fifty-five and over would probably be retired forthwith on full salary, while younger men could be released with either current wages guaranteed for a

time ahead, or a lump-sum payment, so that either way they were sure of not losing out. Generosity should be the order of the day. Society benefits from changing these men from pensioners to productive workers and should therefore stand the costs of changing them. Of course I assume here a certain value judgment: that we owe certain duties to our fellow citizens as individuals or as families, but that we owe nothing to a corporate personality known as "the coal industry," and nothing more than thanks to those who, like Lord Robens, have tried their considerable and commendable best to do the impossible. Others will feel insulted at the proposal to put away "their" coal industry, but there is no arguing about tastes.

This brings us to the balance of payments. Getting rid of coal means a large addition to the import content of fuel. Furthermore, four months' supply, say, when Area fuel needs are about 14 million barrels daily, means 1.7 billion barrels of storage, costing, if my estimates are correct, nearly $5 [£1.79] billion. Import content of both oil supply and storage varies widely among nations. Only one general remark is in order.

The balance of payments can be considered as a short-term liquidity constraint, like the cash management of a private firm. Expenditures profitable to a business enterprise must either be postponed or else covered by special financing arrangements if the necessary funds are not otherwise available. But to refrain from profitable expenditures permanently because cash is not available immediately is the kind of ultra-conservatism which assures the death of the enterprise.

For a nation, the balance of payments may be regarded as not a temporary liquidity constraint but as a permanent policy objective: autarchy. It is an expensive luxury for rich countries, but not ruinous. However, given fixed exchange rates, it means permanent incurable foreign-exchange deficits. For if an economy is to accept expensive food, cement, energy, or what not, for the sake of saving foreign exchange, the level of domestic costs is so high that exports cannot find markets. The plight of underdeveloped countries, undone by their passion for import substitution, ought to serve as a warning to those more fortunate.

*   *   *   *   *

There is no dilemma of cheap versus secure fuel for Europe, nor for Japan, Australia, and other Asiatic nations. The only way to cheap and secure fuel is to stockpile oil and get rid of coal. The measurable economic gain is huge, but the non-economic gain is not to be despised: the end of a filthy scar on the landscape.

FOOTNOTES

Page	Note

1   1   In 1950 Iran output was 663 thousand b/d, or a total Middle East output of 1760, or 37.6 percent. See annual reviews, recently entitled "World Wide Oil," in the Oil and Gas Journal, and recently Oil and Gas International.

2   1   See the Oil and Gas Journal, December 26, 1966, p. 122, giving discovery dates of Nigerian fields, each one of which represented an effort of at least a few years, perhaps of many.

2   2   Oil and Gas Journal, December 31, 1956, p. 154, on the beginnings of Libyan exploration, and on Morocco, Algeria, and Gabon. There is also mention of an encouraging oil show in Nigeria, other than the discovery recorded in n. 2.

3   1   European Coal and Steel Community, 1967, Annual Report, Statistical Appendix, Table 13. Taxes are excluded; they range from 1 percent in Belgium to 11 percent in France. An average of prices weighted by total output in the various producing basins is $16.10.

3   2   E.C.S.C., Nouvelles Réflexions sur les Perspectives Energétiques de la Communauté-Européenne (1966), p. 21. These are largely supplementary labor costs. A weighted average (1966 Annual Report, Statistical Appendix, Table 2) is $5.11. Hence total average cost per ton is $16.10 + $5.11 = $21.21.

3   3   Conversion factors can only be approximate. Those used here are from Petroleum Press Service, giving fuel oil 18.3 and bituminous coal from 10.2 to 14.6 thousand btu/lb., we calculate with a middle value of 12.35. Then 18.30/12.35 = 1.48, and $21.21 x 1.48 = $31.40.

4   1   There is a variety of sources, the periodic reports being in Platt's Oilgram Price Service (New York) and Europa Ol-Telegramm (Hamburg). During the first half of 1967 it has been around $10.70 for barge lots; cargoes are about 25 cents cheaper. Hence $31.40 less $10.50 is $20.90. Moreover, the operating cost is somewhat less in burning oil than coal.

4   2   According to the National Board for Prices & Incomes, Report No. 12: Coal Prices (Cmd. 2919, 1966), total estimated colliery expenditure 1966-67 was Ł810 million plus Ł10 million for fixed asset replacement. Total debt was Ł960 million (p. 2); an interest charge of 7.5 percent is applied, rather than the official one of 4.8 percent, which means Ł73 million. Although interest is a fixed cost, it must be used as a proxy for the capital cost of maintaining a given rate of output. (The Prices & Income Board notes that electricity earns 6.75 percent, gas higher than 6 percent, and "industry generally" 12 to 14 percent. Surely the last figure is a closer approximation to the true drain on the British economy. However, we use the 7.5 percent of the United Kingdom Atomic Energy Authority as a conservative estimate of capital cost.)

Page	Note	

4   2
(cont.)

Total cost is then Ь893 million, which comes to Ь5.27 or $14.75/
ton for 170 million tons. E.E.C. plus U.K. production totals
380 million tons, averaging $17.30 per ton, or $27.05 per ton.
Subracting $10.70 gives $16.35. We take no account of the very
small production in other countries.

This estimate seems consistent with that of Turvey and Nobay,
in the Economic Journal, vol. 75 (December 1965), p. 792, of
coal sold "to industry" in 1964 at Ь5.8 [$16.25] per ton,
since a delivery charge is presumably included. (Sources and
methods are not explained.) Brechling and Surrey, "An Inter-
national Comparison of Production Techniques: The Coal-Fired
Electricity Generating Industry," National Institute Economic
Review, May 1966, p. 33, gives the 1963 average price of coal
delivered to generating plants as 42 pence [49 cents] per mill-
ion btu, a much better measure of price. Assuming 29 million
btu per long ton (12,400 btu/pound and 2240 pound tons), the
price per ton would be Ь5.02 [$14.05]. This again seems con-
sistent, since coal delivered to electric generating plants
would be expected to be cheaper than the average for all coal
at the mine.

4   3

Compare Nouvelles Réflexions (1966), p. 27, with the Etude sur
les Perspectives Energétiques à Long Terme de la Communauté
Européenne (1962), Ch. 9, Sec. 4. The Etude was reviewed in
the Economic Journal, vol. 74 (1964), by E. F. Schumacher,
identified only as living in London. He criticized projection
thirteen years ahead, to 1975: "These figures are not worth
the paper they are written on. They are a case of spurious
verisimilitude bordering on mendacity."

An article in the London Times (April 11, 1963), had predic-
ted thirty-seven years ahead, to A.D. 2000: a steeply rising
real cost or even physical shortage of fuel. The writer was
economic adviser to the National Coal Board, E. F. Schumacher.

4   4

Address to Coal Industry Society, March 6, 1967.

4   5

U.S. Bureau of Mines, International Coal Trade, May 1967, p. 17,
gives 398 million tons, or 269 million oil equivalent. Coking
coal consumption in 1964 was estimated by O.E.C.D., Energy Pol-
icy (1966), p. 32, at 65 million t.o.e., or 96 m.t.c.e., and
it has not changed appreciably since. Imports in 1966 were just
under 25 million metric tons, and if we assume that half was for
coking coal, then European production of coking coal (8 percent
or less) was about (96 less 12) 84 m.t.c.e. or 57 m.t.o.e.
Hence European coal produced for other than coke was in 1966
about 314 m.t.c.e. or 212 m.t.o.e. Reckoning at $16.35 per
m.t.o.e., this comes to $3.47 billion.

4   6

M. A. Adelman, "Oil Production Costs in Four Areas," 1966 Pro-
ceedings of the Council on Economics, A.I.M.E. (American Insti-
tute of Mining, Metallurgical and Petroleum Engineers); conveniently

Page	Note	

4   6   summarized in <u>Petroleum Press Service</u>, May 1966. Hereafter
(cont.)   cited as O.P.C.F.A.

5   1   Tentative estimates are presented in detail in my letter to
          <u>The Economist</u>, July 17, 1965, p. 272. Revised estimates based
          on C.E.G.B. data were presented to the Tokyo meeting of the
          World Power Congress in October 1966 (publication forthcoming).

5   2   Testimony presented to the Select Committee on Science and Tech-
          nology in March 1967 by Mr. Brown; the calculations are as of
          September 1966.

5   3   Sir William Penney, <u>Nuclear Power</u> (the Citrine Lecture 1967),
          pp. 8-9.

5   4   During 1960-65, N.C.B. expenditures were Ŀ532 ($1490) million,
          Ŀ89 ($242) million annually; specific colliery expenditure was Ŀ462
          ($1295) million, Ŀ77 ($216) million annually. But even non-colliery
          expenditures are for coal products. Hence the total is coal in-
          vestment, and totally wasteful.

6   1   "The World Oil Outlook," in <u>National Resources and Economic Devel-
          opment</u>, ed., Marion Clawson (John Hopkins Press for Resources for
          the Future, 1964), pp. 121-23. Cited in <u>P.E.P.</u>, <u>A Fuel Policy
          for Britain</u> (1965?), p. 183.

6   2   Compare the $1.27/barrel at Kharg Island in Iran (OPCFA). Con-
          struction costs at Bantry would be lower, land costs higher.
          The first Japanese central terminal system will include stor-
          age facilities for three million tons (22.2 million barrels).
          The cost of the entire project, including sea berths, docks,
          pumps, etc., is estimated at $32.2 [Ŀ11.5] million, or $1.45
          [Ŀ0.518] per barrel. <u>Zosen</u>, August 1967, p. 18. Clearly a
          doubling or more of storage alone would cost only a fraction of
          the average cost of the whole operation. Hence our investment
          figure may be much too high.

6   3   The detailed evidence is in a study now in preparation, well in-
          formed persons in the trade will not (privately) contradict the
          statement.

6   4   République Française, Assemblée Nationale, 2c Séance du novem-
          bre 1966, p. 4321.

7   1   <u>Rand Daily Mail</u> (Johannesburg), August 24, 1966, p. 1.

7   2   In 1965 (later figures not available) O.E.C.D. Europe consumed
          918.4 m.t.c.e. non-coking coal plus oil. Bureau of Mines, <u>Inter-
          national Coal Trade</u>, February 1967, p. 15. Conversion of the
          total to oil is on the basis of equivalence of coal to crude oil,
          not fuel oil; but using the same source and method as in note 6
          to p. 4, the proportion is a barrel of oil of 34° gravity equal
          to 0.207 metric tons of coal, hence 4.44 billion barrels.

Page	Note

7   3   Interstate Commerce Commission Tariff 1355-A, Bessemer & Lake
Erie R.R. That the operation is profitable is shown by the
later expansion of the original facilites, and by another rail-
road setting up a similar installation. Another terminal was
announced early in 1967, with initial capacity of 1.2 million
and ultimate capacity of 4.5 million short tons, costing $5.75
[₤2.05] million. N.C.P.C. Newsletter, February 2, 1967, p. 4.
Hence the capacity cost per ton lies between $2.85 [₤1.02] and
$1.28 [₤0.46] but much nearer the smaller figure. At 11 percent
capital charge, the cost would be about 14 cents [1 shilling]
per short ton per year, which is consistent with the other esti-
mates. Capital and operating costs would be lower for dead
storage, but these are at best first approximations.

8   1   M. A. Adelman, "American Coal in Western Europe," Journal of
Industrial Economics, vol. 14, 1966.

8   2   For exports of steam coal, see International Coal Trade, July
1967, p. 6. For total Community consumption see Annual Reports:
1964, p. 60, 1967, p. 65.

8   3   Journal de la Marine Marchande, 31 August 1967, p. 1931.

8   4   According to the Colliery Guardian (London), January 20, 1967,
U.K. coal manpower fell from 510,556 end-1963 to 446,788 end-
1965 and 413,667 end-1966. The annual decline rate over the
three years was thus 7 percent, in 1966, 7.5 percent. The Re-
port of the National Board for Prices and Income, op.cit., ex-
pects an increasing loss rate (p. 6), and the end-1966 employ-
ment noted above is lower than their estimate. Hence to sub-
tract 7 additional percent for an end-1967 estimate of 385,000
seems conservative.

The attentive reader will have noticed that British labor re-
quirements per ton are much higher than E.C.S.C., yet prices
are much lower. This anomaly might repay further study.

According to the Annual Reports of the European Coal and Steel
Community, the 1963-66 decline (as of end-September) averaged
5.6 percent per year, but was down 11 percent in 1965-66 alone
(1967, tab. 42). From the first half of 1966 to that of 1967,
the decline in underground workers was 13.5 percent. (Internat-
ional Coal Trade, August 1967, p. 9.) Projecting the September
1966 figure forward by fifteen months at that rate comes to 525
thousand. Added to the British total, this is 910 thousand for
all Western Europe.

The highest-paid workers in the E.C.S.C. coal mines receive re-
spectively $2640, $2900, $2800, in Germany, Belgium, and France,
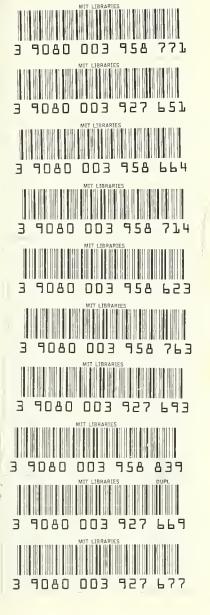respectively. E.C.S.C. 1967 Annual Report, tab. 53.

Date Due