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## NOTES ON AGENDA ITEMS

presented by  
M.A. Adelman

General Comments

1. All concerned with petroleum, whether in public or private enterprise or government and whether regarding it as producers or consumers, must forecast and live in the future. Significant decisions on production, refining, transport and use, such as electricity, transport, or petrochemicals, must deal with expected variables rather than present ones. In particular, attention needs to be paid to the determinants of output and prices over the next 15 or at most 20 years. Beyond that point, forecasts are not useful. Discounting at only 8 per cent, the value of a good decision (or the penalty of a bad one) twenty years hence is only 1/5 what it is today. And 8 per cent is a very low allowance or discount rate. For discounting reflects more than the cost of money and the chance to reinvest it in the interval; whether in money-making enterprises or in schools or other public projects makes no difference to the greater value sooner rather than later. To an equal or even larger extent a discount rate reflects the uncertainty of our expectations, especially because of the changes which technology will bring about. Hence excessively long prediction periods are a vain presumption. Or else they are a pathetic unwilling recognition that the policy one urges is useless or pernicious. For example, if coal in western Europe were needed 20 years hence - it certainly is not needed today - it would be cheaper to shut down the mines forthwith and then start digging them again 20 years hence, assuming that in fact they ever would be needed which they probably would not.

2. A decision must be based on some reference price of petroleum and competing products. Price is the decisive variable because it sums up all the forces in any market: demand, supply, and the degree of control or monopoly. A government which considers launching its own program of finding,

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developing, and producing oil; or building a nuclear reactor; or building a hydro-electric system, etc., must consider the cost of obtaining energy through its new program as against the cost of obtaining it through imports. A rational policy must explicitly consider expected prices. This is not easy. Even the current price may be difficult to find. The future price can only be guessed with considerable margin for error. Where a nation has an over-valued currency, the cost of imports in foreign exchange must be adjusted to estimate the true costs to the economy. Even above this "shadow" or true cost, there may be a premium for domestic production in order to substitute for imports. For example, the establishment of a new energy-producing industry may serve to educate its personnel, or confer some other incidental benefits. These supposed gains are usually illusory, but in any given instance may be real; if so, they should be estimated. Furthermore, capital may be offered for such an industry which cannot be obtained for any other purpose, at least not as cheaply. The value of this accommodation must also be reduced to terms of unit cost. Premia need also to be stated and set down explicitly. Some kind of ceiling must be calculated and set beyond which it does not pay to furnish the energy from home production, but instead to import.

3. A policy of import substitution is often necessary in a developing economy, but it must always be applied with great care. Choosing a more expensive material or product over a less expensive one loads higher costs upon an economy which has already too little working margin. If long-term policy is excessively oriented toward saving of foreign exchange, the foreign exchange crisis becomes permanent. For if by import substitution the industries of the country are saddled with high costs of energy, food, cement, etc., export industries burdened by high costs will be unable to compete.

No sector of the domestic economy should be exempted from this requirement: state the true cost of domestic supply and of imports, adjusted if necessary for over-valued currency, and by the domestic premium. No sectors of the economy are in any sense so basic or important that they must be provided at home. To speak of "the commanding heights of the economy" or the most "basic industries" is indulgence in rhetoric at the expense of the national income.

4. The reference prices used in various countries today are much higher than current prices of oil, crude or products. A 1962 German report projected much higher than current crude oil and products prices. In 1963 the five year plan of Venezuela envisaged 1960 crude oil prices or perhaps a little higher. The new British nuclear reactor Dungeness B will produce electric power, if we accept the published figures at face value, at an oil-equivalent of \$15.60 per metric ton. The Italian atomic energy authority uses a reference price of approximately \$16 to \$17. In fact heavy fuel oil is available in cargo lots in northwest Europe at around \$10.50 and in Italy at \$1 less. If the authorities are right, the price of heavy fuel oil and other oil products will increase considerably and in the near future. Projects take a long time to plan, so that the action taken today is determined by the forecasts of some time ago. Thus the important report

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issued in 1962 and 1964 by the European Communities projected heavy fuel oil at about \$18 per metric ton when the current price was about \$12. The new edition or supplement issued in April 1966 lowered this forecast to \$12, which as we have seen is still above though close to the current value.

Since oil prices have been declining irregularly since 1958 in the face of predictions of increase, it is not too soon to ask whether there is really any prospect that prices will rise in the near not the distant future. Paying a dollar too much these next few years is not compensated by saving a dollar in years to come.

5. Some years ago I predicted that prices would probably decrease but would certainly not increase. Since then they have kept on decreasing. In my opinion, the forces which on balance have very slowly pushed prices down are still operating and will hold throughout the next 15 or 20 years. Consider first the supply factor: costs in the big producing area, the Persian Gulf. My estimates hold only within wide proportional margins for error but the absolute amount of possible error is not great: current production costs are about 10 cents per barrel including a return on the investment at 20 per cent exclusive of taxes. The main determinant of future costs will be the size of Persian Gulf reserves and the strain which will be put on them. If we take estimates of total energy consumption in the non-communist world over the next 15 years, and estimates of this kind have worked out well in the past, I load the dice by assuming there will be no nuclear power development between now and 1975, and that two-thirds of non-U.S. coal will disappear in the meantime. On these assumptions we obtain not the most likely estimate for world non-communist consumption but rather the highest figure which is worth talking about. In fact there will obviously be a good deal of nuclear construction, if the proceedings of last October's World Power Conference in Tokyo, which I attended, are any indication. I will further bias the prediction by disregarding natural gas anywhere and further bias it by disregarding the chance of increasing output anywhere except in the Persian Gulf fields now known. I set to zero all future discoveries. Thus I have multiplied an improbably high consumption estimate by an improbably high proportion to be supplied from existing fields to derive an estimate of cumulative 1965-1980 production. These cumulative production figures when subtracted from probable reserves in known fields exploited in 1964 in the Persian Gulf, give us a 1980 reserve-production ratio of about 22 to 1, rather than the existing 30 to 1. Thereby production costs in the Gulf are nearly doubled from 10 to 20 cents per barrel. But obviously these costs are far below any prices that ever existed or are considered likely. The upshot is that so far as demand and supply alone are concerned, there is nothing to look for but decreasing prices.

But this does not end the matter, since the international oil market is not and never has been a completely free market. Demand and supply are not left alone. Price is also influenced by other, including political factors. These have kept the price from going down faster than it would otherwise

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have done, and I expect this will continue to be true, but neither since 1958 nor today have these economic or political factors been able even to stop the price decline, let alone reverse it.

6. Therefore, to plan domestic petroleum production, or hydro-electric or nuclear plants, with reference prices higher than current, is badly mistaken. With all signs pointing to lower prices, the highest possible reference price should not exceed today's prices. What are they? Data are of course scanty, and not precise. We look only at arm's length transactions between independent buyers and independent sellers. So called "prices" which are set within an integrated organization are simply bookkeeping entries to minimize taxes, and attention paid to them is a waste of time. If we take as a standard 34 degree gravity crude at the Persian Gulf, buyers with the largest bids and the best credit rating pay around \$1.20, those not so well located, particularly east of Suez, pay \$1.30 cash equivalent. An integrated company selling at the open market prices in western Europe and subtracting current transport costs and refining cost (the latter including a 10 per cent return on investment) probably realizes a little less than this, say around \$1.10.

These are not rock-bottom or lowest or "unusual" prices, but rather average or representative of what is known of real not fictitious prices today. Where medium size tankers are available, 55 thousand tons, they are available for long-term charter today at around Intascale less 51 or 52 per cent. This means that if a suitably good anchorage can be provided, and these are not unduly expensive, for a large steady volume of imports, the cost from Persian Gulf to Rio should be around 55 cents per barrel, to Buenos Aires around 58 cents and even to Valparaiso no more than 73 cents. (Current rates to Buenos Aires are very much higher than this, largely because the channel and the port are so shallow and also because waiting time seems to be abnormally long.) These are of course current long-term charter rates. In the future the outlook is for even lower rates as larger and more efficient tankers replace the ships now in use, and as ship prices go a bit lower than the current level, which is based on a great strain on the capacity of the Japanese shipyards. Hence the delivered cost of crude oil available to either a private or public company which earnestly seeks it out - for cheap oil will not simply offer itself - is around Rio \$1.75 a barrel, which seems to be near the actual price now being paid by Petrobras, around Buenos Aires \$1.88 - the current additional 40-odd cents is the penalty for not deepening a channel in the River Plate estuary - and to Valparaiso of \$2.03.

7. As for heavy fuel oil, its price is always below that of crude oil. This is a necessary result of the economics of the refining process, not of any artificial arrangements. If the price of heavy fuel oil rises to the level of crude, the crude can simply be burned without refining. Hence heavy fuel oil cannot rise above the price of crude for any but the most special and temporary reasons, and it is always below the price of crude. Calculations to show that heavy fuel oil should "properly" or "by rights" bear a "fair and reasonable share" of refining costs are simply a waste of time, failure to reflect on the economics of refining.

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8. Therefore, the reference prices for domestic industry should be no higher than the figures just shown, and indeed somewhat lower. Correction if any in respect either of over-valued currency or of the premium on import substitution will vary among countries.

9. In my opinion the price of crude will continue to decline, so that reference prices for policy decisions should start with even lower values than the ones just mentioned. The only way to avoid this conclusion is by supposing that the producing nations will not only form a world-wide cartel, but will maintain and operate it effectively. The private world oil cartel of 1928-39 was at best only a partial success, and the market is today much bigger and therefore harder to control.

At any rate, the subject of prices calls for the most careful analysis of existing observations, and of discussion among the participants.

#### SPECIFIC NOTES ON NUMBERED AGENDA

##### Notes on Agenda, Paragraph 6

Past predictions of total energy "demand," more accurately total energy consumption, have been quite accurate, since the correlation between income and energy is fairly close. But very considerable mistakes have been made in underestimating the share taken by oil and gas and overestimating the share taken by coal. The forecasters were not wrong in their economics. But they did not allow for as much competition as was allowed to seep into the system, permitting the higher priced coal to be displaced by lower priced oil and gas. I suggest that this tendency to underestimate the force of competition is always present, and just as one effect was to give more oil and gas consumption than expected, so another effect is to give lower prices than expected.

##### Notes on Agenda, Paragraph 7

It is not clear what is meant by the expressions "maximum yield" and "conservation". (The United States has furnished and fostered some incorrect concepts which are in effect the incidental result of its particular regulation, an elaborate scheme of deliberate waste.) The proper objective either of a private company or of a national economy should be to maximize the present value of a deposit of oil or gas, and thereby make the most of a private or a national asset. Maximum ultimate recovery of oil or gas is wasteful. "Conservation" of oil or gas by leaving it in the ground makes no sense unless it is expected that the increase in the price will be faster than the rate at which future receipts may be discounted. The reasons for and against such an expectation should be plainly set down to allow the responsible parties to decide. In the recent past, it has been a costly mistake.

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Notes on Agenda, Paragraph 8

Capital requirements are not necessarily great at the stage of exploration and production. They depend on the particular reservoir conditions at a particular time and place.

The capital requirements of exploration are impossible to predict. They may be literally infinite per barrel where nothing is found, and they may be nearly zero, as was the case in most of the Persian Gulf. In areas where there has been some past exploration, there is some basis for guessing the kind of deposits that may be found by more exploration, but this is fairly risky gambling.

Development - the capital cost of production - of the big Persian Gulf supplies is in the neighborhood of \$100 per daily barrel. (Even supposing that past estimates have erred at every possible step, it can be no higher than \$200.) Tanker transportation from the Persian Gulf to northern Europe, taking the average ton of oil carried, will probably require an investment of no more than \$620 per daily barrel, while European refining will require about \$400. Hence the development investment, far from being heaviest, is only about 1/10 of the total \$1,140 even if we take no account of marketing investment. Elsewhere development investment may be \$2,500 or more per daily barrel, but transport-refining should not exceed twice the amounts given here, thus changing the proportions completely.

Investment factors several times as high as \$1,140 have been widely circulated, but it is not explained just how they were derived or constructed. More particularly, estimates of capital requirements which average in the United States with the rest of the world should be disregarded. What we need for private or public business policy is the array of capital requirements figures region by region to see how much more it costs in one place than the other, in order that those needing to set reference prices will have the data they need on the competition they face.

Notes on Agenda, Paragraph 9

The exchange of experience among the various parties concerned is of course an excellent idea, but I think it should be oriented toward each person learning what can be done, rather than in averaging the good and bad decisions together. More particularly, for information on a reference refining margin, we should pay attention to the 40 cents a barrel necessary in Europe today (assuming an 80,000 b.d. refinery and a return of 12.5 per cent after a 50 per cent tax) and not the unnecessarily high margins paid somewhere else.

Notes on Agenda, Paragraph 10

Financing of petroleum operations under private enterprise is not dependent on past prices or profits, but on expected future profits. Even high profits or a high cash flow in the United States has not prevented a

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drastic falling off in exploration, which began just when prices had been raised in 1957. Making financing dependent on the receipts of oil companies is a dangerous slogan for government corporations. It leads to arbitrary high prices to let the national company seem to be paying its way. But if the prices are higher than the best alternative means of obtaining the energy, the apparent profit is a deception, and the economy is burdened by the losses of the nationalized company.

Notes on Agenda, Paragraph 11-12

A. The price structure of refined products is a highly complex one because it depends on the particular mix which the refineries turn out, and these vary from place to place. It also depends in part on the available substitutes. In the United States, the availability of cheap coal and natural gas has pushed the price of heavy fuel oil far below the price of crude oil. In Europe, the demand for town gas helped strengthen the price of naphtha very decidedly from about 1963 down to the present. But with the discovery of large scale gas supplies in and around the North Sea, the tide must be expected to turn. Thus the reference prices for naphtha for petrochemicals must be revised. Early in 1965, a reference price of \$21 per ton in Europe was seriously urged. We now know that chemical manufacturers were really paying only \$16.67 per metric ton. Hence the reference price for the future ought to start even lower.

B. Current price information is difficult to obtain and it usually needs considerable evaluation to bring it to some current standard. The one I propose we use is that of a 34° crude f.o.b. the Persian Gulf.

C. The first source of information is reported transactions in the petroleum press. These may be as delivered (c.i.f.) or f.o.b. While nearly always authentic these reports are also hard to evaluate because there are various terms of the bargain which may or may not be identified. The most important are: quality, delivery, credit, buy-back, and currency. When one of these terms is unknown, the error may be relatively small, or quite major. In any case, since these are seen differently by different people at different times of any year, they account for quite a good deal of variability.

D. The second source of information is that of reported customs statistics which are published in a number of countries. The great bulk of these are altogether useless, for two reasons. First, they are not arm's length sales but mere entries on the books of an integrated organization. They are not transactions and must be disregarded. The second source of error would exist even if the first did not. Even if all the price figures were bona fide transactions, most of them would be contracts, and the average is a meaningless mixture of old and new contract prices, so that one can not learn prices on current contracts reflecting current market conditions. When prices are on the decline, as over the last decade, the level of average customs declarations would be too high, but the rate of year-to-year decrease might be too steep. For the rate of decrease would reflect not

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only the declining price on new contracts, but on replacement of old contracts by new ones. For this reason, the average prices in such countries as Italy and Germany are above current prices, but the rate of decline may be steeper than in current prices; it is not clear.

E. Nevertheless, some kinds of published customs information can be used to a limited extent. Where we are able to identify a source of crude as being relatively free or open market, particularly if it is a consistent source and is consistently cheaper than the average, the information is worth using.

F. Published customs figures can also be useful in tabulating the imports from Soviet Russia. These are real arm's length transactions. The Russians have always sold for as good a price as they could, though this was usually somewhat below the price that oil companies could obtain. The discrepancy has tended to get less and less, so that Soviet prices on new transactions are today not much below the open market level.

G. Finally, it is possible to approximate what integrated oil companies realize on their own shipments out of the Persian Gulf. If one takes open market prices in northwest Europe, which is much the biggest market, and subtracts a refining margin and a tanker rate, the net is what an integrated company could realize. This estimate has a considerable margin for error. Moreover, the usual estimates of refining margins and tanker rates are much too high, yielding Persian Gulf netbacks which are much too low. Published refining margins are too high because they are generally based on out-dated excessive investment capital requirements. The tanker rates usually assumed are nearly always much too high for the same reason that we mentioned in dealing with customs statistics. An average of all contracts old and new in a period of declining tanker freight rates is far above the level of rates available in the trade. These errors are avoidable because current tanker rates can be found since there is a very wide and active market both for short-term tanker service, at single-voyage or spot rates, and also for long-term charters, which can be translated into spot equivalents.

H. 1. Bearing in mind the warnings given that all figures are approximations, and that any single one of them may turn out to be really higher or lower than it appears, there seems to be a range within which most current transactions fall. We can conclude this because we will deal with many different types of sales and situations, so that an error affecting one will not affect all of them. Yet they come out within a certain range in terms of 34° crude at the Persian Gulf: from a low of about \$1 a barrel to a high of about \$1.35.

H. 2. The lowest prices in terms of Persian Gulf equivalent are in Libya, where on the basis of German border prices, subtracting current low freight rates, we have a realization f.o.b. Libya of around \$1.45. However, there are also indications of some transactions around \$1.35, and a large long-term one at \$1.30. If we take \$1.40 as a representative figure, then at current tanker rates the Persian Gulf equivalent price is about \$1.05.

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Furthermore, higher quality of libyan crude because of less fuel oil and sulfur, under the traditional reckoning of 2 cents per degree A.P.I. gravity, would be worth 10 cents more, but if we conservatively take only half of this, the Persian Gulf equivalent becomes an even \$1 a barrel. Libyan prices about 35-odd cents lower than Persian Gulf equivalent prices are a major anomaly or disequilibrium in the price structure, and it is unlikely that this can continue indefinitely. Either Libyan prices go up, or Persian Gulf prices go down. Since Libyan output, especially free Libyan output, is a small part of total sales to western Europe, the tendency should be much stronger for Libyan prices to go up than Persian Gulf prices to go down, but this has not been true so far. At the beginning of 1966, when Libyan taxes were drastically increased, there were many prophecies repeated that Libyan free prices would henceforth go up because only tax advantage had been keeping them down. In theory this was wrong, and in fact Libyan prices have shown no perceptible increase during 1966. However they may yet increase if Libyan supply cannot be expanded and if Persian Gulf prices do not fall toward \$1.05 a barrel.

H. 3. German border prices can also be shown to equate to be around \$1.25 for Kuwait crude, and reckoning at the traditional 2 cents per degree gravity, this makes a 34° equivalent of \$1.31. Furthermore, relatively small amounts of crude from miscellaneous Persian Gulf countries - but none of them so small as to be mere spot sales or distress cargoes - indicate prices of around \$1.25. The equivalent Soviet Russian price is \$1.27, so it may be seen that the Soviet price is no longer the lowest. This makes it more useful, in that it gives us a means of quick reference: if we look at the latest Soviet price in any country, and bring this back to a Persian Gulf equivalent, this means that it is not too far from current prices paid to other suppliers.

H. 4. Italian border prices seem to work out somewhat lower than German, but the reliability of the figures seems to be less. As in Germany, Soviet prices are no longer the very lowest; they are certainly near the bottom of the range. But this probably means that there are a number of factors and payments of which we are unable to take account because we have no inside information, and which do not exist on Soviet sales.

H. 5. Valuable information is also had by the three most recent offers to Argentina on public bids. When we deduct from c.i.f. prices the high freight rates needed because of the shallow harbor, and the credit allowance, we come out with f.o.b. Persian Gulf equivalent prices of \$1.29 - \$1.41; \$1.19 - \$1.31; \$1.28 - \$1.33. Again, we must warn of the relatively wide margins for error in these transactions, because we have had to take account of such factors as may vary considerably from season to season.

H. 6. Recent sales to Brazil seem to have been around \$1.70 for Kuwait crude and our best evaluation is about \$1.20 f.o.b. equivalent for 34° crude. A refinery in the Caribbean reports availability of an unstated grade of Middle East oil at \$1.60/barrel delivered, 95 cents f.o.b.

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H. 7. Looking now east of the Persian Gulf, the official valuations of crude delivered by integrated oil companies to their India refining subsidiaries is \$1.40, so the true arm's length figure must fall appreciably below it. Recent offers in connection with new refinery projects, allowance made for the value of loans to the seller, come to somewhere between \$1.28 and \$1.31. Of course, if we used the much higher interest rate applicable to the buyer, the government of India, we would come out with lower prices, but I think this would be inappropriate, since we are trying to find out what it is that the seller is receiving, not what the buyer is giving. Prices for Japanese destinations seem to be about \$1.30; very recently perhaps as low as \$1.26.

H. 8. If now we look at the realization to the integrated producer-refiner, we start with the open market value of a barrel of crude in the Channel ports of Belgium and Holland, where something like a free market exists. At the end of 1966 the average c.i.f. price was around \$2.05 per barrel. If we subtract a current refining margin, and a current tanker rate (Intascale less 52), the f.o.b. equivalent in the Persian Gulf is in round numbers about \$1.10. This is of course very close to what is now being received in arm's length transactions, but it is somewhat lower, as might be expected. At any rate, it shows that there is at present no strong influence tending to push prices up or down because one part of a structure is out of alignment with the other.

In summary, the current price of crude oil at the Persian Gulf is somewhere in the neighborhood of \$1.20 a barrel cash equivalent to a buyer of the best credit rating. These are not exceptional prices, but are available to any large well-informed responsible buyer. Individual bargains sometimes are higher, sometimes lower. But this is the place from which the calculation of a reference price should at least begin though it need not end. And for reasons indicated elsewhere, I think the future prices will tend to be lower than current ones.

But even if prices neither rise nor fall but remain at current levels, current policies will tend to injure both oil-producing and oil-consuming nations. Consumer countries will be penalized by using expensive substitutes for imported oil (domestic oil, coal, hydro, nuclear), while producing nations will lose markets they would have had. Both sides will lose because of the mistaken belief that current prices are abnormally and temporarily low. And the higher the policy makers expect prices to go, the greater losses they will inflict on their countries.