

THE ENERGY CRISIS AND THE CONSEQUENT
RISING COST OF WORLD ENERGY

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(This address was given by Mr. Carter, Commercial Manager and Chairman's Representative for the Shell Group of Companies in Queensland, to a meeting of the Queensland Division of the Institute in Brisbane on 31 October, 1973.)

The present Middle East conflict has thrown into sharp relief the dominant role which the Middle East and North African countries play in the world petroleum scene and makes us realise the problem facing the Western nations over the next two decades during which time oil is the only readily expandable source of energy. It is probably not generally realised that the "petroleum era" is likely to be only a short transitional period in the lifetime of the world and will probably last little more than 200 years as a major source of energy. As approximately half that time has already gone, the petroleum shoe is starting to pinch in some countries and this applies particularly to the USA. It is not so much that demand exceeds supply as the fact that new discoveries are well below the increasing demand. There is no crisis as far as total energy is concerned, but it will be obvious that if the Middle East and North African countries restrict supplies there will be shortages of petroleum in certain parts of the world. If they were to withhold supplies entirely there would be a crisis of considerable proportions, but one would not expect this to happen as the economies of these producing nations are dependant on their oil exports.

Looking longer term, say 15-20 years hence, there could be an energy crisis if we do not continue along the nuclear path, but I will expand further on this subject later in my talk. In view of the Middle East conflict, questions which must come to mind at the moment are:-

- * What part does petroleum play in the energy scene?
- * What are the reserves of petroleum?
- * Which countries have the greatest demand for oil?
- * What are the other sources of energy - where are they, and how soon can the world convert to them?
- * What is Australia's position regarding energy?

I will deal with each of these questions and by so doing hope to give you a clear overall picture of the present scene and likely future developments.

Petroleum's role in the energy scene:

Petroleum today enjoys approximately 54% of the world energy market and this percentage has been increasing year by year for the past 50 years. To indicate the developments in the demand for energy I will go back to 1930 and thus cover a period within the lifetime of many of those present today.

In 1930 coal provided 75% of the total energy needs of the world and petroleum supplied only 17%. Today coal supplies only 21% and petroleum has risen to 54%. Whereas the total energy demand has historically increased at the rate of 65% per decade, petroleum has increased at the rate of 100%, and if this growth continued we would use as much in the next 10 years as we have in the past 110 years since Drake drilled his first well in

Pennsylvania. By the year 2000 we would be using 8 times as much petroleum as we are today and in 100 years time we would be using 1,000 times as much.

These huge increases are not attainable, simply because the rate of discovery is less than the growth in demand. It is therefore obvious that other sources of energy will have to take up the slack caused by petroleum's eventual decreased momentum in growth. In addition to petroleum at 54% and coal at 21%, the present share of the market of other sources of energy are:- (excluding U.S.S.R., Eastern Europe and China).

Natural Gas	approximately	18%
Hydro Power	approximately	6%
Nuclear Power	approximately	1%

The only one of these which is likely to increase dramatically is Nuclear power. Petroleum may hold its percentage into the 1980s, but it is then likely to decline. Coal too will find it difficult to hold its position although the slide will probably be very gradual - and by that you will realise that growth can be at the rate of 50% per decade and there would still be a decline in market share (if an overall 65% per decade energy growth is maintained).

The reason for the tremendous growth of petroleum has been purely an economic one. In other words petroleum has been cheaper than other sources of energy. An indication of the cheapness of petroleum is illustrated by the fact that in Australia the price received by the Industry for standard motor spirit is less today than it was 20 years ago (i.e. 1.1c per gallon less) and this trend also applies to other petroleum products. I might mention that over that period excise duty has increased by 142% and the reseller margin by approximately 100%.

Reserves:

Of the total world reserves of petroleum 62% are held in the Middle East and there is little doubt that in a purely physical sense the Middle East reserves could meet the demand. But the physical problem is not expected to be the greatest problem. Economic and political measures in the producing countries are playing their part and threats that restrictions will be imposed on exports could have a serious effect on supplies. In other words the Middle East and North African countries have a virtual stranglehold over the world supply. If however we relate these holdings to total energy reserves we obtain a much different picture for the Middle East and North African countries control only approximately 1.5% of the total world energy resources.

This low percentage in no way lessens the importance of the role played by the Middle East and North African countries for this 1.5% represents a large proportion of the world's energy needs today. Unfortunately the conversion to other sources cannot be achieved overnight, but it is obvious the conversion must commence immediately and the main consuming countries are conscious of this fact.

As a matter of interest the other important areas of petroleum reserves are as follows:-

U.S.S.R., Eastern Europe and China	12%
North America	9%
Rest of the Western Hemisphere	14%
Far East & Australia	3% (Australia .7%)

The oil industry has historically endeavoured to maintain a ratio of reserves to demand of approximately 30:1. In other words, in any one year the known reserves have been 30 times the demand in that year. This does not appear to be achievable in the future and even to maintain in ten years' time a ratio of 15:1 we would need to find 20 fields the size of the Alaskan field, 400 fields the size of the Eko Fisk field in the North Sea, or another Middle East - and this does not appear to be possible.

Incidentally, Australia needs to find one Barrow Island every year to maintain its present reserves position of 67% indigenous crude.

The present energy problem is mainly in the USA which has 6% of the world's population and uses 33% of the world's energy. Due to environmental pressures there have not been any refineries built in the USA during the past 6 years and it is estimated that they need another 60 refineries each of 150,000 barrel/day capacity to supply their needs by 1985.

In 1968 the export/import ratio of petroleum in the USA was approximately square. Today the USA is importing 25% of its petroleum needs and it is predicted that if this trend continues their expenditure on oil imports in 1980 will be approximately \$20,000 million, rising to \$30,000 million in 1985. The percentage of imports of their total usage would then be approximately 50%. It has been claimed that supplies from Alaska will alleviate the position, but frankly this is not so because the present planned Alaskan production is likely to supply only 8-10% of the needs of North America which would be absorbed by the increased usage in 2-3 years. Admittedly it is possible that Alaskan production can be increased, but this would of course reduce the life of the field. There is also the possibility that additional fields will be discovered in the Alaskan area. You can appreciate that a \$30,000 million import bill could cause concern in the USA, and this is another reason why steps are being taken in that country to solve the energy problem.

Actually the U.S. is well served for total energy, particularly in coal and shales, coal being 48% of the known world reserves. The shales of Colorado are also very great and together with coal and the tar sands of Athabasca in Canada would provide potential many times that of the total present known reserves of conventional oil. Even in petroleum the USA is an important factor, producing approximately 25% of the world's supply. You can thus see that as far as total energy is concerned the USA is well provided; their present problem being entirely a shortage of petroleum and natural gas in comparison with their demands.

President Nixon has recently announced steps to overcome the problem - The measures are far reaching and involve expenditure of some thousands of millions of dollars over the next five years in research and development of new energy sources.

It is not only the USA which is likely to have shortages of petroleum, for Japan in particular is in an invidious position as far as total energy is concerned. Japan has virtually no indigenous energy and her demand is increasing greater (percentage-wise) than any other industrialised country in the world. She is therefore making every endeavour to search for energy and must make long term arrangements for her energy requirements whether it be petroleum, natural gas, coal or uranium.

Europe too has its problems, even though the finds in the North

Sea will relieve the situation to a considerable extent. It was estimated that the North Sea finds would supply only approximately 12% of Europe's needs but with further discoveries of recent date there are predictions of a much higher percentage coming from this source. The U.K. in particular will be much better placed than had been envisaged and could in fact be in a position to supply most of her petroleum and natural gas needs by the early 1980s. The U.S.S.R. is believed to be self sufficient in that her oil needs and oil supplies are virtually in balance.

The fact that crude prices for petroleum are likely to rise is already an accomplished fact for you will be well aware of the increased prices demanded by the OPEC countries. It is of some interest to trace the development of crude oil prices from the Middle East from the period preceding the OPEC Agreement in 1971 up to the present day.

The prices I will quote will be for Australian quality crude and they are in Australian dollars.

Prior to the OPEC Agreement	:	\$1.70 per bbl.
OPEC Agreement 1971	:	\$2.30 per bbl.
Escalations and increases to cover devaluation since 1971 have brought it up to	:	\$2.75 per bbl.
and now the price has been further increased to	:	\$3.20 per bbl.

The equivalent U.S. price is approximately \$4.90 (US) per bbl.

You will be aware that the Australian price for Esso/BHP crude is \$A2.08 bbl. which means we are well below the present OPEC price of \$A3.20. There is every probability that there will be further increases and the disparity between the Australian price and the overseas price will increase accordingly.

It is not generally realised that the escalating price together with the demand for Middle East oil could by 1985 give the producing countries in that area an income in the region of \$65,000 million per annum. This presages a major shift in the balance of economic power and presents a challenge to the international monetary system.

In addition to the increase in crude prices the marketers are lumbered with other escalating costs.

There is the normal inflationary trend which exasperates us all. In addition we have the tremendously increased costs of drilling offshore where a well could cost up to \$5 million. Shell recently drilled one in the Arafura Sea and one in the Rowley Shoals area which together cost us \$11 million. They were both dry holes. This illustrates the very high risks in oil exploration and the necessity for worthwhile returns when success is achieved.

I might mention that the Sedco rig used for drilling these wells is the most sophisticated in the world in that it can drill in water up to 2,000 feet deep and to a depth of 30,000 feet through the Continental Shelf. It is not anchored in the conventional manner but is secured by acoustic beacons imbedded in the sea and beaming on the sensors on the craft. This information is fed into computers and further details as to the strength of the wind, the strength of the tide and the height of the waves is also input into these computers which activate a bank of propellers and hold the craft virtually still even in a gale. The capital

cost of the rig is \$14½ million and its running cost is approximately \$50,000 - \$60,000 per day.

The other concern of the Oil Industry is the huge capital costs which will be required in the future.

It has been estimated by the Chase Manhattan Bank that from 1970 to 1985 the Industry worldwide will require investment of one million million dollars for exploration and downstream activities (pipelines, refineries, installations, transportation, etc.). Historically 80% of exploration costs have been provided from the retained earnings of the International Oil Companies, but 80% today will not go anywhere near as far as it once did and the tempo of exploration cannot be maintained from the retained earnings alone. A consortium of world banks have agreed to provide £500,000 million sterling to finance exploration and downstream activities and if this can be utilised it will go a long way towards solving the problem.

There is the fact however that companies may not be prepared to borrow any greater ratio than they now do, the present ratio of borrowings to capital employed is around 22% and it is unlikely that companies would wish to greatly increase this percentage in view of the fact that it is high risk capital. The huge amounts of money required are also illustrated by the fact that tankers are now in the 500,000 ton capacity. My company has ordered 2 x 533,000 ton tankers for construction and there is at least one larger than this on order - 706,000 ton tanker ordered by Globlik.

The ideal solution as far as the Oil Companies are concerned would be to allow them to make such increased profits that 80% of retained earnings would cover exploration needs. This would not require any dramatic increase in prices for profitability per gallon internationally is only approximately 1c per gallon and you can therefore see that doubling this figure would not be any great imposition on the energy user, particularly in the light of the large increases which in any case are likely to apply because of the other factors mentioned. There is no doubt that if the exploration money is forthcoming, world demand could be satisfied in the foreseeable future.

You may ask what is it we must do to ensure there is not a world energy crisis at some future time. In the short term the solution lies in maximum concentration on exploration for oil and gas. This should be coincident with development of the other fossil fuels, either as primary sources of energy or for hydrogenation of these sources for production of gas or oil. In the medium term we must accelerate the development of nuclear power and in the long term we must solve the technological problems of Fusion Power and Solar Power and make them economically viable. It is obvious that all energy will increase in price. Petroleum has already done so and as a result other fossil fuels are becoming more attractive alternatives. There will undoubtedly be a big demand for coal as a primary source of energy and this is illustrated by President Nixon's speech whereby coal production in the U.S. is to be given considerable impetus. Liquefaction of fossil fuels is planned for the near future and this will probably be in the priority of tar sands, shales and then coal, but as the coal reserves are by far the greatest it will in due course provide the greater share of synthetic oil.

I repeat however that liquefaction is only a practical solution once it becomes economic and it will not become economic until the price of petroleum crude rises to around \$6.00 per barrel -

and that looks as though it will be achieved very soon.

Medium term the nuclear programme must be continued. I have already indicated that petroleum cannot take up any greater share of the market and that nuclear is the only source of energy which could take up the slack in the 1980s onwards. Present developments in other countries give the best indication of the probable growth of nuclear power and the consequent demand for uranium. There are already over 30 nuclear reactors in the U.S.A. and it is planned that there will be 175 by the year 1980. Japan has 5 nuclear reactors at present and proposed additional plants will increase nuclear energy output thirty-fold by 1985. Europe too is developing its nuclear potential and expects to provide 25% of its electricity generation from nuclear power plants by 1985.

We have recently read that in the U.S.A. the price for uranium has increased from \$6.50 to \$10 per pound and there is talk of the U.S. restrictions on imports being lifted. Once the world demand accelerates the price is likely to increase further and the high grade producers will be in the box seat. You will thus see that no matter in which direction one looks the demand for energy will grow and irrespective of the type of energy there will be price increases. The days of cheap energy are gone forever.

This now brings us to Australia. Where do we stand?

Petroleum: 67% of our petroleum usage comes from indigenous crude. 10% of the Australian production is from Barrow Island which means that this represents 6.7% of our total usage. As the demand for petroleum in Australia has historically increased at the rate of approximately 7%, we need to find another Barrow Island every year (and in due course more). Petroleum supplies 50% of our energy needs and natural gas approximately 2½%, but it is expected by 1980 that this figure will have risen to at least 9% with oil flattening out at the 50% mark.

As already mentioned, the price for Australian crude is \$A2.08 per barrel as against the present overseas OPEC price of approximately \$A3.20 (US\$4.90) per barrel with every indication that it will rise further. It seems sensible that if we are to induce exploration in Australia the price for crude will have to rise in line with the overseas price, for it is unreasonable to expect companies to explore here for a lesser price than elsewhere even though stability of government may be greater than in some areas of the world. If we do not discover more oil in quantity (another Barrow Island each year) we will find in a few years time that our percentage of indigenous crude will be down considerably and we will then be importing from overseas at the then price which applies and our balance of payments could be seriously affected. In considering price of Australian crude it is hoped that unsuccessful exploration will be taken into account.

It is important to appreciate that Australia's consumption is only 1% of the world offtake and its production is only approximately .7% of world production. Furthermore it has been estimated that of the total ultimate recoverable reserves of oil and natural gas liquids in offshore fields of the world, only 1% is likely to be on the Australian Continental Shelf. This is in waters up to 200 meters deep and within 40 nautical miles of the shore. If we extend the distance to 200 nautical miles, the Australian percentage increases to 1.5%. It is therefore unrealistic to expect that oil exploration companies will be clambering over one another to explore in Australian waters unless the price is

comparable with that obtainable elsewhere.

Natural Gas: You will be aware of the Government policy to establish a pipeline grid covering most of Australia. There are many arguments for and against this proposal and I am sure you know them all. It does appear however that some incentive will have to be given for exploration as companies can only continue their efforts if they are receiving a worthwhile return on capital employed.

It is thus reasonable to assume that the price of natural gas will follow the overseas trend. The present conflict in the Middle East together with the Suez campaign and the Six Day War illustrates the benefit of vertical integration of petroleum activities. Integration gives the international oil companies the flexibility to reorganise supplies so that there is minimum dislocation to consumers. The expertise of the industry has been built up over the past century and it seems unwise to reject the material advantages to be gained from this expertise.

Coal: Australia has large reserves of coal in comparison to our needs but we are not a major producer as far as the world scene is concerned. However, it does look as though additional reserves will be proved as exploration continues. It is understood the Federal Government will allow exports of coal provided the cost is right, but complete clarity on the subject will not be available until the policy has been enunciated in detail. Huge capital investment will be necessary before liquefaction is economic and considerable research into the feasibility of gasification and liquefaction is being conducted overseas. We need to be careful we do not isolate ourselves from the benefits of this research.

Uranium: Australia is fortunate indeed in that we already have approximately 10% of the world's reserves of uranium and our grades are high in comparison with other countries. I have indicated that the prices are rising overseas and it appears that exports will depend upon the level of prices the Government considers sensible.

The Minister for Minerals and Energy has stated there will not be any further sales of uranium by Australian producers to overseas interests other than those already agreed until the price rises to an acceptable level and it is the Federal Labour Government's intention to buy from the producers and to control the marketing themselves. It has been indicated they may establish an enrichment plant and sell the enriched product.

There is no doubt that when the breeder reactor is widely accepted the demand for uranium will diminish. It is also realistic to assume that when Fusion power becomes a reality the nuclear age will commence to phase out. It is therefore necessary that these probabilities are carefully considered when determining Australia's policy regarding uranium reserves and our marketing strategy.

I have endeavoured to illustrate to you the reasons why the cost of energy will escalate considerably. You can see that this is already happening and I have illustrated why this escalation is likely to continue. There are some areas of doubt as in what way Australian investors will participate in this growth but one can conclude that unless Australian energy prices are somewhat in line with those pertaining overseas our exploration effort may decline and we will not be the store-house of energy we could well be.

In view of the recent developments in the Middle East it would seem imperative to give encouragement to explorers for all forms of energy so that we build up our reserve position to the highest possible level.

This I feel could well be done without any cost to the taxpayer and in fact the Government would probably get sufficient income from taxes, excise duty and royalties to implement many of the social philosophies which it has enunciated. There could be no complaint that Australia should have an energy policy which will ensure our energy needs for generations to come, but this will be better assured if we encourage explorers to prove up greatly increased reserves as quickly as possible.

Australia's rise to prosperity and affluence has been built upon the importation of technology and capital from overseas. We still need the benefits of both and can assure our future by a policy which welcomes overseas investment and expertise in conjunction with Australian partners.

The conservation of energy must be recognised as a priority aim. Active measures should be taken to prevent waste and to increase the efficient use of existing sources of energy through economies in transport, improved insulation, discouraging the expanding use of electricity and conservation of the environment - particularly in regard to measures which result in using up more energy. This cannot be achieved overnight but by doing so the main industrial nations will not only conserve reserves but will enhance the way of life of their peoples and improve their balance of payments by reduction of energy imports.

Before concluding I feel that one should mention the other sources of energy which are available to cater for the world's future needs. In addition to the present and future reserves of fossil fuels, hydro power and nuclear power, the world's energy requirements are certain to be augmented to some extent by wind power, tidal power and geothermal energy. These however are unlikely to play a major part in the world energy scene. The only other sources which may do so are Fusion Power and Solar energy. If the technological and economic problems with regard to these possible energy sources can be solved we would have limitless energy for many thousands of years to come. However, there is quite some division of opinion as to when they will be mastered. I have heard one authority contend that solar power will not be available as a major source of energy until 500 years hence - I have read where others contend it will be mastered in the 21st Century. I do not know the timing but it is probable this source will become possible and economic in due course.

Similarly with fusion power, this too will give us virtually infinite energy, limited only by the amount of lithium available in the earth's surface. When one considers that the atom was smashed within four years of the attempt and that a man was walking on the moon within nine years of commencing the space programme, it is not too optimistic to expect fusion power or solar power technology to become a reality in due course. Once the huge capital moneys required for the research are made available the problem will undoubtedly be solved.

Considering that 120 years ago we did not have petroleum as a source of energy and 40 years ago we did not have nuclear power, it seems unlikely that we will not solve our energy problems in the future. I am confident that we will.