public domestic debt is greater than the country's GDP, and the servicing of this debt amounted to $7 bn in 1988. Looking into the expenditure budget of 1998, for example, this country cannot financially survive on any price below $16 to $18 per barrel. It is, therefore, inconceivable that this country, and for that matter many other OPEC countries, should allow prices to fall below a level that could be considered the minimum.

The question is, however, to what extent they can continue restricting their production in order to ensure that price? Keeping the price at $16-$18/b in the longer run as a minimum means a vicious circle that pushes OPEC's core into continually reducing their production for the benefit of the other producers inside and outside OPEC. High prices tend to mean further increase of oil supplies outside OPEC and a dampened demand growth. The result is an inevitably falling "call" on OPEC oil. Such a price is more than enough to continue encouraging investment in high-cost oil producing areas, such as the North Sea and Caspian Sea. It has been seen that when the price fell to $10 per barrel in 1998, many expansion projects in those high-cost areas were either cancelled or postponed because they proved economically unviable at such low oil prices. With a higher price they can resume expansion. Since in order to maintain a certain price level, OPEC has to continue playing the role of the swing producer, the higher non-OPEC production is, the lower the "call" on OPEC. Therefore, high prices will generate greater pressure on OPEC in the future to further reduce production to keep the price at those levels. On the other hand, higher prices would weaken the growth of demand, especially in Asia.

The time, therefore, will surely come when OPEC will face the same dilemma as in 1998, and will have to choose between reducing further production or accepting lower prices. It is obvious that with the expectation of increasing oil supplies, this process of continuing production cuts must have its own limitations. The loss in the OPEC market share was already so great that a further reduction would be materially extremely difficult. In other words, OPEC's future ability to reduce production in order to keep prices up will erode over time with the result that the price of oil will be inherently weak.

Inherently low oil prices could discourage the consumption of gas, especially as most of the latter source of energy is to be found in the Middle East and the FSU, both of which account for about 73%of world gas reserves.The cost of transportation is very high. In the case of transporting liquefied gas, it is only a price of over $20 per barrel for Brent crude that can cover the built-in cost of a barrel of oil equivalent of gas, including the recovery of capital and a reasonable profit margin. Investing in liquefied gas requires not only a high price level but also its durability, i.e. price stability at that level for a relatively long period of time. The reason is that investment cost in the transportation of LNG, at both producing and consuming ends, is decided by both sellers and buyers on the basis of long-term contracts. Price volatility can affect the long-term economic feasibility of these investments, and the decision-making thereon with a view to securing the recovery of heavy capital investment and reasonable profit margins.

Transporting natural gas through pipelines is confronted not only with the high cost of construction, but is also, and perhaps more importantly, confronted with geopolitical problems

Transporting natural gas through pipelines is confronted not only with the high cost of construction, but is also, and perhaps more importantly, confronted with geopolitical problems. For example, investment in a gas transportation project via pipelines from the Gulf area to Europe is shrouded with many geopolitical uncertainties as it has to cross certain Middle East countries which are prone to local political problems or conflict (such as Iran, Iraq, Israel, Jordan, Syria and Turkey). In this instance, the investment in gas transportation via pipelines would be justified only by a high premium that would cover the economic and political risks.

Natural gas resources are abundant, as proven reserves today can cover more than 63 years of 1997 production.Future demand for this clean, more efficient and environmentally friendlier fossil fuel could be much brighter than oil. Yet many uncertainties could shroud the future of its demand. Being in direct and fierce competition with oil, future trends of the latter will have a bearing on natural gas consumption. Weaker oil prices do not favour natural gas, but environmental considerations do, at the expense of oil. Tax policies in consumer countries can also penalise oil in favour of natural gas. Unpredictable geopolitical developments in the two great natural gas-producing regions, namely the Middle East and the FSU, could influence long-term investment in pipeline transportation, whereas technological progress reducing the cost of transporting liquefied natural gas could definitely be a plus in encouraging consumers to rely more on a more benign source of energy: natural gas. ■

23% over 1996. However, with the target of reducing emissions under the Protocol, the consumption of hydrocarbon fuels should be reduced by 29% from the levels expected to have been reached otherwise by that time. Naturally it is expected that not all the hydrocarbon reserves would have to be reduced by the same percentage. Oil, having greater emissions than natural gas, will be under much more pressure. The same CGES study estimates that meeting the Kyoto Protocol's target, oil consumption in the OECD area by 2010 would be 5 mbpd below the level prevailing in the OECD in 1996, implying a cutback of 13% from the current levels.

The heavy taxes imposed by OECD countries on oil, especially in Western Europe, have the effect of dramatically increasing the cost paid by the end-consumer irrespective of the movement of oil prices in the world market

Although this target is hardly achievable, given the economic growth requirements for fuel, and despite the uncertainty about ratification of the Protocol by a sufficient number of countries to bring it into effect, the Protocol by itself indicates how great world concern for environmental issues are. Already discussion of the issue of carbon tax has opened in the EU since the 1980s.

The financial policies of oil-consuming countries may contribute to further dampening growth rate of oil consumption. The heavy taxes imposed by OECD countries on oil, especially in Western Europe, have the effect of dramatically increasing the cost paid by the end-consumer irrespective of the movement of oil prices in the world market. The tax on a composite barrel paid by the endconsumer in Western Europe has grown from less than 40% in 1985 to about 67% now. In the case of gasoline, the tax component could reach as much as 80%. Domestic oil taxation imposed in the industrialised countries constitutes a wall that isolates domestic prices of oil from world market prices of crude so that when the latter fall, consumers do not benefit because of these high taxes. By contrast, when the oil price is high, the end consumer has to pay yet higher prices. Oil taxes in the US and Japan are lower than in Western Europe, so that changes in the price of crude oil in world markets can be partially reflected in the internal price.

The trend of abundant oil supplies and weaker demand is bound to continue into the future so that oil prices will likely be under downward pressure in the early decades of the next millennium. The over-supply of oil may become an embedded feature in the world oil industry, leading to an inherent weakness in the oil price.

The future trends of oil prices will also depend on whether OPEC can continue to regulate its own supplies in removing the oil supply surpluses as it has been doing through its quota systems since 1983.

Oil Prices and the Future of OPEC

Events of the last two years have shown that OPEC has changed in structure, giving the crucial role for its core, i.e. the major producers - Saudi Arabia, Kuwait, Venezuela and, at some point in the future, a fully rehabilitated Iraq as well as Iran. Other members of OPEC have become increasingly marginal. The process of decision-making has shifted from a whole OPEC-concerted action into side-talks and negotiations outside the Organisation by a limited number of its members. Decisions are taken in consultation- often within the Gulf Co-operation Council (GCC) and or elsewhere, and agreements are reached between the big producers meeting outside the Secretariat. OPEC's "Conference" meetings role has become more a means of formalising agreements already made by the few. The last OPEC meeting serves as a good example: the Conference lasted only two or three hours and served to formalise and endorse.

Agreements already reached in the Hague between Saudi Arabia and Venezuela, together with a non-OPEC member, Mexico.

The future ability of producers to regulate oil supplies and achieve a market balance can be found in economic and political developments inside the major producers forming the core of OPEC, notably Saudi Arabia, which is virtually the major if not the only force to be able to drive the market through production. It became obvious that in this country, as well as in other major OPEC member countries, the crucial factor that shapes oil price policy in the short-term is the mounting financial pressure. The economy of all these countries, in particular Saudi Arabia, have become extremely vulnerable to falling oil prices, as a result of their continual budget deficits and increasing dependence on oil revenues.

Budget deficits in these countries have become embedded in the economic structure that cannot be considered a temporary or short-term phenomenon. In Saudi Arabia, for example, the cumulative budgetary deficits since 1983 have reached more than $230 bn, mainly financed through local borrowing from banks and financial institutions. Saudi Arabia's

in world oil supplies dropped from 65% in 1978 to 38% twenty years later.

The drop in OPEC's share to defend the oil price was not shared evenly by all OPEC members, but only by a limited number- mainly Saudi Arabia, Kuwait and Iraq, whose combined share dropped more heavily than the others. Between 1979 and 1997, their combined production dropped by about 4 mb/d, whereas some other OPEC members (Iraq, Qatar, UAE and Venezuela) have increased their combined production by more than 2 mb/d.

The only force that has prevented prices from falling since themid-1980s has been OPEC's production cuts in order to conserve the balance between demand and supply at the desired price levels

The oil price developments of 1998 and 1999 show clearly that without OPEC's continual cutting back of its production and hence its market share by a substantial amount, oil prices would never have doubled from the 1998 level of $10 per barrel. In these two years, OPEC's production cuts in three stages amounted to about 4.3 mb from the level decided in Jakarta in November 1997. These production cuts not only mean a decrease in market share but also a real burden on the oil industry in those countries as a result of keeping substantial production capacities unused, the maintenance of which can cost billions of dollars. OPEC's unused production capacity today stands at about 7.5 mb/d, more than three-quarters of which exist in only four countries: Saudi Arabia, Kuwait, Venezuela and United Arab Emirates.

Increasing oil supplies are likely to continue in the future, especially if the major oil producing countries in the Middle East open their industries to foreign investors. A sanction-free Iraq can alone add to its pre-war capacity of 3.5 mb/d no less than a further 3 to 5 mb/d in a matter of 5 to 7 years. Many OPEC countries outside the Gulf (Algeria, Libya, Nigeria and Venezuela) are already encouraging foreign oil companies to invest in new capacities. Furthermore, production capacities outside OPEC are expected to increase so that by 2010 no less than 5 to 6 mb/d of additional oil can be put on stream from West Africa, the Caspian Sea and South America, although some believe that certain non-OPEC oil supplies, such as the North Sea, may decline by that time.

Against this trend of increasing oil supplies, the question is whether world demand can grow at a rate sufficient to absorb these increases of production capacity amounting to no less than 10 mb/d within 10 years.

A host of economic and technological factors could conspire against robust growth of world demand during the early decades of the next century. the likely growth in the world economy.

And its components, technological developments towards a more efficient use of energy, the environmental constraints penalizing oil, fiscal policies in the consuming countries, etc. Over the period 1987 to 1997, world oil consumption grew by an average growth rate of 1.5% a year. The fastest regional growth in oil consumption was that of Southeast Asia. In the four years to 1997, the Asia-Pacific region provided 5 mb/d of the 6 mb/d increase of global oil consumption.

What will happen in that region in the coming decades will therefore have an enormous bearing on future world demand for oil. The financial crash in Southeast Asia in 1998 leaves no doubt that even if the economy rebounds, its former very high growth rates of consumption will not be repeated in the foreseeable future.

On the other hand, the dynamics of economic growth in the industrialised countries of the West have changed in structure towards low-energy intensive sectors. Propelled by the great revolution in information technology, the ascendant industry now, especially in the USA, is the communications and electronics industry, which is one of very low energy intensity. This means less growth energy demand per economic growth over the last twenty years. In fact there has been a continuous decline in energy intensity in the industrial countries in general.

Furthermore, enviromental considerations could take their toll on oil consumption because environmentalists' ambitious programmes, if successfully implemented, would mean substantially less burning of oil in order to achieve a lower level of carbon dioxide emissions.

Although it is uncertain whether the Kyoto Protocol (mentioned earlier) can ever be fully implemented, it has, nevertheless, far-reaching implications as far as energy is concerned. Under its terms there are specific targets for reducing the emissions of six greenhouse gases by the year 2010- namely, that the OECD countries reduce their emissions by 7% from their 1990 levels. This naturally means a drastic reduction in energy consumption from the levels that would have been expected to have been obtained by that year, all things being equal.

It is estimated that without the Protocol's constraints, the OECD primary energy demand in 2010 would increase by

The future for world natural gas consumption will therefore depend on the trends that lie ahead for certain factors, i.e. oil prices, environmental constraints, and technological development especially in the area of transportation. This paper will deal with the effect of oil prices on the future for world gas supply and demand balance.

Oil price Trends and the Future of Natural GAs

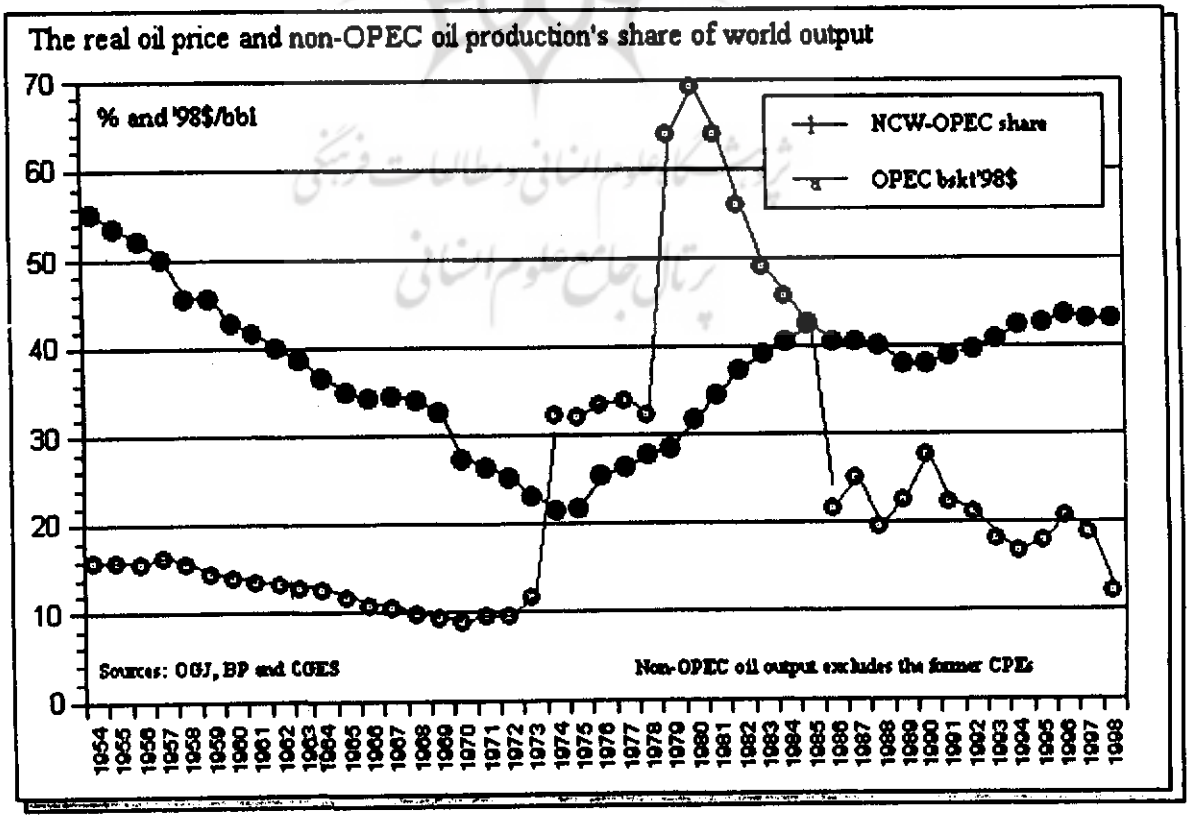
Oil prices in the first two decades of the coming millennium will basically reflect world oil supply and demand balances, on the one hand, and the capability of OPEC to regulate supplies with a view to stabilising the price, on the other.

Many economic and technological developments would suggest that the world will be living with an abundance of oil supplies. At the same time, those indications would suggest that future growth of world oil demand may not be as strong as in the past. The world may, therefore, have to witness a continuous state of oil over supply, with mounting downward pressure on oil prices. The only force that has prevented prices from falling since the mid-1980s has been OPEC's production cuts in order to conserve the balance between demand and supply at the desired price levels. OPEC has been doing this at the expense of its own share in world oil production.

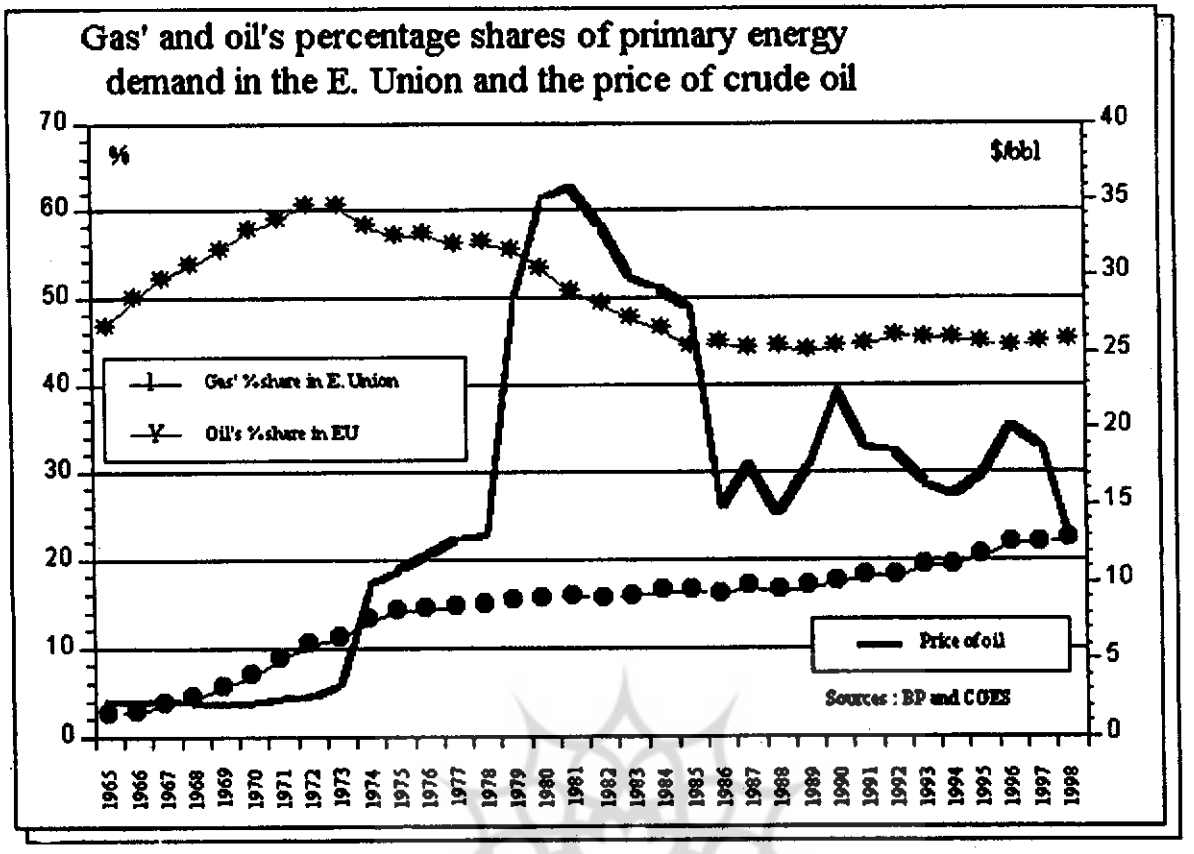
The phenomenon of an inherent oil over-supply, with which we live today, has been the result of OPEC's own price policies and practices over the last two decades, beginning with OPEC's price shocks which took the price of oil from about $3 per barrel in the summer of 1973 to over $35 per barrel in the first quarter of 1980. Besides the price shocks, the persistence of OPEC in holding artificially high prices through production cuts and quota systems accelerated the process of dramatic growth in oil supplies from costly areas which hitherto were considered to be not economically viable to develop. Graph 3 shows how the non-OPEC share in world oil supplies, outside the FSU and US, was reacting against price movement. The great leap of those supplies happened when oil prices were increasing exponentially and tapered off when prices became lower since 1985.

The concept of OPEC being the last-resort source of oil supply (the swing producer) led to a dramatic increase in the share of new oil (non-OPEC oil from outside the FSU and USA) from the North Sea, South America, the non-OPEC Middle East and West Africa, etc. This dramatically increasing new oil emerged as an aggressive competitor for OPEC oil. The oil supplies from these regions increased from about 6 mb/d in 1970 to about 27 mb/d in 1998, and replaced OPEC oil in the world market. With its policy of being the last-resort supplier, OPEC's production had to fall from its peak of 1974 of about 32 mb/d down to about 15 mb/d in 1985 and up to its current peak since of 27 mb/d. OPEC's production now is about 5 mb/d less than it was in 1974, whereas non-FSU world consumption of oil during this period has increased by about 13 mb/d. If both the FSU and US are excluded, OPEC's share

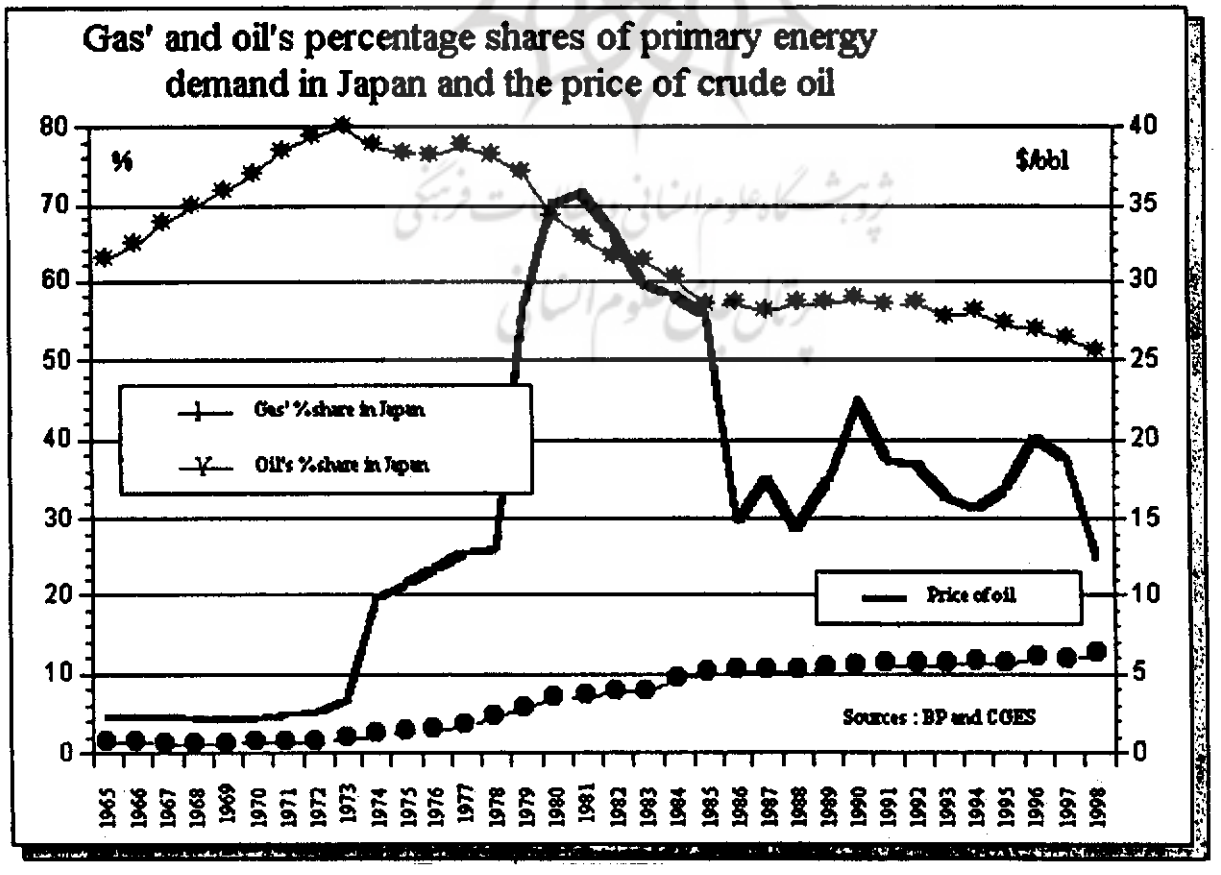
Graph 3

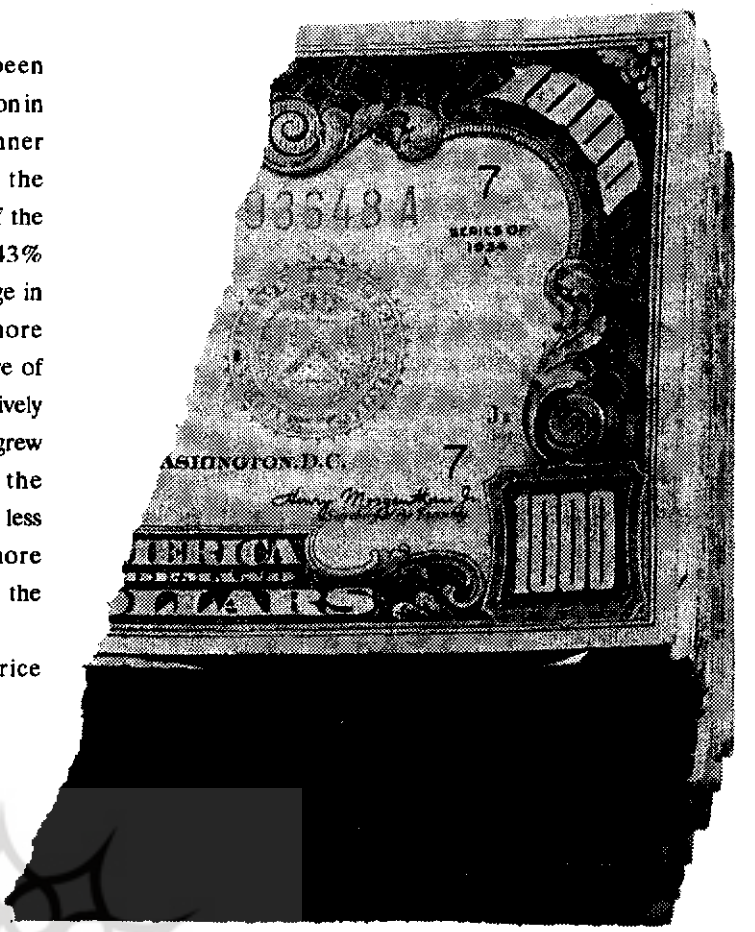


Graph 1



Graph 2





Persian Gulf Gas Resources Conference
7th-8th November, 1999, Tehran-Iran

The impact of Oil Prices on Natural Gas Supply and Demand Balance

Dr. Fadhil Chalabi
Vice President, CGES-UK

Over the last twenty years, world energy has been undergoing far-reaching structural transformation in which natural gas has emerged as the net winner (together with nuclear energy). This has happened at the expense of oil, whose share in the energy consumption of the OECD countries has decreased from 54% in 1978 to 43% twenty years later. Among the OECD countries the change in respective shares of energy sources has been much more pronounced in Western Europe and Japan where the share of oil dropped from 56% and 76% to 45% and 51% respectively during this period. By contrast, their share of natural gas grew from 14% and 5% to 22% and 13% respectively. In the United States, the change in favor of natural gas has been less pronounced because this source of energy played a more important part in US energy pattern much earlier than in the other OECD countries.

A major force behind this change was OPEC's price shocks and policies of the 1970s and 1980s which induced energy consumers in the industrialised countries to reduce their dependence on oil and to diversify their energy supplies. With a lead time, OPEC's price explosions created an economic and political environment which facilitated consumers' endeavors to shift to alternative sources of energy. Technological research was enhanced and heavy capital investment made to render the subsitution of oil by gas economically feasible.

Prior to the oil price explosion, natural gas consumption in Europe was confined to the limited resources of Holland and Italy. Transporting gas from other areas was too expensive to undertake during the era of cheap oil. The very high OPEC prices of the 1970s and 1980s justified huge capital investments in transporting natural gas to Europe from North Africa and the Former Soviet Union (FSU). More important is that these higher oil prices substantially improved the economics of transporting natural gas in liquefied form.

The impact of oil price movement on the respective share of oil and natural gas in the European Union and Japan is illustrated in Graphs 1 and 2.

The increase in the share of natural gas and the corresponding decline in that of oil happened between 1973 and 1985 when the price of oil leapt from less than $3 per barrel to $28 per barrel. When thereafter the price crept downward, the two opposing movements of both shares almost tapered off.

Although to a lesser extent, environmental factors have recently played a much more significant role than in the past- when the industrialised countries, especially in Europe, were less aware of such considerations. The issue of protecting the environment from the adverse effects of burning fossil fuels has been brought to the fore as an issue in world politics, especially in Western Europe where the Green parties have been gaining increasing votes. Rightly or wrongly, the burning of oil and coal is regarded as the real culprit of climate change and is held Responsible for so-called global warming. The burning of these two fossil fuels is thought to be the cause of increasing levels of carbon-dioxide emissions in the air. Environmental political pressure has been increasing so much that the UN Conference at Kyoto had to adopt a "Protocol" which is aimed at a drastic reduction in the consumption of oil in favor of "Friendlier" sources of energy like natural gas.