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Middle Eastern Energy After the Iraq War: Current and Projected Trends

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The Iraq War has removed a tyrant, but it has had little impact on the overall importance of Middle Eastern energy – except to cut short-term Iraqi production and create new uncertainties about Iraq's mid-term export capacity. Similarly, for all the talk of new U.S. energy policies and energy discoveries in other areas, there have been no meaningful changes in global and U.S. strategic dependence on Middle Eastern energy exports.

The Middle East dominates world energy exports today and will almost certainly do so for decades to come. This is true even if one assumes steady progress in conservation, major improvements in the supply of renewables, and major increases in energy supplies from gas, coal, nuclear power and renewables. There are many sources of global energy estimates, they use many different models, and they produce many different results. One of the most respected modeling efforts, however, is conducted by the Energy Information Agency (EIA) of the U.S. Department of Energy (DOE). It is one of the few modeling efforts that both is supported by large analytic resources and annually recalibrates its results based on its past results.

The EIA estimates for the period 2000-2025 reflect substantial average annual growth in global consumption of natural gas (2.3-3.5 percent), coal (0.6-2.2 percent), nuclear (0.7-1.3 percent) and renewables (1.6-2.4 percent). They expect major improvements in global efficiency and conservation, especially in the developing world, the former Soviet Union (FSU) and Eastern Europe. Even so, they project an average annual increase of 1.0-2.6 percent in the use of oil. The reference-case estimate is 1.7 percent.

The International Energy Agency (IEA) makes exactly the same estimate of an average annual increase in world oil consumption: 1.7 percent. Two other respected modeling efforts do not go as far into the future but do make estimates through 2015. The PIRA Energy Group estimates that oil consumption will go up by 1.8 percent per year, while Petroleum Economics Ltd. (PEL) estimates a rise of 1.6 percent. All estimates assume major increases in energy from natural gas, coal and renewables, although the IEA, PIRA and PEL all predict that the gain in nuclear energy will be much lower than the EIA projections.[1] **[TABLE 1]**

It is always possible to assume some technological breakthrough that will sharply reduce the need for oil, or some massive discovery outside the Middle East. Since the United States first sought to reduce its dependence on foreign oil as part of Project Independence in the early 1970s, various experts have promised the solution could come from offshore oil reserves outside the Middle East, fuel cells, shale oil, nuclear power, fusion, geothermal energy, wind, conservation and a host of other means. None of these promises, however, has paid off in altering the fundamental balance of energy supply or in reducing global economic dependence on Middle Eastern exports.

OIL VS OTHER SOURCES

It is notable that the highest risks in terms of the gains in other sources of energy are in nuclear (because of the perceived safety risk) and in coal (environmental problems). While renewable energy sources are often seen as desirable in terms of emissions, virtually all of the gain comes from large hydroelectric plants, which are increasingly seen as posing a major environmental risk. Put differently, if any shortfall occurs in the highest-risk areas in global energy supply, the demand for oil will actually be much higher than models currently estimate, particularly because oil remains by far the most efficient way of transporting energy flexibly over long distances. Similarly, the higher the rate of global economic growth, and the more developing nations actually develop, the higher the demand for oil and oil imports.

In terms of actual oil consumption, the EIA estimated in 2003 that world oil consumption will rise from 66.1 million barrels per day (mbd) in 1990, and 76.9 mbd in 2000, to 81.1 mbd in 2005, 89.7 mbd in 2010, 98.8 mbd in 2015, 108.2 mbd in 2020, and 118.8 mbd in 2025. While this is only an average annual increase of 1.8 percent per year, it amounts to a total increase of 41.9 mbd between 2000 and 2025 – a cumulative increase of 54 percent.[2] **[TABLE 2]** The EIA Annual Energy Outlook 2004 does not provide all of the same detail, but indicates indicates that world oil demand is projected to increase from 78 million barrels per day in 2002 to 118 million barrels per day in 2025. [3]

The future can, of course, be very different. By definition, no one can predict a technological breakthrough. No one can predict economic growth or environmental developments with any precision. Even extrapolating existing trends in known sources of energy over more than two decades is certain to produce substantial errors. However, it seems highly unlikely that the world economy could change radically enough to produce major short-term (2003-10) changes in the broad structure of global energy balances, and there are many reasons why the Middle East would probably continue to dominate the world oil market for the next two decades even if substantial changes took place in global demand.

The Middle East has been, and will continue to be, a critical factor in meeting global demand and in providing oil exports. It has more oil; this oil is cheaper to produce; it has the infrastructure to export it cheaply and in large amounts; its cost for additional production are very low; and domestic demand for oil is low relative to total production capacity. In fact, if some major breakthrough should reduce global demand for oil, it is higher-cost producers in other areas that would have to cease producing first.

SIZE OF MIDEAST RESERVES

There are a number of different ways to estimate oil reserves, and there are many debates over the size of probable reserves, future discoveries, how to count heavy oil and tar sands, and the rate of future advances in recovery technology. In broad terms, however, most experts would agree with the BP estimate that the Middle East has some 65.4 percent of the world's total reserves of 1.047 billion barrels – or 69.6 percent if Egypt, Algeria, Libya, and Tunisia are included. Once again, the vast majority of these reserves

are held in the Gulf. The Gulf and Yemen have 65.2 percent of the world's reserves. The Levant has 0.2 percent, and North Africa has 4.2 percent.[4] Moreover, according to this method of estimation, the broad patterns in the distribution of the world's oil reserves have not changed in more than a decade, unless one counts the reclassification of Canadian tar sands. The end result of more than 30 years of exploration since the oil embargo of 1973, has been to increase the Middle East's percentage of proven total world oil reserves.

One of the most interesting departures from the conclusions reached in the BP estimate is the possibility of including Canadian tar sands in estimates of world reserves on the grounds that they can be produced at a cost of $16 to $26 per barrel, less transportation. An analysis by DOE indicates that this may prove possible, but would take years to fully confirm and requires a massive new production and transportation infrastructure. Accordingly, the DOE estimates that even if this reserve estimate proves fully valid, in real-world economic terms it would only lead to 2.2 mbd worth of actual production by 2025, and 1 mbd of exports to the United States.[5]

The U.S. Geological Survey (USGS) provides another way of considering how estimates of world reserves might change in the future. It not only estimates proven reserves – which are recoverable with today's technology and today's costs – but the potential growth in reserves in known fields and the probable size of undiscovered fields. According to the USGS, the present total size of proven reserves is 1,212.9 billion barrels – substantially higher than the BP estimate. The Middle East has 685.64 billion barrels, or 58 percent of the total.[6]

If one looks at potential discoveries through 2025, the USGS estimates that known reserves and fields will be found to have another 730.5 billion barrels by 2025, and that the Middle East will have 252.5 billion barrels, or 34.6 percent of this total. If one combined proven reserves and reserve growth, the Middle East would have 938.1 billion barrels, or 48 percent of 1,943 billion barrels. This indicates that the Middle East could shrink as a percentage of future world production, and this is even truer if one considers the USGS estimate of undiscovered fields and reserves. The USGS estimates that undiscovered fields and reserves could amount to another 939.9 billion barrels, and that the Middle East could have 269.2 billion barrels, or 28.7 percent of this total. If one combines proven reserves, reserve growth and undiscovered reserves, the Middle East would have 1,207.3 billion barrels, or 42 percent of a global total of 2,882.9 billion barrels. **[TABLE 3]**

The International Energy Agency (IEA) uses a mixture of its own data bases and the USGS estimates. It estimates total world oil production to date at 718 billion barrels, and annual production in 2001 at 75.8 mbd. It projects 959 billion barrels of remaining reserves and 939 billion barrels of undiscovered reserves. Saudi Arabia has an estimated 221 billion barrels in remaining reserves, and 136 billion barrels in undiscovered reserves. Russia ranks second with 137 billion barrels in remaining reserves, and 115 billion barrels in undiscovered reserves. Other Middle East states dominate the rest of the picture.[7] **[TABLE 4]**

- Iraq is estimated to have 78 billion barrels in remaining reserves, and 61 billion barrels in undiscovered reserves.

- Iran is estimated to have 78 billion barrels in remaining reserves, and 67 billion barrels in undiscovered reserves.

- The UAE is estimated to have 59 billion barrels in remaining reserves, and 10 billion barrels in undiscovered reserves.

- Kuwait is estimated to have 55 billion barrels in remaining reserves, and 4 billion barrels in undiscovered reserves.

- Libya is estimated to have 25 billion barrels in remaining reserves, and 9 billion barrels in undiscovered reserves.

- Algeria is estimated to have 15 billion barrels in remaining reserves, and 10 billion barrels in undiscovered reserves.

- Qatar is estimated to have 15 billion barrels in remaining reserves, and 5 billion barrels in undiscovered reserves.

- The Kuwaiti-Saudi Neutral Zone is estimated to have 8 billion barrels in remaining reserves, and 0 billion barrels in undiscovered reserves.

- The United States is estimated to have 32 billion barrels in remaining reserves, and 83 billion barrels in undiscovered reserves.

There are, however, serious uncertainties in any such estimates of near- and mid-term impact of new discoveries on the world oil market. The cost of production varies sharply from region to region once one considers reserve growth and undiscovered reserves. Much of the production would have to come from the FSU, and from Latin American and African states, where production costs are often at least twice those in the Middle East. The estimates of reserve growth require major advances in enhanced oil recovery to make production economically viable outside the Middle East, and it can take decades to create the production and export infrastructure necessary to exploit undiscovered reserves.

PROJECTED INCREASES IN MIDEAST PRODUCTION

Given these factors, it is hardly surprising that most estimates indicate that the Middle East will steadily expand its oil production, increase its share of world production, and increase its impact on the global economy through 2030. Once again, there are major uncertainties in any such estimates, but the reference case of the EIA of the DOE does include forecast production from Canadian tar sands and substantial exploitation of enhanced oil recovery and new discoveries outside the Middle East.

Reference-case Estimates

Even so, the EIA estimates that total oil production capacity of the OPEC states of the Persian Gulf will increase from 22.4 mbd in 2001 to 24.5 mbd in 2005, 28.7 mbd in 2010, 33.0 mbd in 2015, 38.96 mbd in 2020, and 45.2 mbd in 2025.[8] The EIA's Annual Energy Outlook 2004 (AEO2004) estimates that total OPEC oil production will reach 54 million barrels per day in 2025.

Put differently, Gulf OPEC oil production capacity will increase from 26.9 percent of total world capacity in 1990, and 28.3 percent of world capacity in 2001, to 32.0 percent of world capacity in 2015 and 36.3 percent of world capacity in 2025.[9] These figures would be even higher were other non-OPEC "Gulf" oil producer powers like Oman and Yemen included.

While the Gulf dominates this increase, the EIA also estimates significant increases in oil production capacity in North Africa. Algeria and Libya are estimated to increase their production from 3.3 mbd in 2001 to 3.4 mbd in 2005, 4.0 mbd in 2010, 4.3 mbd in 2015, 5.0 mbd in 2020, and 5.7 mbd in 2025.[10] If the entire Middle East and North African (MENA) region is considered, oil production capacity will increase from 22.9 mbd in 1990 and 27.5 mbd in 2001 to 29.9 mbd in 2005, 34.9 mbd in 2010, 37.2 mbd in 2015, 46.4 mbd in 2020, and 53.6 mbd in 2025. This would mean that total MENA oil production capacity would increase from 33.0 percent of total world capacity in 1990, and 34.7 percent of world capacity in 2001, to 35.5 percent of world capacity in 2005, 39.8 percent in 2010, 40.1 percent in 2015, and 43.0 percent of world capacity in 2025.[11]
[TABLE 5]

The IEA makes generally similar projections, although it uses different time periods and definitions of the regions to be assessed. It estimates that global oil demand will increase by an annual average of 1.6 percent during 2000-30. This compares with 1.8 percent for the EIA over the period from 2000-30.[12] This is a relatively narrow difference in the estimate of the coming shifts in demand for oil. For example, similar estimates by Shell call for 1.1 percent average annual growth, and DRI/WEFA for 2.2 percent growth, [13]

As a result, the IEA estimates that total OPEC Middle Eastern production will increase by an annual average rate of 3.0 percent per year from 2000-30, and will grow by 1.4 percent a year as a share of total world production. The IEA estimates that total Middle Eastern OPEC production will grow from 21.0 mbd in 2000 (28.1 percent of the world oil supply) to 26.5 mbd in 2010 (40.4 percent), 37.8 mbd in 2020 (36.4 percent), and 51.4 mbd (54.1 percent) in 2030. The rest of the Middle East is projected to cut production from 2.1 mbd in 2000 to 1.8 mbd in 2010, 1.5 mbd in 2020, and 0.9 mbd in 2030.

Key Uncertainties in Production Capacity

It should be noted that the projected increase in production capacity made by both the EIA and IEA are based on economic models that assume Middle Eastern states can and will expand production capacity to meet market demand. They are not based on country plans to actually fund and implement such increases. This makes any such estimates –

and projections of increases in exports – considerably more uncertain than projections based on country plans. At the same time, most countries in the region only have limited long-range plans to expand production capacity. Most react to market forces rather than risk anticipating them.

It is equally important to note that the MENA region has been the scene of more than ten conflicts and major internal-security struggles over the last two decades, and has also been affected by U.N. and U.S. sanctions. As a result, it is important to review the IEA assessment of increases in production by country and understand that the expansion in each country involves at least some security risks. The EIA reference-case projection for 2025 does estimate increases by OPEC countries, and the result can be summarized as follows:[14] **[TABLE 5]**

- Algeria, from 1.6 mbd in 2001 to 2.8 mbd in 2025 (75 percent, 2.2 mbd to 3.0 mbd).
- Iran, from 3.7 mbd in 2001 to 4.9 mbd in 2025 (32 percent, 4.6 mbd to 5.7 mbd).
- Iraq, from 2.8 mbd in 2001 to 5.2 mbd in 2025 (75 percent, 4.8 mbd to 6.1 mbd).
- Kuwait, from 2.4 mbd in 2001 to 5.1 mbd in 2025 (113 percent, 4.3 mbd to 5.7 mbd).
- Libya, from 1.7 mbd in 2001 to 2.9 mbd in 2025 (71 percent, 2.4 mbd to 3.1 mbd).
- Qatar, from 0.6 mbd in 2001 to 0.8 mbd in 2025 (0.0 percent, 0.8 mbd to 0.8 mbd).
- Saudi Arabia, from 10.2 mbd in 2001 to 23.8 mbd in 2025 (133 percent, 17.6 mbd to 30.3 mbd).
- The UAE from 2.7 mbd in 2001 to 5.4 mbd in 2025 (100 percent, 4.9 mbd to 5.9 mbd).

The variations shown in parenthesis reflect projected market forces. The lower production capacity is the result of high oil prices that ease the revenue and cash-flow problems of exporting states. The high production-capacity estimate is the result of low oil prices and the need to increase production to increase export earnings. To put this in perspective, the reference-case estimates project the OPEC Gulf nations to have a total production capacity of 45.2 mbd in 2025 – a rise of over 100 percent above the 2001 level. The low-end estimate would be 37.0 mbd, and the high-end estimate would be 54.5 mbd. If North Africa and the rest of the Middle East were considered separately, they would increase in the reference case from 4.7 mbd to 8.4 mbd – a rise of 78 percent. The low estimate would be 7.9 mbd. The high estimate would be 8.6 mbd. The reference-case

estimate for the entire MENA area would be 53.6 mbd. The range would be 44.9 mbd to 63.1 mbd.

Many in the oil industry feel that all these estimates of future production capacity are too high and that the countries in the region will be slower to increase production. It should be noted that Iraqi oil production was only 800,000-1,200,000 in August 2003 because of the impact of the Iraq War and its aftermath. Iran and Libya have failed to modernize and increase production for more than half a decade because of internal political developments and external sanctions. Kuwait has fallen badly behind in field development and technology because its National Assembly has blocked suitable investment reforms. Algeria continues a civil war. The problem of terrorism has become more serious in the Gulf region and Saudi Arabia in particular.

This does not mean that the EIA and IEA projections will not prove accurate over time, but that there are security as well as market risks. Future production and export capacity are as much energy risks as embargoes or temporary interruptions in production.

Projected Increases in Mideast Exports

Oil exports follow a different pattern from increases in oil production because many producers consume most or large portions of their domestic production. The Middle East retains massive surplus capacity relative to domestic demand. This explains why its share of world exports is so much higher than its share of total production or production capacity.

According to estimates in the BP Statistical Review of World Energy, the Middle East produced an average of 20.97 mbd in 2002.[15] This was 28.5 percent of the world total of 73.94 mbd. The Middle East exported an average of 18.1 mbd in 2002, or 41.4 percent of the total world average of 43.63 mbd in exports.[16]

If the four oil exporters in North Africa are considered as part of the Middle East – something that most Middle Eastern analysts would do – Egypt, Algeria, Libya and Tunisia produced an average of 3.86 mbd in 2002.[17] This was 4.9 percent of the world total of 73.94 mbd. The North African states exported an average of 3.1 mbd in 2002, or 0.7 percent of the total world average of 43.63 mbd in exports. The total MENA region produced a total of 24.83 mbd, or 33.6 percent of the world total. The total average oil exports were 21.2 mbd in 2002, or 48.6 percent of the world total.

If one uses the EIA, rather than the BP estimates referenced earlier, the Gulf OPEC states exported an average of 16.9 mbd, or 30 percent of a world total of 56.3 mbd. If one includes the North African states, the exports climb to 19.5 mbd, or 35 percent.[18] The DOE projects that Gulf OPEC exports will reach 35.8 mbd by 2025; OR 37 percent of the world total of 94.6 mbd. If one includes North Africa, the level of exports climbs to 40.6 mbd, or 43 percent of the world total. This is a rise of 7-8 percent in the Middle East's share of global oil exports between 2001 and 2025.[19]

The EIA summarizes the trends in Gulf oil exports as follows in its Annual Energy Forecast for 2003 :

> Considering the world market in crude-oil exports, the historical peak for Persian Gulf exports (as a percent of world oil exports) occurred in 1974, when they made up more than two-thirds of the crude oil traded in world markets.... The most recent historical low for Persian Gulf oil exports came in 1984 as a result of more than a decade of high oil prices, which led to significant reductions in worldwide petroleum consumption. Less than 40 percent of the crude oil traded in 1984 came from Persian Gulf suppliers. Following the 1985 oil-price collapse, the Persian Gulf export percentage again began a gradual increase, but it leveled off in the 1990s at 40 to 45 percent when non-OPEC supply proved to be unexpectedly resilient.
>
> In the *AEO2003* reference case, Persian Gulf producers are expected to account for 45 percent of worldwide trade by 2007 – for the first time since the early 1980s. After 2007, the Persian Gulf share of worldwide petroleum exports is projected to increase gradually to 66 percent by 2025. In the low oil-price case, the Persian Gulf share of total exports is projected to reach 76 percent by 2025. All Persian Gulf producers are expected to increase oil production capacity significantly over the forecast period, and both Saudi Arabia and Iraq (assuming the lifting of United Nations export sanctions after 2003) are expected to nearly triple their current production capacity.

These totals understate the true importance of the Middle East because the EIA now issues an estimate for the Middle East per se, although its estimates for the region exclude exports from Oman, Yemen and the Levant.

DIRECTION AND IMPORTANCE

Oil is a global commodity distributed in a global market. With the exception of differences in price because of crude type and transportation costs, all buyers compete equally for the supply of available exports, and the direction and flow of exports changes according to demand. The percentage of oil that flows from the Middle East to the United States at any given time has little strategic or economic importance. If a crisis occurs, or prices change drastically, the source of U.S. imports will change accordingly. Moreover, the United States is required to share all imports with other Organization for Economic Co-operation and Development (OECD) countries in a crisis under the monitoring of the IEA. In a crisis, the United States will pay the same globally determined price as any other nation.

Further, the U.S. economy is dependent on energy-intensive imports from Asia and other regions. In this case, what comes around literally must go around. While the EIA and IEA do not make estimates of such indirect imports of Middle Eastern oil in terms of finished goods from other countries that are dependent on Middle Eastern exports, analysts guess that they would add at least 1 mbd to total U.S. oil imports. To put this figure in perspective, direct U.S. oil imports increased from an annual average of 7.9 mbd in 1992 to 11.3 mbd in 2002. A total of 2.6 mbd worth of U.S. imports came from the Middle East in 2002.[20] If indirect U.S. imports, in the form of manufactured goods

dependent on imports of Middle Eastern oil, were included, the resulting figure might well be 30-40 percent higher than the figure for direct imports.

The United States is also increasingly dependent on the health of the global economy. U.S. economic activity and growth is dependent on how well the economies of Europe, Asia and Latin America function. With the exception of Latin America, Mexico and Canada, all of America's major trading partners are critically dependent on Middle Eastern oil exports. In 2002, MENA supplied 5.0 mbd of 11.9 mbd in European imports (42 percent). MENA exporters supplied 4.0 mbd of Japanese imports of 5.1 mbd (79 percent). MENA countries also supplied 0.8 mbd of China's imports of 2.0 mbd (39 percent and growing steadily in recent years), 0.2 mbd of Australia's imports of 0.6 mbd (33 percent), and 6.5 mbd of some 8.6 mbd in imports by other Asian and Pacific states (76 percent).[21] **[TABLE 6]**

The global economy will also grow far more dependent on the Middle East and North Africa in the future. The EIA projects that North American imports of MENA oil will increase from 3.3 MBD in 2001 to 6.1 mbd in 2025 – an increase of 85 percent, almost all of which will go to the United States. The increase in exports to Western Europe will be from 4.7 mbd to 7.4 mbd, an increase of 57 percent. This assumes major increases in oil exports from the FSU and conservation that will limit the scale of European imports from the Middle East. Industrialized Asia – driven by Japan – will increase its imports from 4.1 mbd to 6.0 mbd, or nearly 50 percent. China will increase its imports from 0.9 mbd to 5.2 mbd, or by nearly 500 percent; and Pacific Rim states will increase imports from 5.0 mbd to 10.0 mbd, or by 100 percent. **[TABLE 6]**

These trends reflect the impact of the high rate of economic development in Asia, the limits to Asian oil reserves, and the fact that the Middle East is the most economic supplier. In fact, total Asian imports are projected to increase from 18.2 mbd in 2001 to 35.0 mbd in 2025, an increase of nearly 100 percent, almost all of which will go to developing Asian states.[22] Furthermore, the EIA annual Energy Outlook for 2004 indicates that the developing countries of Asia will have the largest growth in demand for oil, and this demand will increase at an average rate of 3.0 percent per year.[23]

These projections are also very similar to the trends projected by the IEA. The IEA projects that total interregional trade in oil will increase from 32 mbd in 2000 to 42 mbd in 2010 and 66.1 mbd in 2030. Middle Eastern exports (less north Africa) will increase from 19 mbd in 2000 to 46 mbd in 2030. Most of these additional exports will go to Asia, with China emerging as the largest market, followed by India. The rise in U.S. imports will be limited by increased exports from Canada because of production from tar sands, from Mexico and from Sub-saharan Africa.[24]

The IEA also provides the longest-term estimate of the share of Middle Eastern exports relative to other regions. It estimates the interregional oil trade at 66.1 mbd in 2030. The Middle East would provide 70 percent of that total. If another 4 mbd were added for North Africa, the MENA region would provide 76 percent. In contrast, Central Asia and the Caspian would provide 4 mbd. Russia would provide 5 mbd, the rest of Africa would

provide 4 mbd, Brazil would provide 0.1 mbd, and the rest of Latin America would provide 3 mbd.[25]

CHANGES IN NATURE OF MIDDLE EASTERN IMPORTS

More is also involved than imports of oil per se. The Middle Eastern states and North Africa are steadily attempting to increase profit margins by producing refined oil products. At the same time, some countries – such as the United States – have created major environmental barriers to new refineries. As a result, the nature of Middle East exports will shift sharply from crude oil to refined oil products over the coming decades.

Middle Eastern refinery capacity has already increased from 5.0 mbd in 1990 (8 percent of world capacity) to 5.9 mbd in 2000 (7 percent). The IEA projects that it will increase to 10.0 mbd in 2010 (11 percent), 12.6 mbd in 2020 (12 percent) and 15.6 mbd in 2030 (13 percent). These figures do not include North Africa because the IEA does not break out its estimates to show the difference between North and Sub-saharan Africa.[26] **[TABLE 7]**

The IEA projects that total OECD demand for imports of refined product will increase from 2 percent of total product demand in 2000 to 11 percent by 2030. The IEA also projects that the Middle East (less North Africa) will export some 7 mbd in refined oil products by 2030, versus 2 mbd for all of Africa, 3 mbd for all of the FSU and 0.2 mbd for Latin America. By this time, North America (virtually all going to the United States) is projected to import 7 mbd in refined product, China 2 mbd and the rest of Asia 3 mbd.[27]

A shift to product imports does not necessarily alter dependence in strategic terms. It can, however, lead to greater dependence on a given Middle Eastern supplier, because it produces precisely the product for a given commercial need. It can also reduce the flexibility of global markets to substitute for Middle Eastern oil because there may be no source of similar refinery or production capacity. A shift to product exports also reduces the total volume of product shipped, although it increases its value, making mbd a less valid measure of dependence on oil imports.

TRENDS IN U.S. IMPORTS

U.S. oil imports are only a subset of U.S. strategic dependence on Middle East oil exports. As has been noted earlier, the United States is dependent on the overall health of the global economy, and largely on amounts of indirect energy imports in the form of manufactured goods dependent on Middle East oil. Moreover, oil is a global commodity, and the United States must compete for the global supply on market terms. As a result, it is the global supply of oil exports, not where the United States gets oil at any given time, which determines availability and price to the United States as well as other nations. The United States is also obliged by treaty to share oil exports with other OECD states in the event of a major interruption in exports.

These realities are reflected in the past patterns of U.S. dependence on oil imports from the Middle East. The EIA reports wide fluctuations in U.S. oil imports over time. If one looks only at total U.S. imports of crude oil, imports from all sources reached 3.2 mbd in 1973. They rose to a temporary peak of 6.6 mbd in 1979, and then slowly declined until 1985, when they reached 3.2 mbd. They then rose consistently, reaching 5.1 mbd in 1988, 6.1 mbd in 1992, 7.1 mbd in 1994, 8.2 mbd in 1997, 9.1 mbd in 2000, and edging towards 10.0 mbd in 2003. [28] **[TABLE 8]**

Imports include product as well as crude oil, however, and if both crude oil and product are counted, U.S. total imports were 6.0 mbd in 1973, rising to 8.6 mbd in 1977, and then dropping to 4.3 mbd in 1984. They then rose to 5.4 mbd in 1986, 6.5 mbd in 1988, 7.2 mbd in 1989, 8.1 mbd in 1994, 9.1 mbd in 1997, 10.4 mbd in 2000, and averaged over 10.5 mbd in 2001-03.[29] It should be noted that some estimates of import dependence only count crude, a method that has little meaning in real world economic terms.

The EIA does not measure U.S. dependence on crude oil and product imports from the Middle East per se, or on the MENA region. It does, however, measure U.S. dependence on imports from the Persian Gulf, which dominate the vast majority of U.S. imports from the MENA area. The share Persian Gulf imports claim of the U.S. market is determined not by the price of crude in an abstract sense, but by the real-world market value of a given type of oil or product delivered to the U.S. market versus the same or similar crude or product delivered from any other source. In practice, even the smallest price differential – sometimes a few cents per barrel – leads the U.S. importer to shift between buying from the Middle East, Africa or any other source.

It should not be surprising, therefore, that the patterns in U.S. imports from the Persian Gulf (Bahrain, Iran, Iraq, Kuwait, Qatar, Saudi Arabia and the UAE) do not reflect the same pattern as total U.S. oil imports. Asian demand leads Asian countries to take advantage of the lower shipping costs from the Middle East, and the United States seeks oil with lower transportation costs from Africa and Latin America. According to the EIA, U.S. petroleum imports (crude oil, lease condensate, unfinished oils, petroleum products, natural-gas plant liquids and hydrocarbon compounds blended into finished products) from the Persian Gulf have fluctuated as follows over time:[30]

- U.S. imports from the Persian Gulf totaled 0.85 mbd in 1973. They were 4.9 percent of total products supplied, and 13.6 percent of total imports.

- U.S. imports from the Persian Gulf rose steadily 1974-77. They totaled 2.44 mbd in 1977. They then were 13.3 percent of total products supplied, and 27.8 percent of total imports.

- U.S. imports from the Persian Gulf declined steadily after that time from 1978-83. They total 1.5 mbd in 1980, 1.2 mbd in 1981, and then dropped sharply to 0.70 mbd in 1983. They reached a low of 0.442 mbd in 1982. They then were 2.9 percent of total products supplied, and 8.8 percent of total imports. They

"bottomed out" at only 0.311 mbd in 1985, with 2.0 percent of product, and 6.1 percent of total imports.

- Changes in Saudi and OPEC price strategy in 1986 led to an increase in U.S. imports from the Gulf to 0.91 mbd in 1986, 1.1 mbd in 1987, and 1.87 mbd in 1989. They were 10.7 percent of total product imports and 23.1 percent of total U.S. imports in 1989.

- U.S. imports from the Persian Gulf fluctuated from 1.57 mbd to 1.8 mbd during 1990-97, and ranged from 9.4-11.6 percent of total products supplied, and from 17.3-24.5 percent of total imports.

- From 1998 onwards U.S. imports from the Persian Gulf have been above 2.0 mbd, reaching 2.1 mbd in 1998, 2.5 mbd in 1999, 2.5 mbd in 2000, 2.8 mbd in 2001, 2.3 mbd in 2002, and averaging 2.8 mbd in 2003. They totaled 2.44 mbd in 1977. They have ranged from 11.3-14.10 percent of total products supplied, and from 19.7-23.3 percent of total imports.

Once again, it must be stressed that such patterns reflect the volatility of transportation costs, world demand and supply, and small margins of difference in the delivered price of oil and product. Moreover, market-driven patterns only apply as long as no major interruption takes place in the exports of given regions and states. It is the trend in both total global export and in total U.S. imports from all sources that counts in terms of strategic dependence.

It is important to note in this regard that neither the Bush energy policy nor the congressional energy bills presented to date will have any meaningful strategic impact on U.S. import dependence. It takes massive shifts in U.S. energy consumption and supply over extended periods of time to accomplish this. There are good reasons that the advocates of such policies either make no meaningful analysis of the impact of their proposals on U.S. import dependence or provide "blue sky" estimates that are little more than intellectual rubbish.

If one turns to the EIA, it is clear that realistic models of U.S. energy needs will lead to steady increases in U.S. energy imports, although no one can predict the exact trends. In the short term, the EIA predicts that total U.S. petroleum imports were 10.9 mbd in 2001 and 10.54 in 2002, and will reach 11.0 mbd in 2003 and 11.3 mbd in 2004. Largely because of a dip in U.S. economic activity, U.S. imports dropped by 3.3 percent during 2001-02, but they are projected to rise by 3.8 percent in 2002-03 and by 3.3 percent in 2003-04.[31]

What is most important, however, is the mid- and long-term picture where temporary economic conditions have less impact and trends tend to be far more consistent over time. The EIA's Annual Energy Forecast for 2003 reports that net imports of petroleum accounted for 55 percent of domestic petroleum consumption in 2001. U.S. dependence on petroleum imports is projected to reach 68 percent in 2025 in the reference case. This

is a rise in U.S. net imports from 10.9 mbd in 2021 to 19.8 mbd in the reference-case (+82 percent). In the low-price case, net imports would rise to 21.1 mbd. They would be 18.2 mbd in the high-price case, 17.8 mbd in the low-growth case, and 22.3 mbd in the high-growth case.[32]

The EIA's annual forecast for 2004, however, reports that net imports of petroleum accounted 53 percent of domestic petroleum consumption in 2002. In this report, U.S. dependence on petroleum imports is estimated to reach 70 percent in 2025 in the reference case, versus 68 percent in the 2003 forecast. In the high oil price case the corresponding imports as a share of total consumption in 2025 are expected to be 65 percent. In the low oil price case, on the other hand, this number is estimated to be 75 percent.[33] (These figures are different from the AEO2003 report, which indicated that the share of imports as a share of total oil consumption was expected to range from 65 percent in high price case and 70 percent In the low price case by 2025.)

Crude oil is expected to continue as the major component of petroleum imports, but refined products are projected to keep growing as a share of total imports because the projected growth in demand for refined products will exceed the expansion of U.S. domestic refining capacity. The EIA projected in 2003 that refined products will increase from a 15-percent share of imports in 2001 to 34 percent in 2025 in the reference case, with 27 percent of net petroleum imports in 2025 in the low-growth case and 39 percent in the high-growth case.[34] In practice, this would mean that product imports would rise from 1.6 mbd in 2021 to 6.7 mbd in the reference case (+82 percent). In the low-price case, net imports would rise to 7.1 mbd. They would be 5.7 mbd in the high-price case, 4.8 mbd in the low-growth case, and 8.6 mbd in the high-growth case.[35]

The EIA's AEO2004 indicates that " refined products are projected to make up 13 percent of net petroleum imports In 2025 in the high oil price case and 25 percent in the high growth case, compared with 20 percent in the reference case, increasing from 13-percent share In 2002."[36]

Once again, the EIA does not estimate the share that MENA countries will provide of these imports. Its forecast does indicate, however, the share of U.S. imports from OPEC during 2003-2025. As for other sources of imports, the EIA indicates that[37]

> Crude oil imports from the North Sea are projected to increase slightly through 2007, but decline gradually as the United Kingdom's North Sea production ebbs. Significant imports of petroleum from Canada and Mexico are expected to continue, while West Coast refiners are expected to import crude oil from the Far East to replace the declining production of Alaskan crude oil. Imports of light products are expected to more than triple by 2025, to 5.3 million barrels per day. Most of the projected increase is from refiners in the Caribbean Basin, North Africa and the Middle East, where refining capacity is expected to expand significantly. Vigorous growth in demand for lighter petroleum products in developing countries means that U.S. refiners are likely to import smaller volumes of light, low-sulfur crude oils.

It should be stressed that these projections of a growth in imports are based on overall

estimates of the trends in U.S. energy supply and demand that include relatively high estimates of U.S. oil and gas production, the use of nuclear power and coal, and use increases in energy efficiency, renewable energy and the domestic production of ethanol.

IMPORTANCE OF MIDEAST GAS

At present, Middle Eastern gas reserves are more important as a means of meeting local energy needs without consuming oil, and providing gas-based petrochemicals, than as exports. This may change in the future, however, as world demand for gas rises. The EIA estimates that global demand for natural gas has increased from 36 trillion cubic feet (tcf) in 1970 to 53 tcf in 1980, 73 tcf in 1990, and 87 tcf in 2000 to 90 tcf in 2001. It is projected to rise to 100 tcf in 2005, 114 tcf in 2010, 133 tcf in 2015, 153 tcf in 2020, and 176 tcf in 2025. This is an increase of more than 95 percent between 2001 and 2025.[38]

Mideast Gas Reserves

The Middle East and North Africa now have a total of 40.8 percent of the world's proven gas reserves (36 percent in the Middle East and the rest in Algeria, Egypt and Libya). These MENA reserves have more than doubled since 1982, and increased from 26.0 trillion cubic meters (tcm) in 1982, to 49 tcm in 1992, and to 63 tcm (2,244 tcf) in 2002.[39] They did so despite major limitations in oil and gas exploration and development due to war and internal conflict in such critical states as Algeria, Iran, Iraq and Libya.

Once again, there is no firm consensus as to how to estimate proven gas reserves, and estimates of potential and undiscovered reserves are too uncertain to be used for the purposes of this analysis. It is clear from virtually all sources, however, that several MENA states have a large share of the world's reserves. According to both the EIA and BP, Bahrain has 0.90 tcm (3.3 tcf) or 0.1 percent of the world total, Iran has 23 tcm (812.3 tcf) or 14.8 percent, Oman has 0.83 tcm (29.35 tcf) or 0.5 percent, Qatar has 14.4 tcm (508.5 tcf) or 9.2 percent, Saudi Arabia has 6.4 tcm (224.7 tcf) or 4.1 percent, the UAE has 6.01 tcm (212.1 tcf) or 3.9 percent, Iraq has 3.1 tcm (109.83 tcf) or 2.0 percent, and Yemen has 0.48 tcm (16.9 tcf) or 0.3 percent.[40] **[TABLE 9]**

Syria has 0.24 tcm (8.5 tcf) or 0.2 percent, and the rest of the Middle East has 0.05 tcm (1.65 tcf). In North Africa, Algeria has 4.52 tcm (159.7 tcf) or 2.9 percent, Egypt has 1.66 tcm (58.5 tcf) or 1.1 percent, and Libya has 1.31 tcm (46.4 tcf) or 0.8 percent.[41]

The EIA and IEA do not provide detailed projections of probable discoveries by country, but many Middle Eastern states have only begun to fully explore their gas reserves; most are likely to make major additional discoveries. EIA does, however, indicate that total global reserves now stand at 5,501 tcf, and undiscovered reserves equal another 4,839 tcf – almost all in the developing world. If these estimates are right, the Middle East and North Africa have another 20-25 percent of the world's undiscovered reserves. Some 2,347 tcf in reserves are expected to be discovered 2000-25, and more than one-half are estimated to be found in the FSU and MENA areas.[42]

The IEA also estimates that the Middle East has 34 percent of the world's remaining reserves and probably has at least 19 percent of its undiscovered reserves.[43] CEDIGAZ (International Information Center for Natural Gas and Gaseous Hydrocarbons), a respected source of energy estimates, indicates that the Middle East has 53.9 tcm of proven gas reserves, and that some 115-136 tcm of the world's ultimate reserves are in the Middle East. This is 34 percent of the world's proven reserves, and 25.4-25.8 percent of its undiscovered reserves.[44]

In contrast, the United States is one of the world's largest gas consumers but is estimated to have less than 10 percent of the world's remaining reserves. It will become steadily more dependent on imports, largely from Canada and Mexico. Europe is one of the fastest growing consumers of gas but is depleting its reserves and will become steadily more dependent on imports from the FSU and MENA. Some sources indicate that Europe will have to import 60 percent of its natural gas by 2020.[45] Japan and most developing Asian states have little or no significant reserves.

Mideast Gas Consumption and Oil Exports

The importance of these reserves is illustrated in part by their ability to limit the growth of Middle Eastern consumption of crude oil. During the decade 1992-2002, regional consumption increased from roughly 1.0 mbd to 1.3 mbd, although this still left the Middle East consuming only 5.9 percent of the world's use of oil. North African consumption increased from 0.67 mbd to 0.77 mbd.[46] This consumption of oil would have been far greater if Middle East oil exporters had not steadily increased their use of local gas as a substitute for oil. Middle Eastern states increased their use of natural gas from 110.6 billion cubic meters (bcm) in 1992 to 205.7 bcm in 2002, and this increase was driven by the creation of more effective national gas-distribution systems in key exporters like Iran, Kuwait and Saudi Arabia.[47] Similarly, key North African states like Algeria and Egypt increased their use of natural gas from 29.1 bcm in 1982 to 47.4 bcm in 2002. **[TABLE 10]**

Current plans call for further major increases in domestic use of gas in most of the Gulf States. The IEA also projects that total Middle East use of gas will increase from 3.6 tcf in 1990, and 6.8 tcf in 2000, to 8.8 tcf in 2010, 11.1 tcf in 2020, and 13.9 tcf in 2025. This is an average annual increase in consumption of 2.3 percent.[48] In contrast, the EIA projects the Middle East will increase domestic oil consumption from 3.4 mbd in 1990 and 5.2 mbd in 2000 to 5.2 mbd in 2010, 6.7 mbd in 2020, and 7.6 mbd in 2025.[49] This is an average annual increase in consumption of 2 percent, and would be at least 4-percent higher without regional domestic use of gas.

Mideast Gas Exports

Any analysis of the Middle East's role in gas exports is even more speculative than an analysis of its role in oil exports. While the Middle East has long exported some gas, exports are just beginning to become a major part of world energy exports. Projections must be based on highly uncertain data as to future export capacity, future demand and

future price. The EIA and IEA do, however, project world demand for gas as one of the most rapidly growing areas of energy demand.

The reference-case of the EIA projects that world use of gas will rise from 73.41 tcf in 1990 and 88.7 tcf in 2000, to 113.9 tcf in 2010, 153.5 tcf in 2020, and 175.9 tcf in 2025. This is an average annual increase in consumption of 2.8 percent versus 1.8 percent for oil.[50] Much of this increase will be met by an increase in domestic production or by major increases in exports from the FSU. The United States however, may well have to make major imports by ship. Korea and Japan already rely heavily on Middle Eastern gas exports, and total developing Asian nation consumption is projected to rise from 3.0 tcf in 1990 and 6.6 tcf in 2000, to 10.4 tcf in 2010, 17.7 tcf in 2020, and 2.16 tcf in 2025. This is an average annual increase in consumption of 4.5 percent, much of which will have to be supplied from the Middle East.[51] The projections of the IEA are somewhat different, but estimate a 2.1 percent annual average increase in OECD Europe consumption between 2000 and 2030, a 2.3 percent average increase in OECD Asia, a 5.5 percent average annual increase in China, a 3.7 percent increase in East Asia, and a 4.7 percent increase in South Asia.[52] **[TABLE 11]**

At present, MENA gas production lags far behind the FSU and Eastern Europe – at about one-third the production, although MENA reserves are slightly larger. All Middle Eastern exports are also in the form of liquid natural gas (LNG), although Iran is exploring shipping gas to Europe by pipeline through Turkey, and several Gulf States have considered pipelines through the Indian Ocean to Pakistan or to India across Afghanistan. Qatar has much larger gas reserves than oil reserves, and has aggressively expanded its LNG facilities. It is seeking to triple its LNG capacity to 45 million metric tons per year by 2010, and to build new gas-to-liquid plants. It is also a key force behind the creation of the first long-distance pipeline to serve customers in the Gulf area – the Dolphin project. The UAE's production of gas is largely associated gas and is limited by oil production. Its consumption of gas is outstripping supply.[53] Saudi Arabia has planned a massive new gas initiative; and, while its efforts to find foreign investment have been delayed and scaled-back, it too is likely to become a major exporter over the coming years.

Algeria is already the second largest LNG producer in the world and exports a significant amount by pipeline. It is Western Europe's second-largest supplier, delivering by pipeline to Italy, Spain and Portugal, and by LNG tanker to France, Spain, Italy, Belgium, Greece and Portugal. Algeria is seeking to add a new 4-million-metric-ton LNG train to its production, and is trying to diversify exports to new markets in the United States. It exports about 0.8 tcf via the Transmed pipeline through Tunisia to Italy. Algeria and Italy are exploring the possibility of a new pipeline through Sardinia and Corsica. Another "Medgaz" pipeline may be built to Spain, with a capacity growing from 0.3 tcf to 0.6 tcf. Egypt is creating gas trains to export to France and Spain.

Egypt has constructed a 270 km gas pipeline to Jordan and hopes to extend this pipeline into Syria with eventual gas exports to Turkey, Lebanon, and possibly Cyprus. Libya is

planning to increase its export capability by building a pipeline from Melita to Sicily with a capacity of 0.3 tcf.[54]

The IEA also projects a massive increase in world dependence on gas imports. It projects an increase in Middle Eastern exports from 23 bcm in 2000 to 365 bcm in 2030.[55] While it is careful to qualify the major uncertainties involved, the IEA projects that interregional flows from the Middle East will increase as follows between 2000 and 2030: 1.7 bcm to 104 bcm to North America, 0.4 bcm to 160 bcm to Europe, 0 bcm to 27 bcm to South Asia, 21 bcm to 60 bcm to Japan and Korea, and 0 bcm to 13 bcm to China. To put these estimates in perspective, they do not include North Africa, because the IEA only provides totals for all of Africa. If only total Middle Eastern exports are included, however, they will increase fifteenfold from 23.1 BCF in 2000 to 351 BCF in 2030. In comparison, the FSU's gas exports will increase 2.5 times from 112 BCF in 2000 to 277 BCF in 2030.[56] **[TABLE 12]**

Dealing with an Uncertain Future

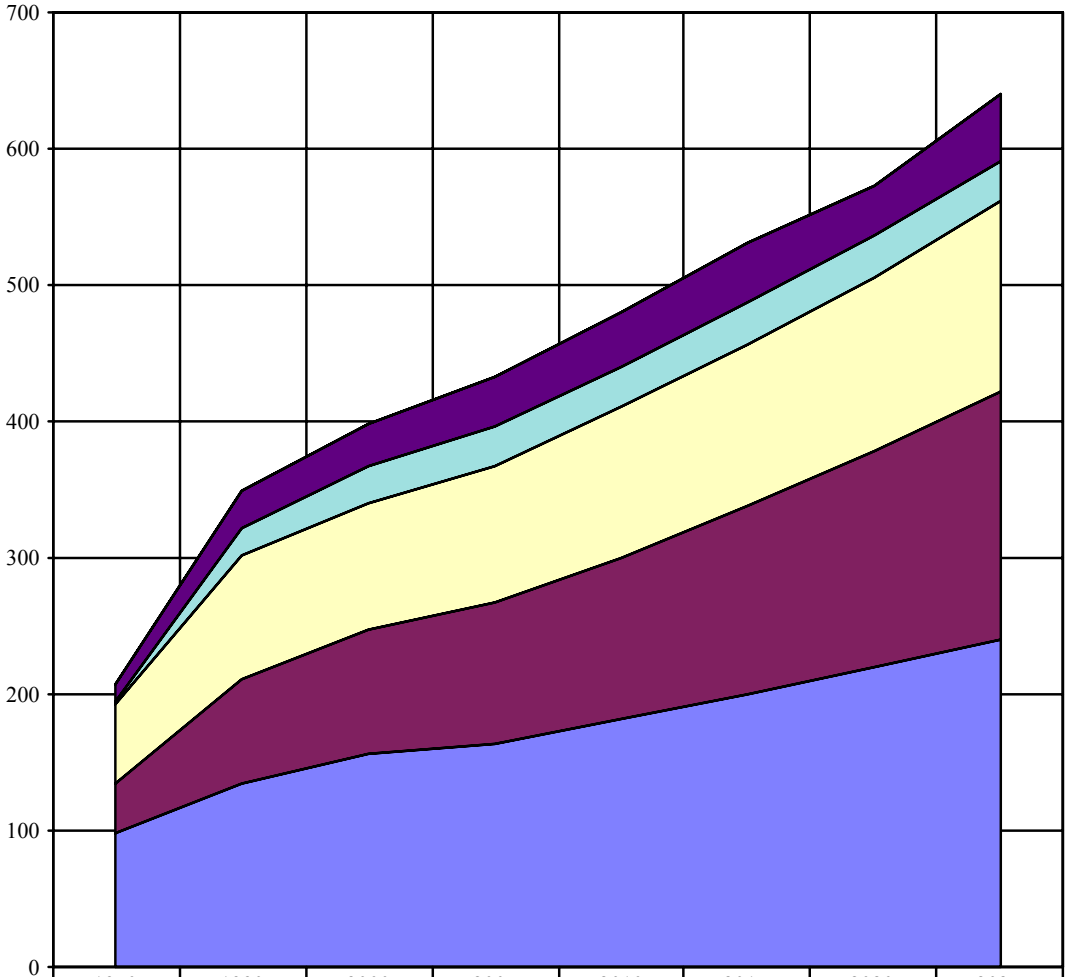
Facts and details are boring, as are statistics and the results of complex models. The moment one actually looks at the results of the respected sources of available energy data, however, it becomes clear that details and numbers actually count. In the real world, there are no near- or mid-term developments that will reduce a growing global dependence on Middle Eastern energy exports, or the world's dependence on the ability and willingness of the Middle East to increase its energy production and export capability.

Time and technology will almost certainly change this situation, but not in a few years or even a few decades – barring some massive, unanticipated breakthrough in alternative energy supplies. In fact, even if dramatic changes did take place in the cost of alternative energy supplies, it might well take a decade for such changes to really have a major global impact. The world has simply invested too much in vehicles, facilities, homes and industrial processes that use oil. Few breakthroughs could take the form of supplies that could be cheaply and quickly produced on a global basis.

This is not always apparent when global energy balances are ignored, or policy makers and analysts look at one small part of the problem – like today's direct U.S. imports of crude oil from the Middle East. It is clear from the previous analysis, however, that the real world is far more complicated and that any honest analysis must reflect that complexity. It should be equally clear that major changes in the future projected by groups like the IEA and EIA might change the numbers but are unlikely to change the broad trend in ways that could radically affect the pattern of global consumption, exports, or dependence on the Middle East.

Table 1

EIA Projection of World Energy Consumption by Type of Fuel: 1970-2025
(EIA Reference Case in Quadrillions of BTUs))



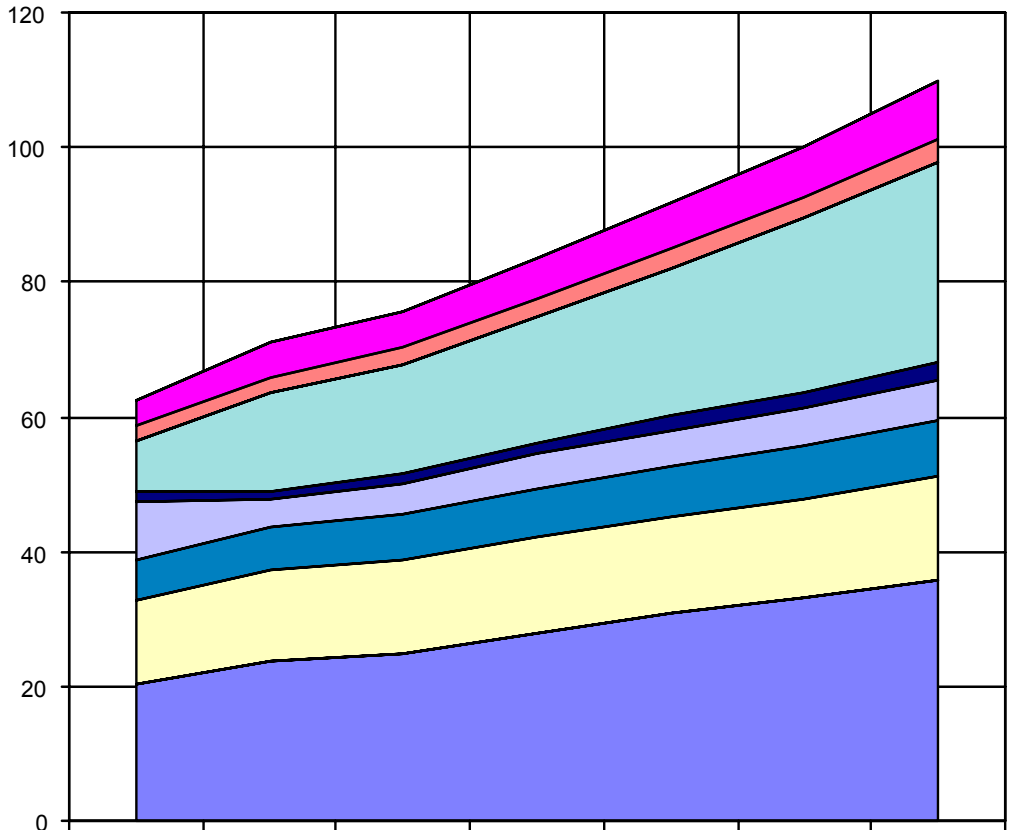
	1970	1990	2000	2005	2010	2015	2020	2025
Total	*206.7	*348.4	*389.9	*433.3	*480.6	*531.7	*583.0	*640.1
Other	12.2	26.4	32.2	37.6	41.5	44.5	37.3	50
Nuclear	0.9	20.3	25.5	27.8	29.1	30.3	29.9	28.6
Coal	59.7	91.6	93.6	100.7	110.9	119.6	128.1	139
Natural Gas	36.1	75	91.4	103	117.5	137.3	158.5	181.8
Oil	97.8	135.1	155.9	164.2	181.7	200.1	219.2	240.7

Source: Adapted by Anthony H. Cordesman from EIA, International Energy Outlook, 2003, DOE/EIA-0484 (2003), March 2003, Table A24, p. 182.

Table 2

EIA Projection of Growth in World Oil Demand: 1990-2025

(EIA Reference Case in MMBD)



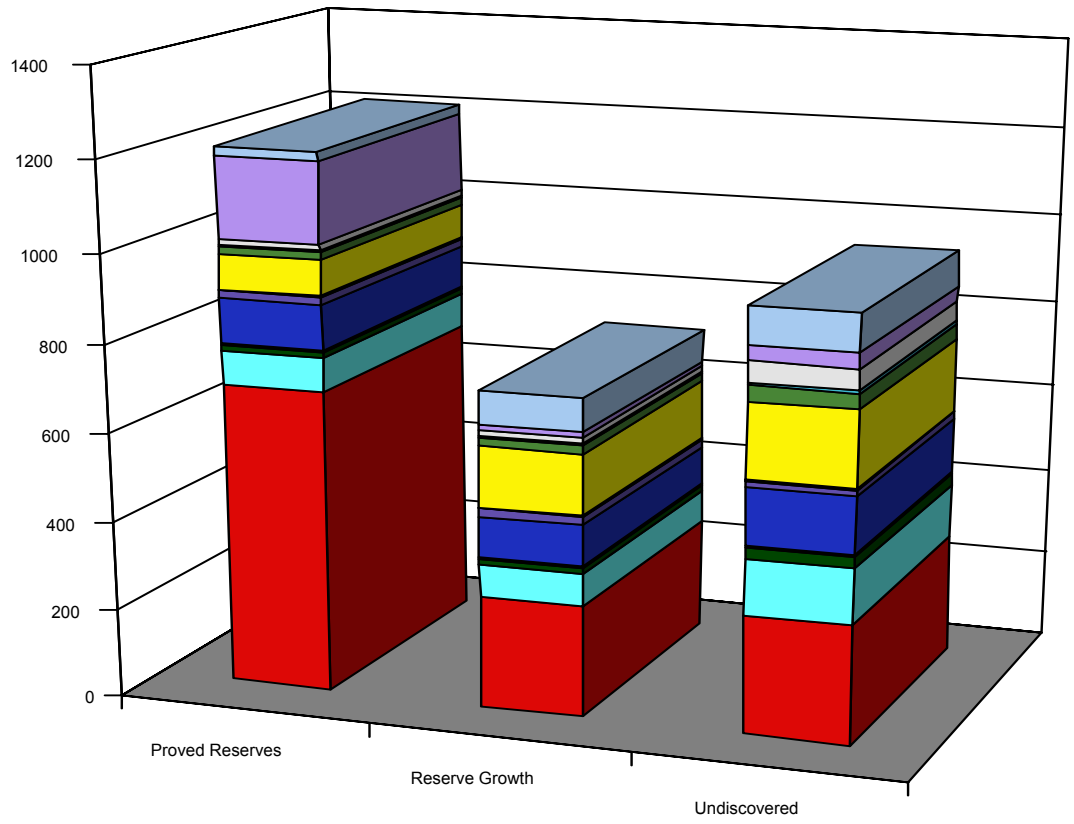
	1990	2000	2005	2010	2015	2020	2025
World	*66.1	*76.9	*81.1	*89.7	*98.8	*108.2	*118.8
Latin America	3.7	5.2	5.4	6	6.7	7.5	8.5
Africa	2.1	2.5	2.5	2.7	2.9	3.2	3.5
(China)	*2.3	*4.8	*50	*5.5	*6.5	*7.7	*8.9
Developing Asia	7.6	14.5	16.1	18.7	22	25.9	29.8
E. Europe	1.6	1.4	1.5	1.7	2	2.2	2.5
FSU	8.4	3.8	4.5	5.1	5.3	5.7	6.2
Jap/Aus/NZ	6	6.5	6.7	7.1	7.5	7.8	8.3
W. Europe	12.5	13.5	14.1	14.4	14.6	14.8	15.3
(US)	*17	*19.7	*20.0	*23.0	*25.2	*27.1	*29.2
North America	20.4	23.8	24.8	27.9	30.7	33.1	35.7

Source: Adapted by Anthony H. Cordesman from EIA, , International Energy Outlook, 2002, DOE/EIAA4 D1.

Table 3

EIA Estimate of World Oil Resources

(In Billions of Barrels)



	Proved Reserves	Reserve Growth	Undiscovered
INDUSTRIALIZED			
US	22.45	76.03	83.03
Canada	180.02	12.48	32.59
Mexico	12.62	12.48	45.77
Japan	0.06	0.09	0.31
Aus/NZ	3.52	2.65	5.93
W. Europe	18.1	19.32	34.58
EURASIA			
FSU	77.83	137.7	170.79
E. Europe	1.53	1.46	1.38
China	18.25	19.59	14.62
DEVELOPING			
C&S America	98.55	90.75	125.31
India	5.37	3.81	6.78
Other Asia	11.35	14.57	23.9
Africa	77.43	73.46	124.72
ME	685.64	252.51	269.19
TOTAL	*1,212.88	*730.05	*939.9
OPEC	*819.01	*395.57	*400.51
Non-OPEC	*393.87	*334.48	*538.39

Source: Adapted by Anthony H. Cordesman from US Department of Energy, International Energy Outlook, 2003, Washington, Energy Information Agency, March 2003, Table 11, p. 37, and usgs.gov/energy/World Energy/DDS-60.

Table 4

IEA Estimate of Oil Reserves, Resources, and Production by County

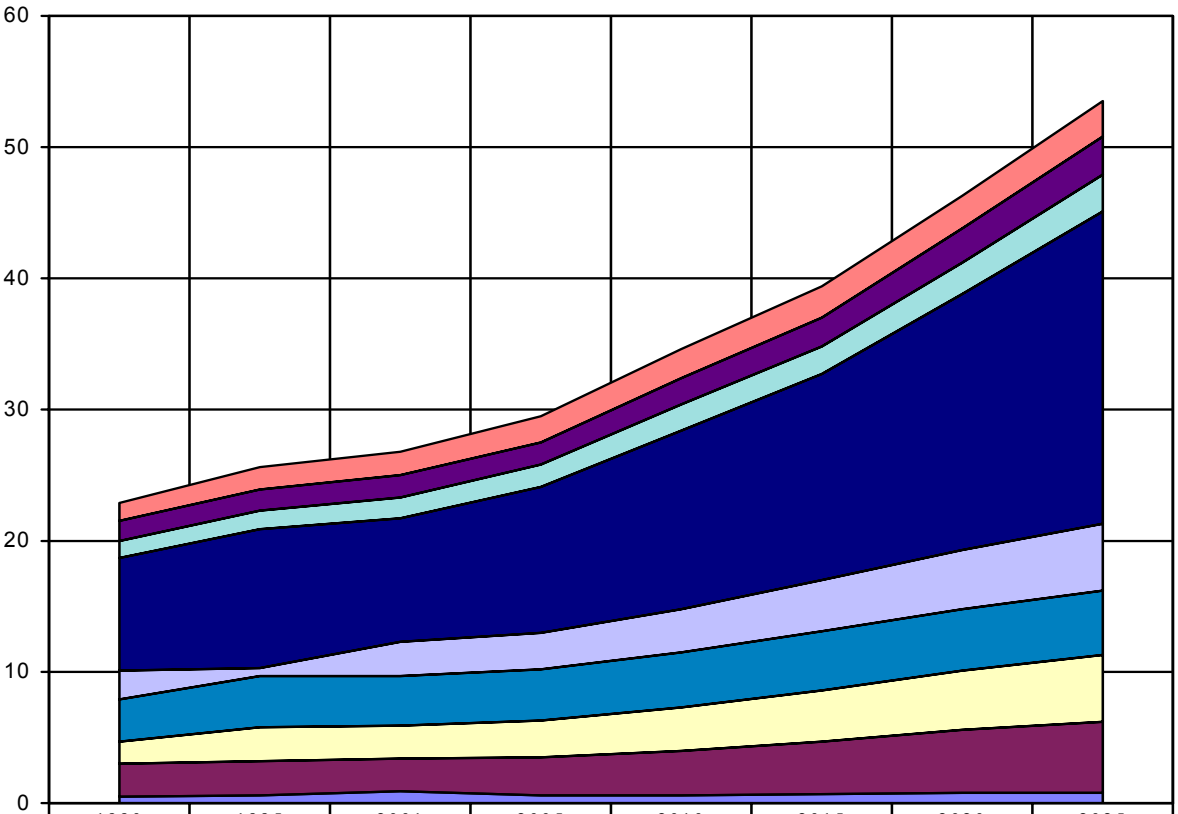
Rank	Country	Remaining Reserves (billion barrels)	Undiscovered Resources (billion barrels)	Total Production (billion barrels))	2001 Production (million barrels)
1	Saudi Arabia	221	136	73	8.5
2	Russia	137	115	97	7.0
3	Iraq	78	51	22	2.4
4	Iran	76	67	34	3.8
5	UAE	59	10	16	2.5
6	Kuwait	55	4	26	1.8
7	US	32	83	171	7.7
8	Venezuela	30	24	46	3.0
9	Libya	25	9	14	1.4
10	China	25	17	24	3.3
11	Mexico	22	23	22	3.6
12	Nigeria	20	25	4	0.8
13	Kazakhstan	20	25	4	0.8
14	Norway	16	23	9	3.4
15	Algeria	15	10	10	1.5
16	Qatar	15	5	5	0.8
17	UK	13	7	14	2.5
18	Indonesia	10	10	15	1.4
19	Brazil	9	55	2	1.4
20	Neutral Zone*	8	0	5	0.6
	Others	73	220	91	16.2
TOTAL		**959**	**939**	**728**	**75.8**

*Kuwait/Saudi Arabia
Note: Estimates include crude oil and NGLs; estimates are taken from the IEA and USGS databases.
Source: International Energy Agency (IEA), World Energy Outlook 2002, Paris, IEA, 2002, p. 97.

Table 5

EIA Projection of Middle Eastern Petroleum Production Capacity By Country Relative to World Capacity: 1990-2025

(EIA Reference Case in MMBD)



	1990	1995	2001	2005	2010	2015	2020	2025
Other	1.4	1.7	1.8	2	2.2	2.4	2.5	2.7
Libya	1.5	1.6	1.7	1.7	2	2.2	2.6	2.9
Algeria	1.3	1.4	1.6	1.7	2	2.1	2.4	2.8
Saudi	8.6	10.6	9.4	11.1	13.6	15.7	19.5	23.8
Iraq	2.2	0.6	2.6	2.8	3.3	3.9	4.5	5.1
Iran	3.2	3.9	3.8	3.9	4.2	4.5	4.7	4.9
Kuwait	1.7	2.6	2.5	2.8	3.3	3.9	4.5	5.1
UAE	2.5	2.6	2.5	2.9	3.4	4	4.8	5.4
Qatar	0.5	0.6	0.9	0.6	0.6	0.7	0.8	0.8
Total Gulf	18.7	-	22.4	24.5	28.7	33.0	38.9	45.2
Total MENA	22.9	-	27.5	29.9	34.9	39.7	46.4	53.6
Total World	69.4	-	79.2	84.2	93.9	103.3	113.5	124.5
Gulf % of World	27.0	-	28.3	29.1	30.6	32.0	34.3	36.3
ME % of World	33.0		34.7	35.5	37.1	38.4	40.9	43.1

Source: Adapted by Anthony H. Cordesman from EIA, International Energy Outlook, 1997, DOE/EIA-0484 (97), April 1997, pp. 157-160; EIA, International Energy Outlook, 2002, DOE/EIA-0484 (2002), March 2002, Table D1; and EIA, International Energy Outlook, 2003, DOE/EIA-0484 (2003), March 2003, Table D1.

Table 6

EIA Estimate of Trends in World Oil Exports By Supplier and Destination: 2001-2025

(Millions of Barrels Per Day)

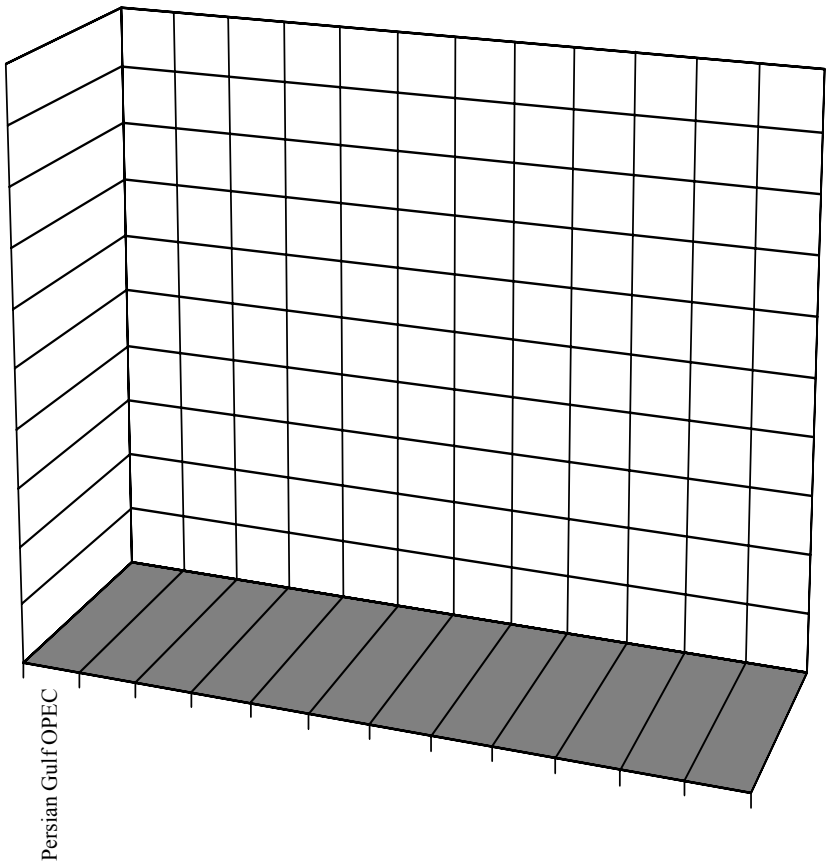
Exporting Region	**Importing Region**							
	Industrialized				Non-Industrialized			
	North	Western	Asia	Total	Pacific	China	Rest of Industrial	Total
2000								
OPEC								
Persian Gulf	2.6	3.2	4.1	9.9	2.7	0.7	1.5	4.9
North Africa	0.3	2.0	0	2.3	0	0	0.1	0.1
West Africa	0.9	0.5	0	1.4	0.1	0	0.1	0.2
South America	1.6	0.2	0	1.8	0.1	0	0.8	0.9
Asia	0.1	0	0.3	0.4	0.2	0	0	0.2
Total OPEC	5.4	5.9	4.5	15.8	3.2	0.7	2.5	6.4
Non-OPEC								
North Sea	0.6	4.7	0	5.3	0	0	0	0
Caribbean Basin	1.8	0.2	0	2.1	0.3	0	2.2	2.5
FSU	0	1.6	0	1.7	0.2	0	0.1	0.3
Other Non-OPEC	2.9	1.3	0.9	5.1	1.9	0.4	1.1	3.4
Total Non-OPEC	5.3	7.8	1.0	14.1	2.4	0.4	3.4	6.2
World Total	**10.7**	**13.7**	**5.4**	**29.9**	**5.6**	**1.1**	**5.9**	**12.5**
2025								
OPEC								
Persian Gulf	6.7	4.5	6.0	16.2	9.4	5.2	5.0	19.6
North Africa	0.4	2.9	0.0	3.4	0.6	0.2	0.6	1.4
West Africa	1.2	1.0	0.3	2.5	1.8	0.3	0.1	2.2
South America	4.3	0.3	0.1	4.7	0.4	0.0	0.3	0.7
Asia	0.1	0.0	0.2	0.3	1.5	0.2	0.11	1.8
Total OPEC	*11,8*	*8.7*	*6.7*	*27.1*	*13.6*	*5.9*	*6.0*	*25.6*
Non-OPEC								
North Sea	0.7	3.4	0.0	4.0	0.1	0.0	0.2	0.3
Caribbean Basin	2.5	0.4	0.1	3.0	0.5	0.0	1.0	1.5
FSU	0.8	4.9	0.8	16.0	4.4	0.4	2.5	7.3
Other Non-OPEC	12.6	2.8	9.6	29.5	5.5	1.8	5.1	12.5
Total Non-OPEC								
World Total	**28.3**	**20.2**	**8.1**	**56.6**	**19.1**	**7.8**	**11.2**	**38.1**

Source: Adapted by Anthony H. Cordesman from estimates in EIA, International Energy Outlook, 2002, DOE/EIA-0484 (2001), March 2002, Table D1, p. 38; and Adapted by Anthony H. Cordesman from EIA, International Energy Outlook, 2003, DOE/EIA-0484 (2003), March 2003, Table 14, p. 42.

Table 6 (Alternative Version)

The Rising Importance Gulf Exports Relative to Other Exports in Meeting World Demand: 2001 versus 2025

(EIA Reference Case in MMBD)



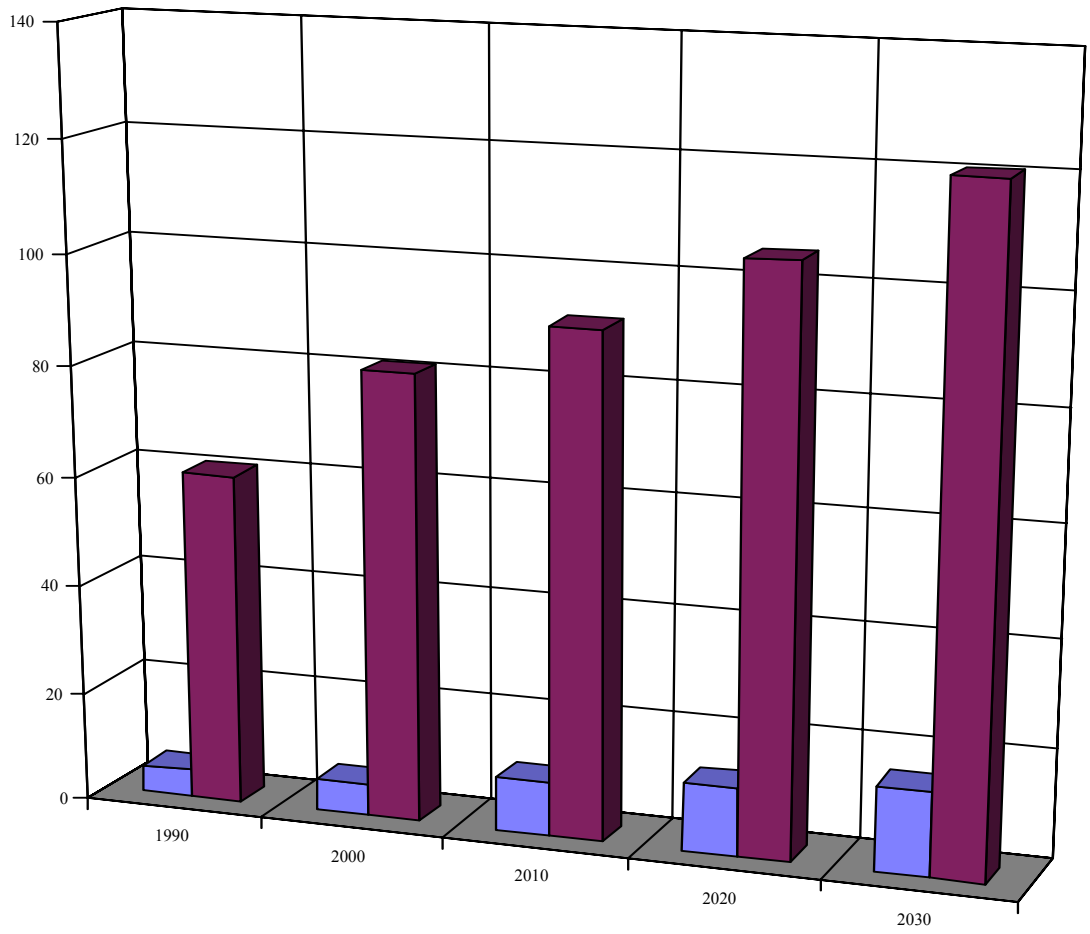
Source: Adapted by Anthony H. Cordesman from EIA, International Energy Outlook, 2002, DOE/EIA-0484 (2002), March 2002, Table 11, p. 38; and Source: Adapted by Anthony H. Cordesman from EIA, International Energy Outlook, 2003, DOE/EIA-0484 (2003), March 2003, Table 14, p. 42.

Table 7

IEA Projection of Middle Eastern Growth in Crude Oil Distillation Capacity: 1990-2025

(in MMBD)

.



	1990	2000	2010	2020	2030
Middle East	5	5.9	10	12.6	15.6
World	60.6	81.5	91.5	105.2	120.6

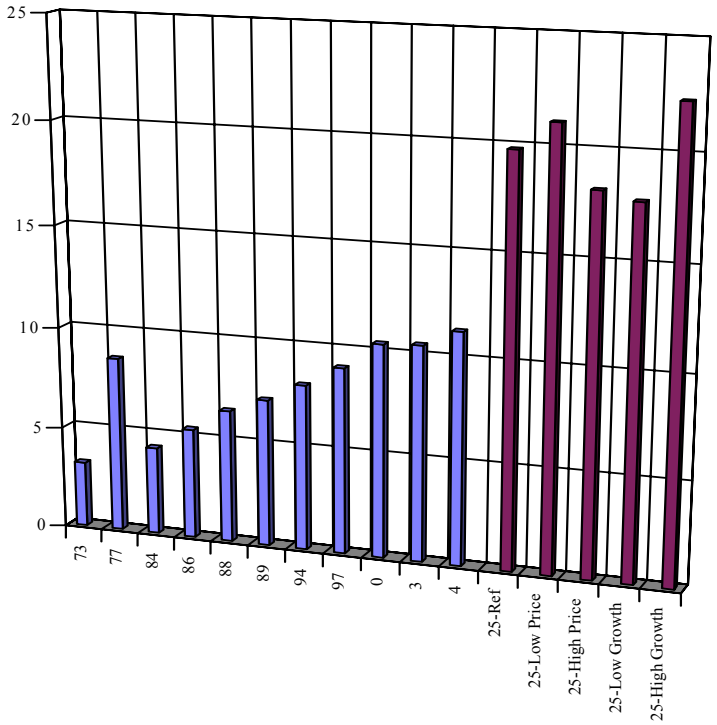
Note: Middle Eastern annual growth is 3.3% during 2000-2030, versus 1.3% for world, 0.6% for OECD North America, 0.4% for OECD Europe.

Source: International Energy Agency (IEA), World Energy Outlook 2002, Paris, IEA, 2002, pp. 102-104.

Table 8

EIA Estimate of Trend in US Oil Imports
(in MMBD)

.



	73	77	84	86	88	89	94	97	0	3	4	25-Ref	25-Low Price	25-High Price	25-Low Growt	25-High Growt
Actual	3.2	8.6	4.3	5.4	6.5	7.2	8.1	9.1	10.4	10.5	11.3					
Estimated												19.8	21.1	18.2	17.8	22.3

Source: EIA, Annual Energy Outlook, 2003, pp. 80-84.

Table 9

MENA and World Gas Reserves and Production

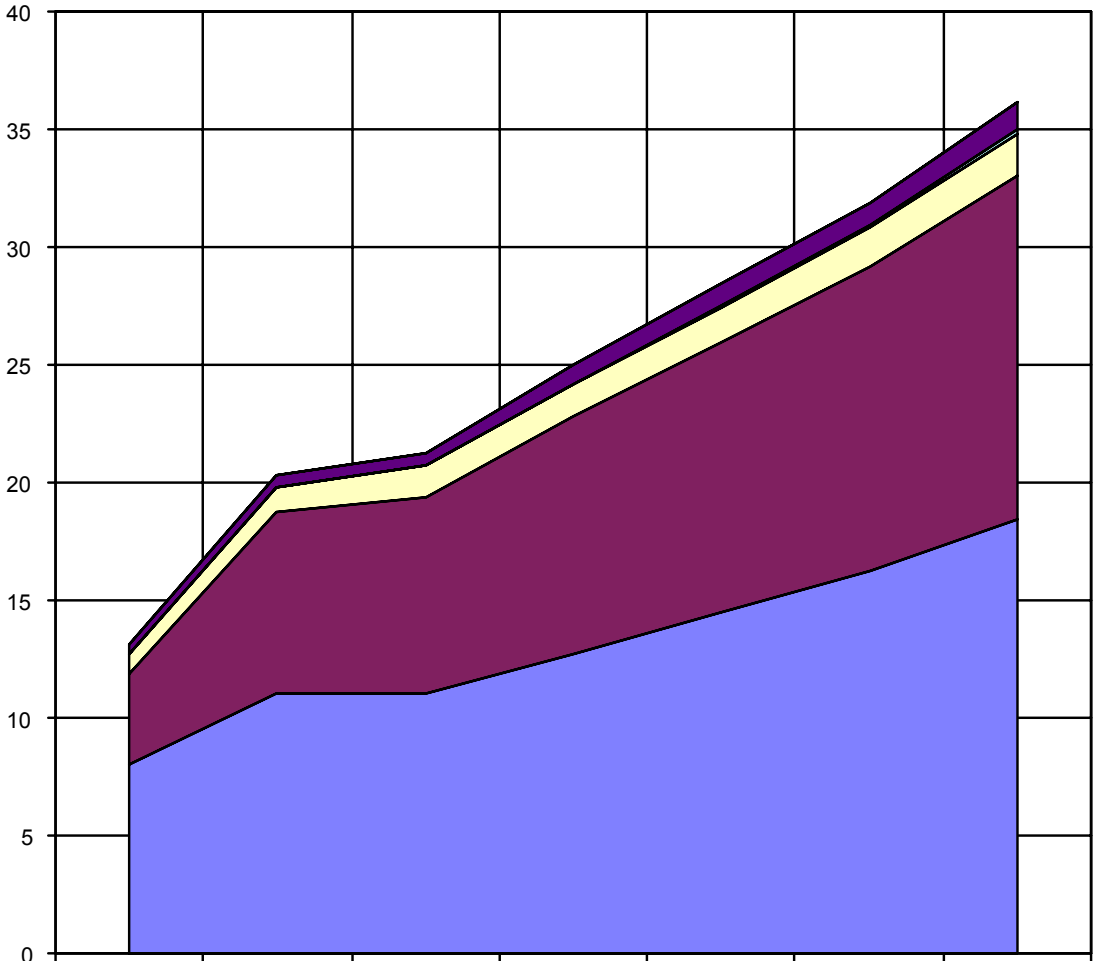
Nation	Reserves in 2000 TCF	Reserves in 2000 TCM	Percent of World Reserves	Production in 2000 - % of World)
Bahrain	0.09	3.3	0.1%	0.4%
Iran	23.00	812.3	14.6%	2.65%
Iraq	3.11	109.8	2.0%	0.3%
Kuwait	1.49	52.7	1.0%	0.6%
Oman	0.82	29.3	0.5%	0.4%
Qatar	14.40	508.5	9.2%	1.2%
Saudi Arabia	6.36	224.7	4.1%	2.2%
Syria	0.24	8.5	0.2%	0.2%
UAE	6.01	212.1	3.9%	1.8%
Yemen	0.48	16.9	0.3%	-
Other	0.05	1.6	-	0.1%
Total Middle East	**56.06**	**1,979.7**	**36.0%**	**9.3%**
Algeria	4.52	159.7	2.9%	3.2%
Egypt	1.66	58.5	1.1%	0.9%
Libya	1.31	46.4	0.8%	0.2%
Total MENA			**40.8**	**12.7**
Russia	47.57	1680.0	30.5%	22.0%
US	5.19	183.5	3.3%	21.7%
EU	3.14	111.0	2.0%	8.3%
Asia/Pacific				11.9%
World Total	**155.78**	**5501.5**	**100%**	**100%**

Source: The reserve and production data are adapted by Anthony H. Cordesman from British Petroleum, BP Statistical Review of World Energy, 2003, London, June 2003, pp. 20-23

Table 10

Diversification of MENA Energy Consumption: 1990-2025

(EIA Reference Case in Quadrillions of BTUs)



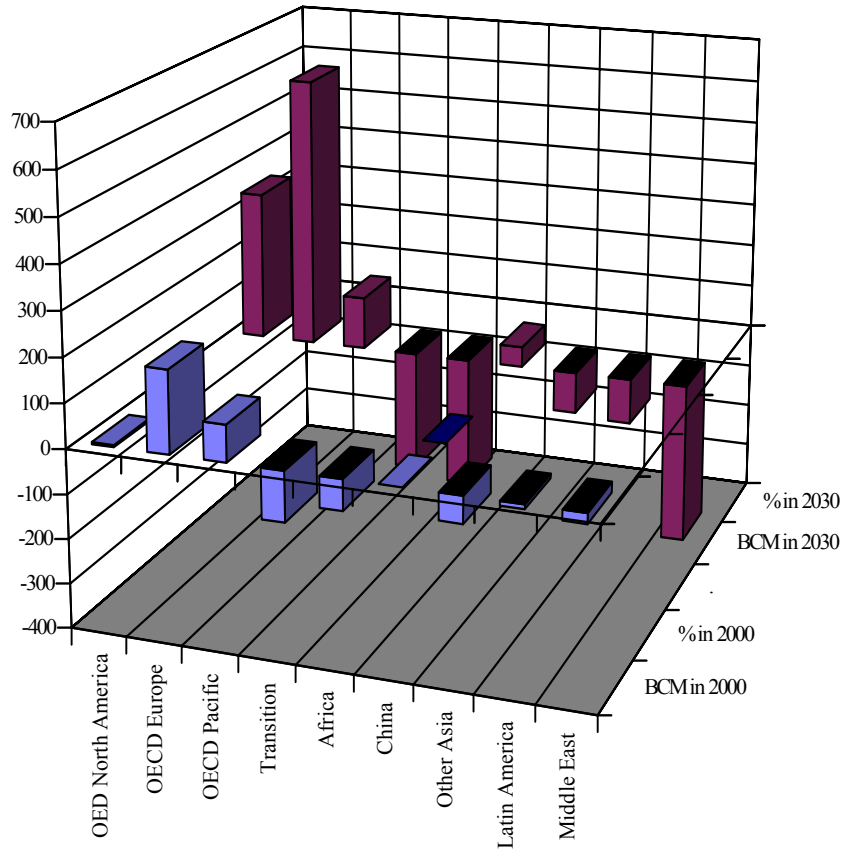
	1990	2000	2005	2010	2015	2020	2025
Total	*13.1	*20.3	*21.4	*25	*28.3	*32	*36
Other	0.4	0.5	0.6	0.8	0.9	1	1.1
Nuclear	0	0	0	0	0.1	0.1	0.2
Coal	0.8	1.1	1.3	1.4	1.5	1.6	1.8
Gas	3.9	7.7	8.4	10.1	11.4	12.9	14.6
Oil	8	11	11	12.7	14.5	16.3	18.4

Source: Adapted by Anthony H. Cordesman from EIA, , International Energy Outlook, 2002, DOE/EIAA4 D1.

Table 11

IEA Estimate of World Gas Import Dependence: 2000 to 2030

(Net Imports in Billions of Cubic Meters (BCM)); Percent is Imports or Exports as Percent of Primary Gas Supply



	OED North America	OECD Europe	OECD Pacific	Transition	Africa	China	Other Asia	Latin America	Middle East
BCM in 2000	5	186	83	-112	-69	0	-60	-10	-23
%in 2000	*1	*36	*67	*-18	*-130	0	*-36	*-9	*-11%
.									
BCM in 2030	345	625	121	-277	-299	47	-94	-103	-365
%in 2030	*26	*63	*50	*-29	*-125	*29	*-19	*-28	*-85

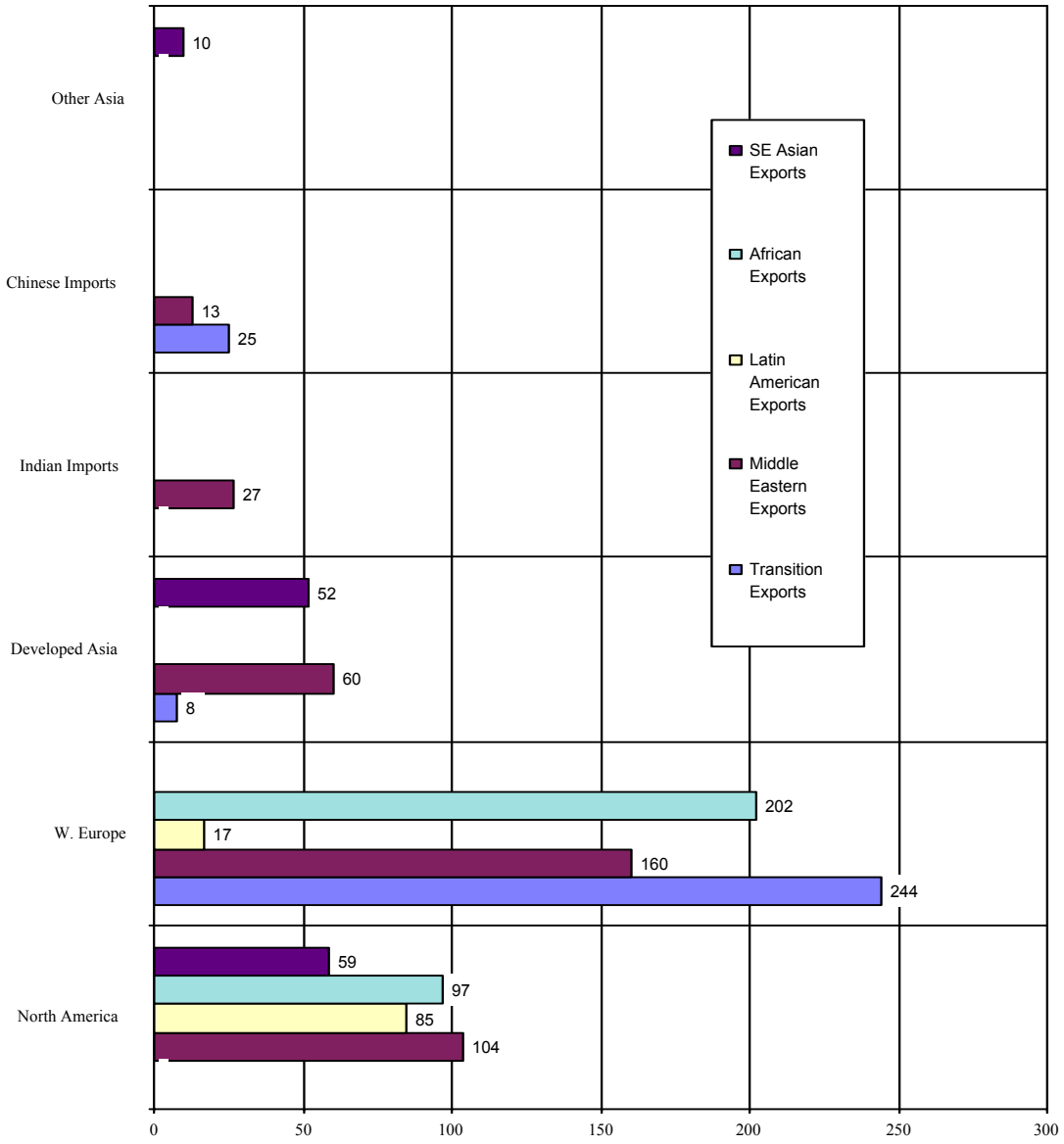
Note: Transition Economics include Russia, other nations of FSU including Central Asia and Caspian, Baltic nations, Eastern Europe, Balkan states, Cyprus, Gibralter, and Malta.

Source: Adapted by Anthony H. Cordesman from IEA, World Energy Outlook, 2002, International Energy Agency, Paris, 2002, p. 117.

Table 12

IEA Projection of Interregional Gas Trade in 2030

(in Billions of Cubic Meters)



Note: Transition = Russia, Central Asia, Caspian, E. Europe, Cypruis, and Malta

Source: International Energy Agency (IEA), World Energy Outlook 2002, Paris, IEA, 2002, p. 119.

[1] Energy Information Agency, *International Energy Outlook, 2003*, Washington, DOE/EIA-0484(2003), May 2003, pp. 18-27.
[2] Ibid., p. 185.
[3] Energy Information Agency, Annual Energy Outlook, 2003, Washington, DOE/EIA-0383(2004), January 2004, p. 68.
[4] BP/Amoco, *BP Statistical Review of World Energy*, (London, BP, 2003), p. 3.
[5] *Energy Information Agency, International Energy Outlook, 2003*, p. 40.
[6] U.S. Geological Survey, *World Petroleum Assessment, 2000*, http://usgs.gov/energy/WorldEnergy/DDS-60. Resources include
[7] International Energy Agency, *World Energy Outlook, 2002 Insights*, (Paris: IEA, 2002), p. 97.
[8] High as these figures are, they are scarcely the maximum, the low-price case estimate is substantially higher. Department of Energy (DOE) estimates that total oil production capacity of the OPEC states of the Persian Gulf will increase from 22.4 mbd in 2001 to 25.8 mbd in 2005, 31.8 mbd in 2010, 38.4 mbd in 2015, 46.6 mbd in 2020, and 54.4 mbd in 2025. Put differently, Gulf OPEC oil production capacity will increase from 26.9 percent of total world capacity in 1990, and 28.3 percent of world capacity in 2001, to 36.0 percent of world capacity in 2015 and 41.6 percent of world capacity in 2025. These figures would be even higher if other non-OPEC "Gulf" oil producer powers like Oman and Yemen were included.

While the Gulf dominates this increase, the EIA also estimates significant increases in oil production capacity in North Africa. Algeria and Libya are estimated to increase their production from 3.3 mbd in 2001 to 3.5 mbd in 2005, 4.2 mbd in 2010, 4.7 mbd in 2015, 5.3 mbd in 2020, and 6.1 mbd in 2025.
[8] If the entire MENA region is considered, oil production capacity will increase from 22.9 mbd in 1990 and 27.5 mbd in 2001 to 31.2 mbd in 2005, 38.1 mbd in 2010, 44.9 mbd in 2015, 54.2 mbd in 2020, and 63.1 mbd in 2025. This would mean that total MENA oil production capacity would increase from 33.0 percent of total world capacity in 1990, and 34.7 percent of world capacity in 2001, to 36.9 percent of world capacity in 2005, 39.8 percent in 2010, 42.0 percent in 2015, 45.8 percent and 48.2 percent of world capacity in 2025.
[9] Energy Information Agency, *International Energy Outlook, 2003*, p. 237.
[10] Ibid.
[11] Ibid.
[12] International Energy Agency, *World Energy Outlook, 2002 Insights*, pp. 91-93; Energy Information Agency, *International Energy Outlook, 2003,* p. 185.
[13] International Energy Agency, pp. 91-93. For a detailed comparison of different estimates, see *Energy Information Agency, International Energy Outlook, 2003*, p. 45.
[14] Energy Information Agency, *International Energy Outlook, 2003*, pp. 235-240.
[15] BP/Amoco, p. 6.
[16] Ibid., p. 18.
[17] Ibid., p. 6.
[18] *Energy Information Agency, International Energy Outlook, 2003*, p. 42
[19] Ibid., p. 237.
[20] BP/Amoco, p. 17.
[21] Ibid.
[22] Energy Information Agency, *International Energy Outlook, 2003*, p. 42.
[23] Energy Information Agency, *Annual Energy Outlook, 2004,* p.68.
[24] International Energy Agency, p. 106.
[25] Ibid., p. 107.
[26] Ibid., p. 103.
[27] Ibid., p. 109.

[28] http://www.eia.doe.gov/fueloverview.html#I, accessed August 8, 2003.
[29] Table 1.7, Overview of U.S. Petroleum Trade, *EIA Monthly Energy Review*, July 2003, p. 15.
[30] Ibid.
[31] EIA, *EIA Short Term Energy Outlook*, August 2003, Table HL-1.
[32] Ibid., p. 80-84.
[33] Energy Information Agency, *Annual Energy Outlook 2004,* p. 95.
[34] EIA, *EIA Short Term Energy Outlook,* August 2003, p. 80-84.
[35] Ibid., p. 80-84.
[36] Energy Information Agency, *Annual Energy Outlook 2004, p.95*
[37] EIA, *EIA Short Term Energy Outlook,* August 2003, p. 80-84
[38] Energy Information Agency, *International Energy Outlook, 2003*, p. 47
[39] BP/Amoco, p. 20.
[40] Ibid., p. 20; Energy Information Agency, *International Energy Outlook, 2003*, p. 49.
[41] Ibid.
[42] Energy Information Agency, *International Energy Outlook, 2003*, p. 50.
[43] International Energy Agency, p. 141.
[44] Ibid.
[45] Energy Information Agency, *International Energy Outlook, 2003*, p. 55.
[46] BP/Amoco, p.9.
[47] Ibid., p.25.
[48] Energy Information Agency, *International Energy Outlook, 2003*, p. 186.
[49] Ibid., p. 185.
[50] Ibid., p. 186.
[51] Ibid.
[52] International Energy Agency, p. 141.
[53] Energy Information Agency, *International Energy Outlook, 2003*, pp. 57-.68.
[54] Ibid., pp. 68-70.
[55] International Energy Agency, p. 117.
[56] Ibid.