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The Growing Importance of Middle Eastern Energy

DRAFT FOR COMMENT AND REVIEW

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March 15, 2004

Acknowledgements

The author would like to thank Jennifer Moravitz, Mehmet Emre Furtun, Stephen Lanier, Adam Whetsone, Daniel Berkowitz, Paul Famolari and Ghada Elnajjar for their help in researching and editing prior work on energy developments in the Middle East and North Africa during past years, and Jennifer Moravitz, Mehmet Emre Furtun, Stephen Lanier for work drawn upon in this study. He would also like to thank his colleagues James R. Schlesinger and Robert Ebel for their advice and help over many years.

This book would also have been impossible to write without the efforts of the Energy Information Agency of the US Department of Energy, and particularly of its country and area analysts. Much of the country and regional analysis is taken from this work by the EIA, and its analysts deserve great credit for consistently excellent reporting over the years. Their work can be readily access via the web at **http://www.eia.doe.gov/emeu/cabs/cabsme.html**.

The work of the International Energy Agency was also of great value, especially in writing the sections on energy investment in Chapter V. Credit should also be given to the many press sources used in researching this book, and particularly to four publications that provide consistently excellent reporting on regional political, economic, and energy developments: the Economist, the Estimate, Middle East Economic Digest, and Middle East Economic Survey. While this book relies primarily on official US government sources, and international organizations like the International Energy Agency and World Bank, for its data and citations, extensive use was made of press sources in researching this analysis.

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I. THE GROWING IMPORTANCE OF MIDDLE EASTERN ENERGY EXPORTS

The Iraq War has removed a tyrant, but it has had little impact on the overall importance and security of Middle Eastern and North African (MENA) energy supplies 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 US energy policies, and energy discoveries in other areas of the world, there have been no meaningful reductions in global and US strategic dependence on Middle Eastern energy exports since the early 1970s, and virtually all projections call for a sharp increase in such dependence between 2004 and 2030.

The MENA region 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 their results differ in detail. There are also many major uncertainties as to the size of the oil and gas reserves in given country, the cost of extracting them, future energy demand, future energy costs, and virtually every other aspect of energy analysis and forecasting.

Most energy experts do, however, agree in broad terms with the data produced by the Energy Information Agency (EIA) of the US Department of Energy (DOE), and the International Energy Agency (IEA). The forecasts and estimates of the work the EIA and IEA also represent the results of one of the few modeling efforts that receive public review and which is supported by large analytic resources. The EIA also annually recalibrates its forecasts and estimates based on its past degree of accuracy.

There are serious limits even in these forecasts. The EIA estimates for the period 2001-2025 are based on demand-driven models, and they tend to exaggerate the increases in world energy use and to understate the costs of providing energy at the projected level of supply. In effect, they estimate the amount of energy the global economy would like, and then find ways to show how energy supplies could increase to meet market needs without becoming unaffordable.

The modeling efforts of most governments and international agencies – such as the International Energy Agency (IEA) and Organization of Petroleum Exporting Countries – present the same problems. Supply-driven models generally project far slower rates of increase in energy supply, or substantially higher prices. Unfortunately, such models are general fun by major oil companies and are proprietary. Their results are not available for public use.

The EIA estimates are likely to be realistic in terms of the role petroleum will play in the world's future energy supply, however, because they assume that future demand for oil and gas will be limited by the impact of other sources of energy, advances in technology, advances in energy efficiency, and the impact of conservation. These estimates forecast a substantial average annual growth in the global consumption of natural gas (2.3-3.5%), coal (0.6-2.2%), nuclear energy (0.7-1.3%), and renewables (1.6-2.4%). They expect major improvements in global efficiency and conservation, and in oil and gas experts from other regions—especially in the developing world, the former Soviet Union, and Eastern Europe. Even so, they still project an annual increase of 1.0-2.6% in the use of oil, and the reference case estimate is 1.7%.

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

There is never any certainty to such estimates of the future role of given sources of energy. It is always possible that some massive technological breakthrough will occur that will sharply reduce the need for oil, or some massive new source of energy resources will be found outside the Middle East. However, ever since the US first sought to reduce its dependence on foreign oil —which took place as part of Project Independence, beginning in the early 1970s -- various experts have promised the solution could come from offshore oil reserves outside the MENA region, or from other sources of energy like fuel cells, shale oil, nuclear power, fusion, geothermal energy, biomass, wind, conservation, and a host of other means.

None of these promises has paid off by altering the fundamental balance of world energy supplies, or by reducing global economic dependence on exports from the MENA region. In fact, thirty years of efforts to find substitutes for MENA energy resources and exports have raised estimates of the percentage of the world's proven oil reserves located in the MENA area, and increased projection of global dependence on MENA exports. One can argue the validity of the way that proven oil reserves are estimated, but BP Amoco estimated that the world had a total of 648.3 billion barrels of reserves in 1978, and that the Middle East and North Africa accounted for 405.7 billion barrels of this total (63%). BP Amoco estimated that the world had a total of 917.8 billion barrels of reserves in 1988, and that the MENA area accounted for 608.1 billion barrels of this total (66%). In 1998, BP Amoco estimated that the world had a total of 1,052.9 billion barrels of reserves, and that the MENA area accounted for 716.2 billion barrels of this total (68%). At the end of 2002, BP Amoco estimated that the world had a total of 1,047.7 billion barrels of reserves, and that the MENA area accounted for 728.3 billion barrels of this total (70%).[2]

Oil Versus Other Sources of energy

It is notable that the highest risks in terms of the gains in the various projections of future sources of energy are in nuclear (because of the perceived safety risk), and in coal (environmental problems). While renewables are often seen as desirable in terms of emissions, virtually all of the projected gain in current projections comes from large hydroelectric plants, which is increasingly seen as posing major environmental risks of a different kind.

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 presently 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.

Such trends only become clear, however, when they are both quantified and portrayed in graphic form. They are too complex to describe in prose alone and the interactions between the trends involved can only be understood by taking the time to compare the numbers and trends developed in different estimates and projections. Like many areas of economics, this may make energy analysis a "dismal science" for those who dislike numbers. As this book illustrates,

however, there is no other way to approach the problem and to illustrate both what estimates predict and the major uncertainties in such estimates.

The following charts and tales illustrate these points, as well as provide an overview of the possible trends in world energy supplies and consumption.

- Chart I.1 shows an estimate by the Energy Information Agency (EIA) of the US Department of Energy (DOE) of world energy consumption by type of fuel through 2025. It projects major increases in the use of hydroelectric and renewable energy (shown as "other"), a more than 100% increase in the use of natural gas, and a roughly 50% increase in the use of coal. The world still, however, nearly doubles its use of oil.

- Chart I.2 shows a similar projection to 2030 by the International Energy Agency (IEA). Hydro increases by nearly 50% in spite of environmental concerns, and renewables nearly triple. Coal use increases by over 50% and the use of natural gas more than doubles. Nevertheless, oil use increases by over 60%.

- Chart I.3 shows that the IEA projects a significantly smaller increase in oil use than the EIA. Nevertheless, oil use is still 39% of all world primary energy consumption in 2030, versus 38% in 2000.

- Chart I.3 shows that the EIA and IEA both model a significant drop in the future rate of increase in oil consumption relative to the past, but that both estimate there will still be a 1.7-1.8% annual increase in oil use over the next 22-27 years.

In terms of actual oil consumption, the EIA estimates that world consumption will rise from 66.1 million barrels per day (MMBD) in 1990, and 76.9 MMBD in 2000, to 81.1 MMBD in 2005, 89.7 MMBD in 2010, 98.8 MMBD in 2015, 108.2 MMBD in 20202, and 118.8 MMBD in 2015. While this is only an average annual increase of 1.8% per year, it amounts to a total increase of 41.9 MMBD between 2000 and 2025 – a cumulative increase of 54%.[3] The EIA's Annual Energy Outlook 2004 (AEO2004) does not provide all of the same detail, but 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.[4]

The actual future will, of course, be different. As has been touched upon earlier, these estimates are based on demand-driven modeling techniques that tend to assume incremental supply is available at moderate prices. Even if they were more realistic in estimating how quickly supply will increase, real world historical trends are never smooth or consistent. By definition, no one can predict a technological breakthrough. No one can predict economic growth or environmental developments with any precision, and extrapolating existing trends in known sources of energy over more than two decades is certain to produce substantial errors.

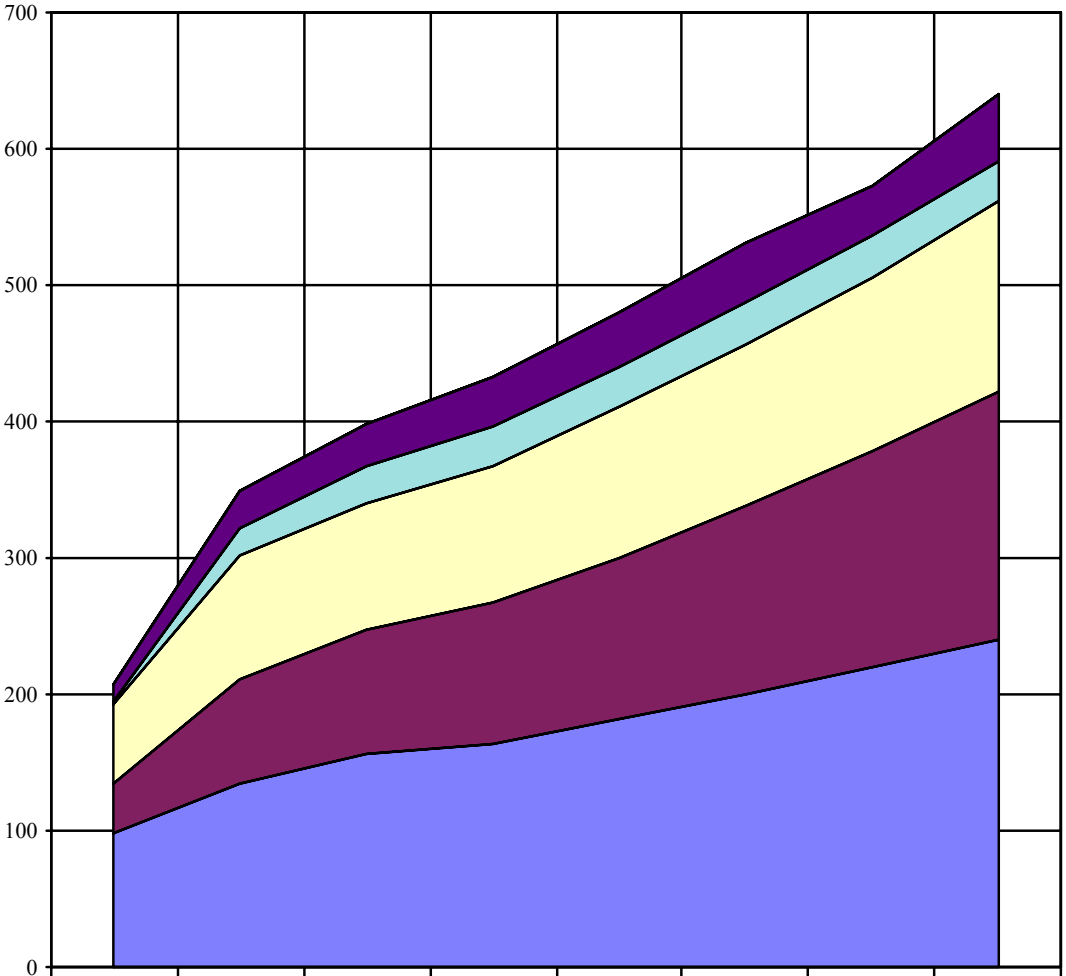
The world's economy does, however, have tremendous momentum. Drastic shifts in the global balance of different types of energy supply involve massive investments in production, transportation, and end-use equipment that are expensive and difficult to accomplish. The world is hard to change in broad structural terms, and most shifts in energy cost, availability, export methods, and technology are incremental and take decades to have a major global impact. It seems doubtful that any of the forces now at work could produce major short term (2003-2010) changes in the broad structure of global energy balances, and there are many reasons why the Middle East will probably continue to dominate the world oil market for the next two decades even if substantial changes took place in global demand.

The MENA area has been, and will continue to be, a critical factor in meeting global demand and in providing oil exports for simple and straightforward reasons. It has more oil, its oil is cheaper to produce, and it has the infrastructure to export energy cheaply and in large amounts. Its cost for additional production are low by comparative standards, and domestic demand for oil in the MENA region is low relative to total production capacity. In fact, if some major breakthrough in other sources of energy or conservation should reduce global demand for oil, higher cost producers in other areas would probably have to cease producing or reduce production first.

Chart I.1

EIA Projection of World Energy Consumption by Type of Fuel: 1970-2025

(EIA Reference Case in Quadrillions of BTUs))



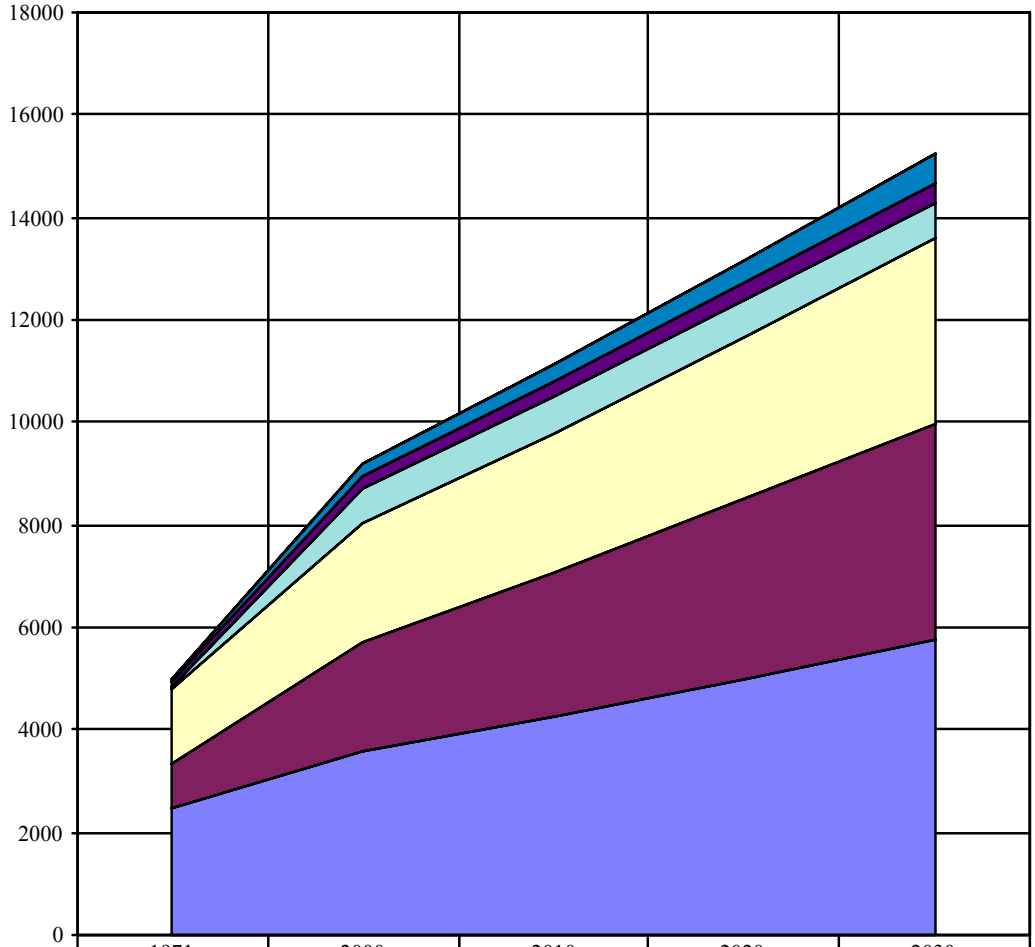
	1970	1990	2000	2005	2010	2015	2020	2025
Total	*206.7	*348.4	*389.9	*433.3	*480.6	*531.7	*583.0	*640.1
Other	12.2	26.4	32.2	37.6	41.5	44.5	37.3	50
Nuclear	0.9	20.3	25.5	27.8	29.1	30.3	29.9	28.6
Coal	59.7	91.6	93.6	100.7	110.9	119.6	128.1	139
Natural Gas	36.1	75	91.4	103	117.5	137.3	158.5	181.8
Oil	97.8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

Chart I.2

IEA Projection of World Primary Energy Consumption by Type of Fuel: 1971-2030

(IEA Reference Scenario in Millions of Tons of Oil Equivalent)



	1971	2000	2010	2020	2030
Total	*4999	*9179	*11132	*13167	*15267
Other Renewables	73	233	336	457	618
Hydro	104	228	274	327	366
Nuclear	29	674	753	719	703
Coal	1449	2355	2702	3128	3606
Natural Gas	895	2085	2794	3531	4203
Oil	2450	3604	4272	5003	5769

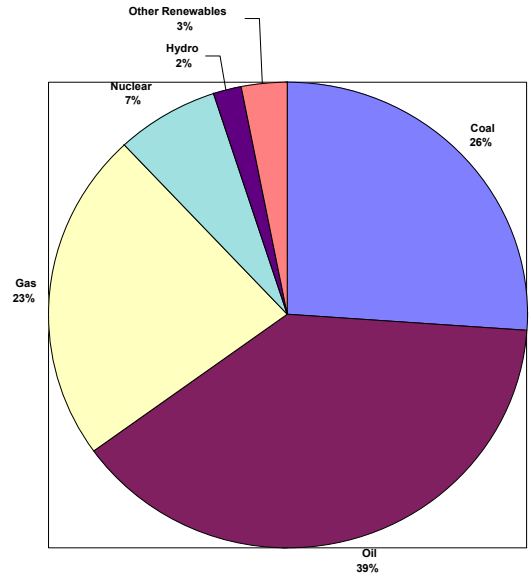
Source: Adapted by Anthony H. Cordesman from: International Energy Agency (IEA), World Energy Outlook 2002, Paris, IEA, 2002, p. 411.

Chart 1.3

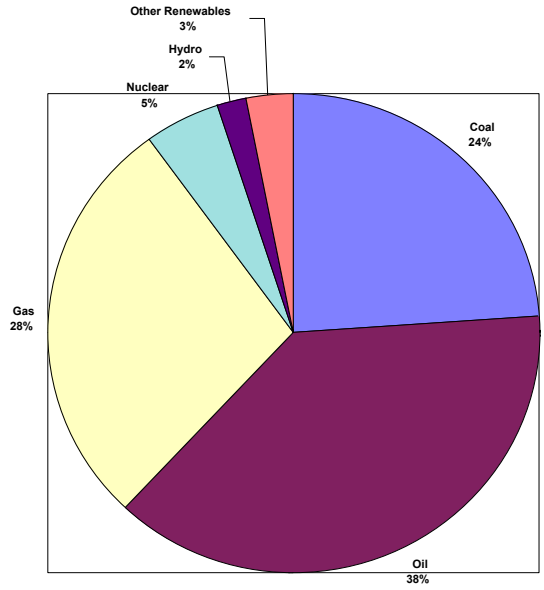
IEA Projection of World Consumption of Primary Energy by Source as Percent of World Total

(In Percent of World Total)

In Year 2000



In Year 2030



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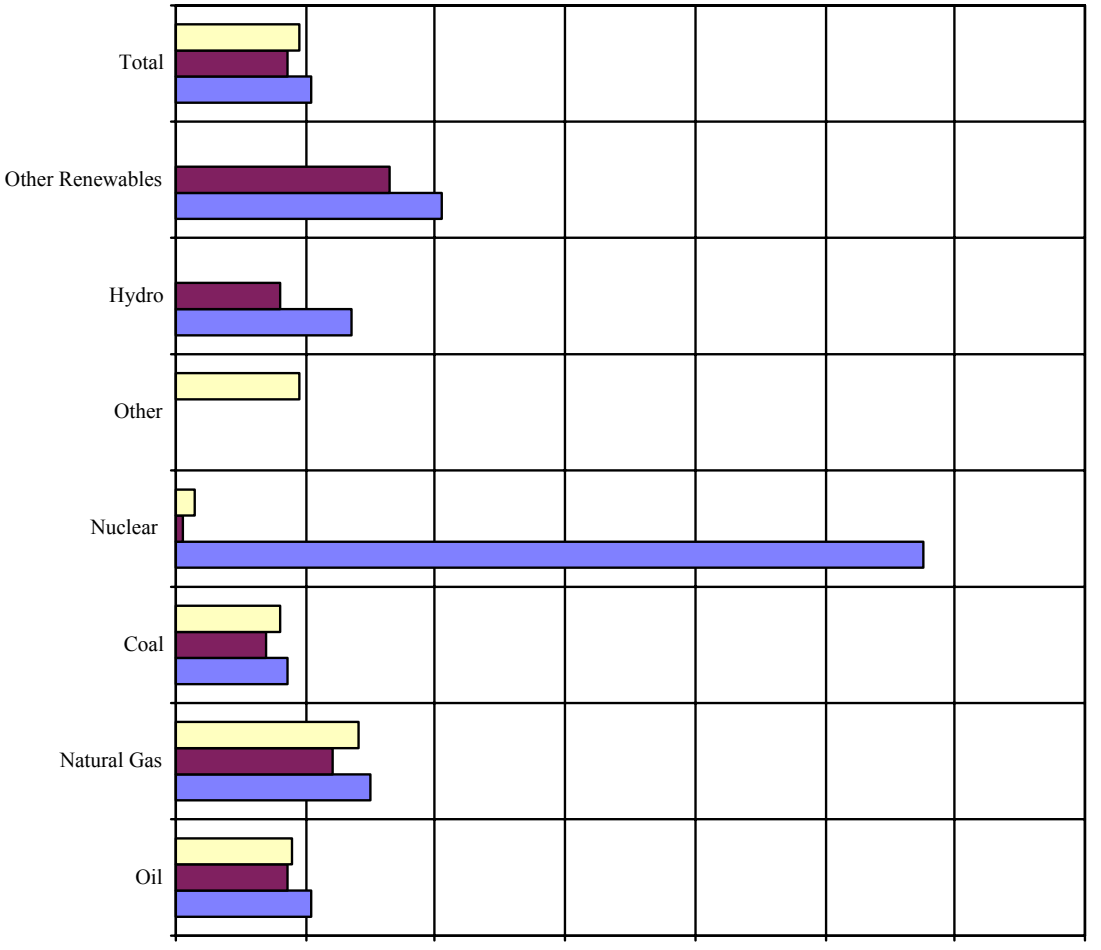
Source: International Energy Agency (IEA), World Energy Outlook 2002, Paris, IEA, 2002, p. 410.

Chart I.4

Comparative EIA and IEA Estimates of Average Annual Percentage of Future Growth of World Energy Consumption by Type of Fuel: 1971-2030

(IEA Reference Scenario in Millions of Tons of Oil Equivalent)



	Oil	Natural Gas	Coal	Nuclear	Other	Hydro	Other Renewables	Total
EIA 2000-2025	1.8	2.8	1.6	0.3	1.9	-	-	1.9
IEA 2000-2030	1.7	2.4	1.4	0.1	-	1.6	3.3	1.7
IEA 1971-2000	2.1	3	1.7	11.5	-	2.7	4.1	2.1

Source: Adapted by Anthony H. Cordesman from: International Energy Agency (IEA), World Energy Outlook 2002, Paris, IEA, 2002, p. 411.

The Size of Middle Eastern and North African Oil Reserves

There are a number of different ways to estimate oil reserves, and there are many debates over the size of probable oil reserves and future discoveries, how to count heavy oil and tar sands, and the rate of future advances in recovery technology. As has been discussed earlier, estimates of the share of the world's total oil reserves that are in the MENA area have increased steadily for a quarter of a century, but some experts question how realistic current estimates of proven and potential reserves really are, and how long the gains from new exploration, drilling, and production technologies can be sustained/

There are also serious debates over how given countries are characterizing and managing their oil reserves, and these involve such key MENA countries as Iraq, Kuwait, Saudi Arabia, and the UAE. Matthew R. Simmons, for example, has challenged current calculations of Saudi oil reserves, and is correct in pointing out that estimates of proven and potential reserves are often issued for political and financial reasons. Certainly, there was a race among Gulf states to increase their claims to proven reserves during the Iran-Iraq War, both to obtain outside aid and to gain political status. Kuwait, for example, claimed its reserves suddenly jumped from estimates of around 65.4 billion barrels in the early 1980s (1982), to around 90.0 billion in 1985. Iran claimed an increase from 58.0 billion barrels in 1982 to 100.0 billion in 1987. Abu Dhabi increased its claims from 58.0 billion to 92.9 billion during this same period. Iraq responded with claims that its reserves increased from 31.0 billion in 1982 to 100.0 billion in 1988, and Saudi Arabia increased its claims from 163.4 billion in 1982 to 257.5 billion in 1989.[5]

In broad terms, however, most experts would agree that the further increases that have taken place in the estimates of the reserves of given Middle Eastern countries since 1990 have large validated such claims, and usually have significantly increased them, based on normal practices in calculating such figures. Such estimates still leave important gaps -- since few MENA countries provide meaningful technical data and key countries like Iran and Iraq have had their exploration and reservoir technology efforts disrupted by war and sanctions – but such uncertainties affect all forms of international statistics and are simply a fact of life. Few in the world's major oil companies would argue with the broad accuracy of BP's estimate that the Middle East has some 65.4% of the world's total reserves of 1.047 billion barrels -- or 69.6% in the North African states of 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 % of the world's reserves, the Levant has 0.2%, and North Africa has 4.2%.[6] Moreover, if one uses the conventional method of estimating proven oil reserves, the broad patterns in the distribution of the world's oil reserves by country have not changed in more than a decade. In fact, unless one counts recent efforts to reclassify Canadian tar sands as part of proven oil reserves, the end result of more than thirty years of exploration since the oil embargo of 1973 has been to increase the Middle East's percentage of proven total world oil reserves.

- Table I.1 shows a BP estimate of the trends in Middle Eastern reserves over the last two decades. It is clear that they have increased consistently over time.
- .
- Chart I.5 shows how Middle Eastern nations rank relative to other leading oil producers in terms of total proven reserves. It illustrates the critical importance of key producers like Saudi Arabia, Iraq, Iran, Kuwait and the UAE.
- Chart I.6 shows the same kind of data, but by region, rather than by country. One striking point is that all FSU reserves – Russia, Caspian, and Central Asia – still total far less than one-tenth of the total Middle Eastern and North African (MENA) reserves. This shows that the FSU cannot act as a substitute for Middle Eastern reserves.

Most departures from the conclusions reached in the BP estimate are the possibility of including Canadian tar sands in estimates of world reserves. Canada has proposed this on the grounds that they can be produced at cost of $16 to $26 per barrel, less transportation. The United states Geological Service (USGS) indicates that recoverable tar sands could be only 20% to 33% of what the Canadian Energy Board claims.[7]

The EIA and has made less ambitious estimates of total oil reserves that consider this issue, and if such sands are included in the pool of proven reserves, the EIA estimates that the share of world reserves would be reduced from some 65% to around 57%. The EIA analysis indicates that the commercialization of Canadian tar sands at this price spread *may* prove to be commercial over time, but that this will take years to fully conform and requires a massive new production and transportation infrastructure. Accordingly, the DOE estimates that even if such a revised estimate proves of world oil reserves does prove valid in real-world economic terms, it will only lead to 2.2 MMBD worth of actual production by 2025, and 1 MMBD of exports to the US.[8] This makes it an interesting possibility, but one that at best has minimal short to mid-term impact.

- Chart I.7 shows how the Middle East's reserves change as a percent of total reserves if Canadian tar sands are counted as proven oil reserves.

The US 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 proved reserves in 1,212.9 billion barrels – substantially higher than the BP estimate. The Middle East has 685.64 billion barrels, or 58% of the total.[9]

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 then have 252.5 billion barrels, or 34.6% of these new discoveries. If one combined proved reserves and reserve growth, the Middle East would have a total of 938.1 billion barrels, or 48% of 1,943 billion barrels. This indicates that the Middle East could shrink as a percent of future world production after 2025.

This would be 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% of this total. If one combines proved reserves, reserve growth, and undiscovered reserves, the Middle East would have 1,207.3 billion barrels, or 42% of a global total of 2,882.9 billion barrels. In short, the Middle East would remain of critical strategic importance but could lose its present level of dominance at some point between 2020 and 2030. An important long-term possibility, but one with little practical importance for current and mid-term energy policy.

- Table I.2 shows the IEA estimate of known and estimated reserves, it should be noted that this estimate differs significantly from the estimate by the EIA. This is an area of major debate and uncertainty, although none of the debates have a material impact on the relative importance of the Middle East.

- Chart I.8 provides similar data based on an EIA estimate, this time by region and subregion.

The International Energy Agency (IEA) uses a mixture of its own databases and the USGS estimates. The IEA calculates total world oil production to date at 718 billion barrels, and annual production in 2001 at 75.8 MMBD. 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.[10]

If one looks at the IEA estimate of the reserves of other major MENA oil producers, they reach the following levels:

- Iraq is estimated to have 78 billion barrels in remaining reserves, and 61 billion barrels in undiscovered reserves (Estimates of Iraq's oil reserves and resources vary widely since only 10% of the country's resources have been explored. Various reports -The Baker Institute, Center for Global Energy Studies, the Federation of American Scientists etc.- indicated that the main deep oil-bearing formations of Iraq located in the Western Desert region, which could contribute addition resources up to 100 million barrels. These resources, however, have not been explored.)
- 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 US is estimated to have 32 billion barrels in remaining reserves, and 83 billion barrels in undiscovered reserves,

Other factors need to be considered in evaluating such estimates of near and mid-term impact of new discoveries on the world oil market. The cost of production from outside the MENA region varies sharply from region to region once one considers reserve growth and undiscovered reserves. Much of the production would have to come from the former Soviet Union, 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.

Table I.1

Middle East and World Petroleum Reserves

(Billions of Barrels)

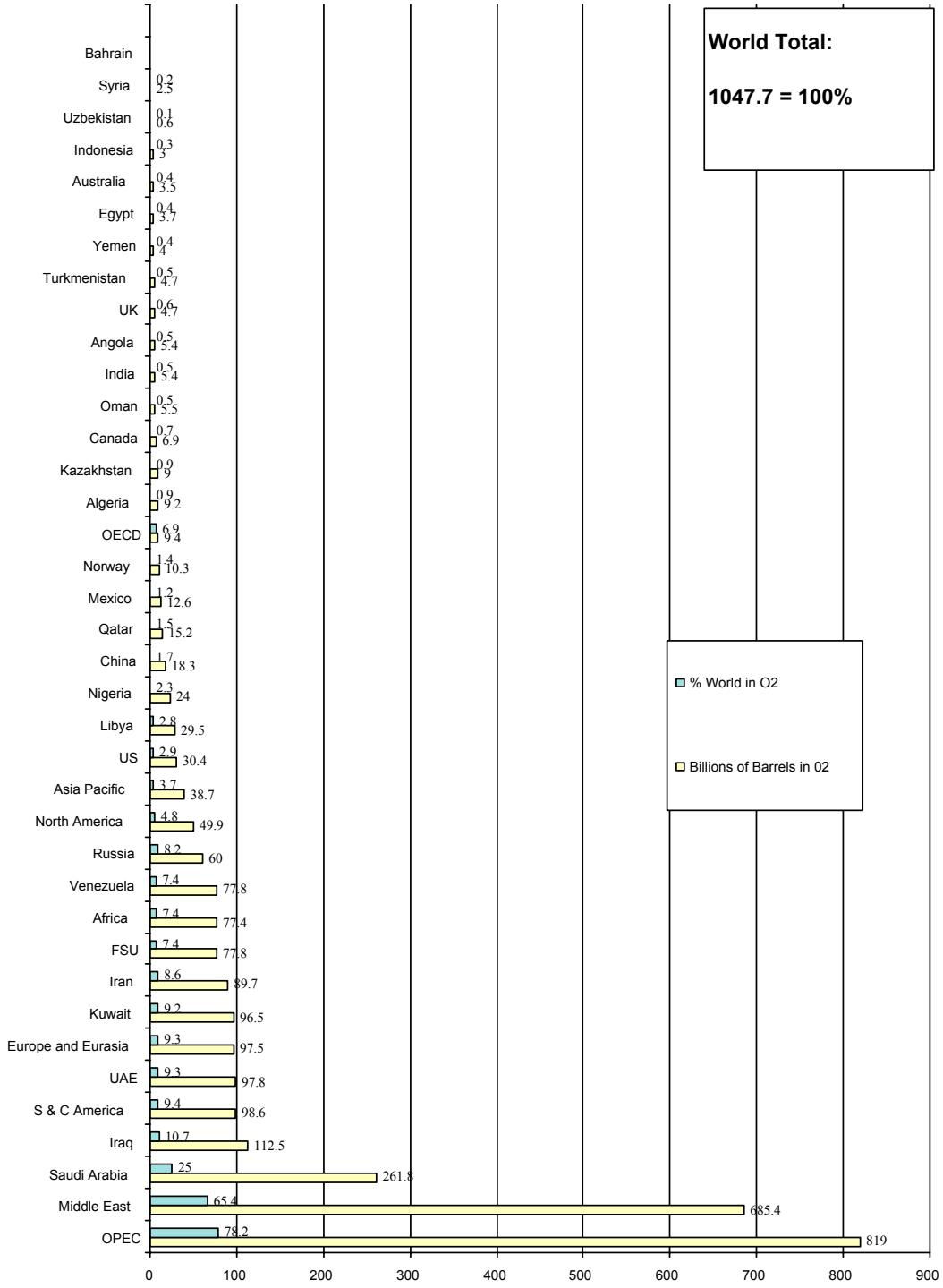
Nation	End 1982	End 1992	End 2002	Percent of World Reserves	R/P Ratio	Production in 2002 - % of World
Bahrain	n/a	n/a	n/a	n/a	n/a	n/a
Iran	55.3	92.9	89.7	8.6	73.8	4.7
Iraq	41.0	100.0	112.5	10.7	>100.0	2.8
Kuwait	67.2	96.5	96.5	9.2	>100.0	2.6
Oman	2.7	4.5	5.5	0.5	16.8	1.3
Qatar	3.4	3.7	15.2	1.5	57.6	1.0
Saudi Arabia	165.3	260.3	261.8	25.0	86.0	11.8
Syria	1.5	1.7	2.5	0.2	11.9	0.8
UAE	32.4	98.1	97.8	9.3	>100.0	3.0
Yemen	-	4.0	4.0	0.4	23.4	0.6
Other	0.2	0.1	0.1	<0.05	7.8	0.1
Total Middle East	369.0	661.8	685.6	65.4	92.0	28.5
Algeria	9.4	9.2	9.2	0.9	16.5	2.0
Egypt	3.3	6.2	3.7	0.4	14.1	1.0
Libya	21.5	22.8	29.5	2.8	59.4	1.8
Tunisia	1.9	1.7	0.3	<0.05	11.2	0.1
Total MENA	405.1	701.7	728.3	69.5	193.2	33.4
Russia	n/a	48.5	60.0	5.7	21.7	10.7
US	35.1	32.1	30.4	2.9	10.8	9.9
Europe/Eurasia	88.8	26.5	35.5	3.6	17.0	11.3
Asia/Pacific	39.2	44.6	38.7	3.7	13.7	10.7
World Total	676.6	1006.7	1047.7	100.0	40.6	100.0

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. 6-8.

Chart I.5

Key Nations in Percent of Total Proven World Oil Reserves in 2002

(Quantity in Billions of Barrels; Percent is Percent of Total World Reserves)

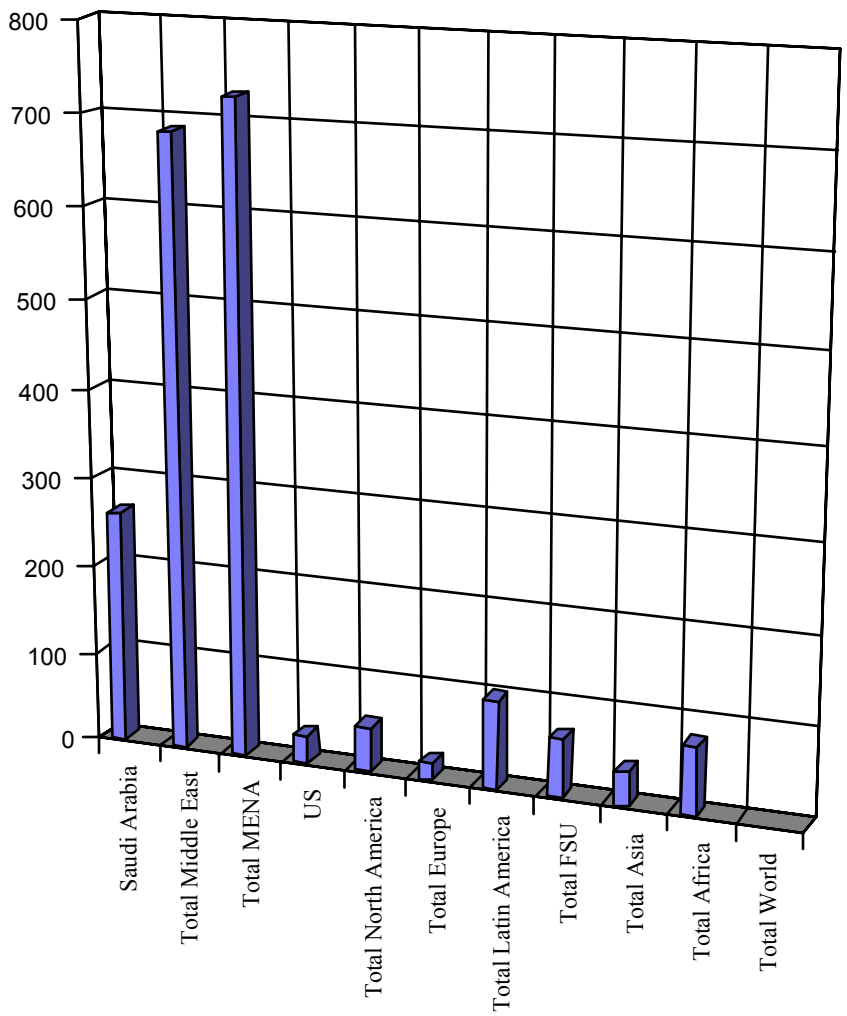


Source: British Petroleum, BP Statistical Review of World Energy, 2002, London, June 2003, pp. 20.

Chart I.6

The Role of Middle East Oil Reserves in Total World Reserves

(In Billions of Barrels)



	Saudi Arabia	Total Middle East	Total MENA	US	Total North America	Total Europe	Total Latin America	Total FSU	Total Asia	Total Africa	Total World
Billions of Barrels	261.6	685.6	725.5	30.4	49.9	19.1	98.6	65.3	38.7	77.4	1047..7
% of World	*25.0	*65.4	*69.3	*2.9	*4.8	*1.9%	*9.4	*6.4	*3.7	*7.4	*100
R/P Ratio	*86	*92	-	*10.8	*10.3	*7.7	*42.0	*22.7	*13.7	*27.3	*40.4

Source: BP Amoco, Statistical Review of World Energy, 2003, June 2003, p. 6.

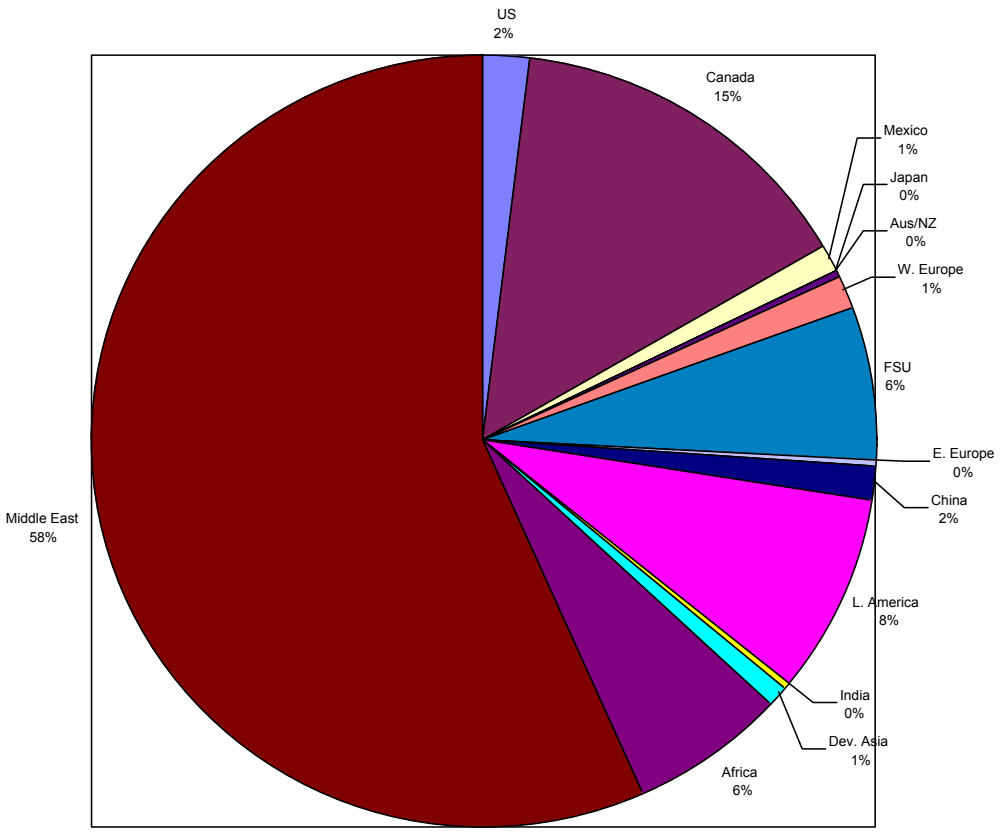
Chart I.7

EIA Estimate of Proven Oil Reserves with Canadian Tar Sands Classified as Crude Oil

(In Percent of World Total)

World Total = $1,212,88 Billion Barrels, OPEC = 819.01 Billion Barrels. Non OPEC Total = 393.87 Billion Barrels

Canadian Reserves = 180.02 Billion Barrels



.

Source: Adapted by Anthony H. Cordesman from EIA, International Energy Outlook, 2003, DOE/EIA-0484 (2003), March 2003, Table 11, p. 318.

Table I.2

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

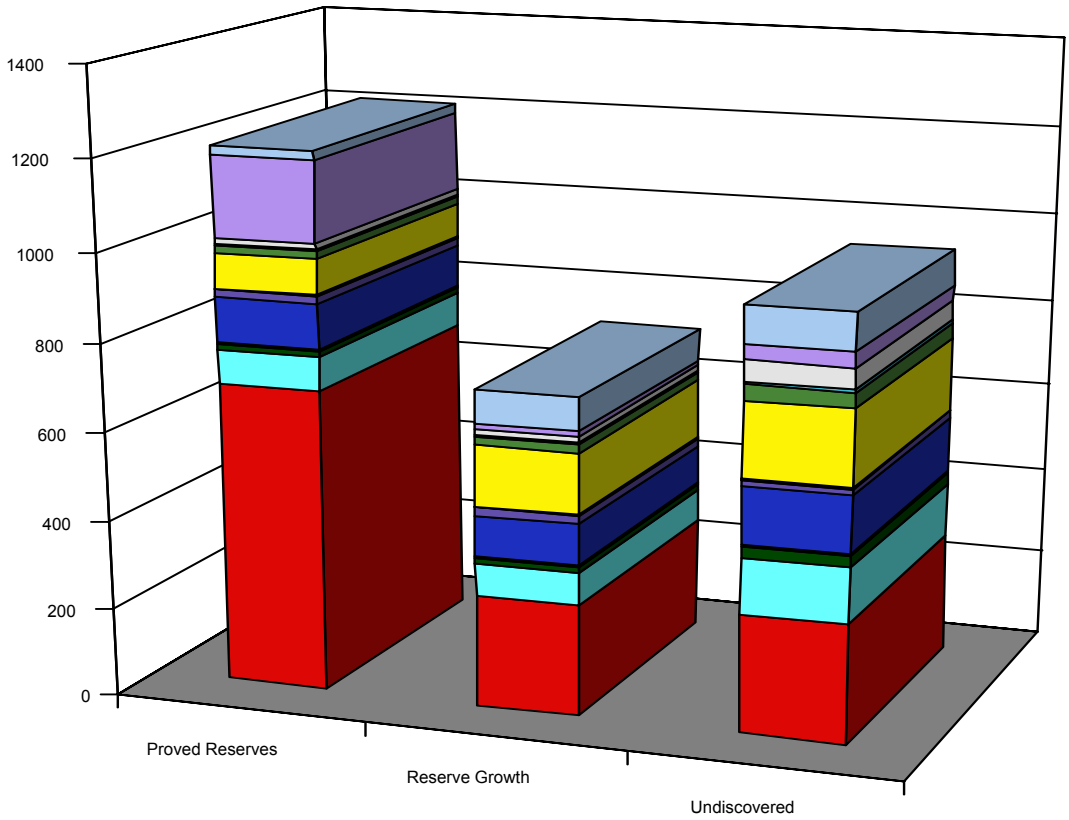
Rank	Country	Remaining Reserves (billion barrels)	Undiscovered Resources (billion barrels)	Total Production (billion barrels))	2001 Production (million barrels)
1	Saudi Arabia	221	136	73	8.5
2	Russia	137	115	97	7.0
3	Iraq	78	51	22	2.4
4	Iran	76	67	34	3.8
5	UAE	59	10	16	2.5
6	Kuwait	55	4	26	1.8
7	US	32	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.

Chart I.8

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.

Projected Increases in MENA Oil Production Capacity Through 2025

Given these factors, it is hardly surprising that most estimates indicate that the MENA region will steadily expand its oil production increase its share of world production, and increase its impact on the global economy through 2025-2030. There are major uncertainties in such estimates, and it must again be stressed that they are based upon demand-driven models that can exaggerate the ease with which major long-term increases can be made in supply at moderate prices, Nevertheless, the reference case of the Energy Information Agency (EIA) of the Department of Energy (DOE) provides what seems to be the most realistic model publicly available, and it does include forecast production from Canadian tar sands and substantial exploitation of enhanced oil recovery and new discoveries outside the Middle East**.**

As a result it is striking that the EIA still estimates that total oil production capacity of the OPEC states of the Persian Gulf alone will increase from 22.4 MMBD in 2001 to 24.5 MMBD in 2005, 28.7 MMBD in 2010, 33.0 MMBD in 2015, 38.96 MMBD in 2020, and 45.2 MMBD in 2025.[11] Put differently, Gulf OPEC oil production capacity will increase from 26.9% of total world capacity in 1990, and 28.3% of world capacity in 2001, to 32.0% of world capacity in 2015 and 36.3% of world capacity in 2025.[12] These figures would be even higher if other non-OPEC "Gulf" oil producer powers like Oman and Yemen were included. Moreover, the EIA's Annual Energy Outlook 2004 estimates that total OPEC oil production will reach 54 million barrels per day in 2025, almost 80 percent higher than the 30 million barrels per day produced in 2002.

Reference Case Estimates of the Increase in Production Capacity

While the Gulf dominates the increase in MENA oil production capacity, the EIA estimates also projects significant increases in oil production capacity in North Africa. Algeria and Libya are estimated to increase their production from 3.3 MMBD in 2001 to 3.4 MMBD in 2005, 4.0 MMBD in 2010, 4.3 MMBD in 2015, 5.0 MMBD in 2020, and 5.7 MMBD in 2025.[13]

If the entire MENA region is considered, oil production capacity is projected to increase from 22.9 MMBD in 1990 and 27.5 MMBD in 2001 to 29.9 MMBD in 2005, 34.9 MMBD in 2010, 37.2 MMBD in 2015, 46.4 MMBD in 2020, and 53.6 MMBD in 2025. This would mean that total MENA oil production capacity would increase from 33.0% of total world capacity in

1990, and 34.7% of world capacity in 2001, to 35.5% of world capacity in 2005, 39.8% in 2010, 40.1% in 2015, and 43.0% of world capacity in 2025.[14]

- Chart I.9 shows the estimated trend in increased oil consumption by region, illustrating the trend in "demand pull" for Middle Eastern exports, particularly in China and developing Asia.
- Chart I.10 shows the historical trend in Middle Eastern oil production, and reveals the differences in annual level that can result from changes in world economic demand.
- Chart I.11 shows the EIA's projection of future increases in oil production by region. It is clear that the projected increases in Middle Eastern capacity shape the curve.
- Chart I.12 shows the EIA's projection of increases in Middle Eastern oil production capacity by country, illustrating the critical importance of Saudi Arabia, and the role of Iran, Iraq, Kuwait, and the UAE.
- Chart I.13 illustrates the impact of different economic and oil price conditions on the estimated rate of increase in Middle Eastern oil production capacity, illustrating one of the key uncertainties involved.

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 average of 1.6% during 2000-2030. This compares with 1.8% for the EIA over the period from 2000-2030.[15] Other sources do reflect more serious differences in the estimate of the coming shifts in demand for oil. For example, similar estimates by Shell call for 1.1% average annual growth, and DRI/WEFA for 2.2% growth, [16]

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

- Chart I.14 shows the IEA's estimate of the increase in oil production by region through 2030. It is measured by a different model and set oil definitions than the EIA estimate, but clearly reveals the same increase in Middle Eastern capacity relative to the rest of the world.

Key Uncertainties in Estimates of Increases in Production Capacity

It should be stressed that it is highly likely that the MENA area will not make all of these production increases at the level that the EIA and IEA estimate and that their estimates of future

energy costs may provide a better model of what the market wants than what countries are capable of supplying or are willing to sell at such prices. As has been noted from the start, these projected increases in production capacity are based on economic models that assume MENA 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 the related projections of increases in exports – much more uncertain than they would be.

There are dangers in estimating and modeling the behavior of countries before the countries involved have made any clear decision about their future plans. Most countries in the region only have limited long-range plans to would be if the countries involved had either declared they would make such increases of that it was in response to market forces. At the same time, most countries in the region have never made serious long-range plans to expand production capacity and most have reacted to market forces although few have risked anticipating them. A country-by-country review of current plans and energy strategies also shows that no MENA country has a credible long-term (2005+) energy plan. There simply is no valid basis for making "supply-based" estimates as distinguished form "market-driven" or "demand-based" estimates.

There are many technical uncertainties in estimating the size and character of oil reserves, and the cost of maintaining and expanding production. Errors of 20% or more can easily occur in projecting the mid and long-term nature and behavior of a given field, particularly when countries have not updated their exploration, testing, and management techniques. Abu Dhabi, Iran, Iraq, Kuwait, Libya, Oman, and Yemen are all examples of MENA states that have demonstrated in the past that they have questionable capability to accurately characterize their reserves and execute oil field development and increase production on a "best practices" basis, although most of these countries do at least approach international standards.

It is equally important to note that market forces are only one of the factors that have shaped MENA behavior. MENA region has been the scene of more than ten conflicts and major internal security struggles over the last two decades, and that the production capacity and exports of several states have been affected by UN and US sanctions. As a result, it is important to

review the assessments of estimated increases in production by country and understand that the expansion in each country involves both economic aid and some security risks.

Even if one only considers economic factors, one can also produce very different estimates. The EIA reference case projection for 2025 does estimate increases by OPEC country under different economic conditions, which are summarized as the "high oil price" (high demand, lesser supply) and "low oil price" (lower demand, higher supply) cases. The resulting EIA projections can be summarized as follows (the minimum and maximum range provided in other projection is shown in parenthesis):[17]

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

As is touched upon above, the variations shown in parenthesis reflect the impact of different projections of 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 these differences in perspective, the reference case estimates project the OPEC Gulf nations to have a total production capacity of 45.2 MMBD in 2025 – a rise of over 100% above the 2001 level. The low-end estimate would be 37.0 MMBD and the high-end estimate

would be 54.5 MMBD. If North Africa and the rest of the Middle East are considered separately, they would increase in the reference case from 4.7 MMBD in 2001 to 8.4 MMBD in 2025 – a rise of 78%. The low estimate in 2025 would be 7.9 MMBD. The high estimate would be 8.6 MMBD. The reference case estimate for the entire MENA area would be 53.6 MMBD. The range would be from a low of 44.9 MMBD to a high of 63.1 MMBD.

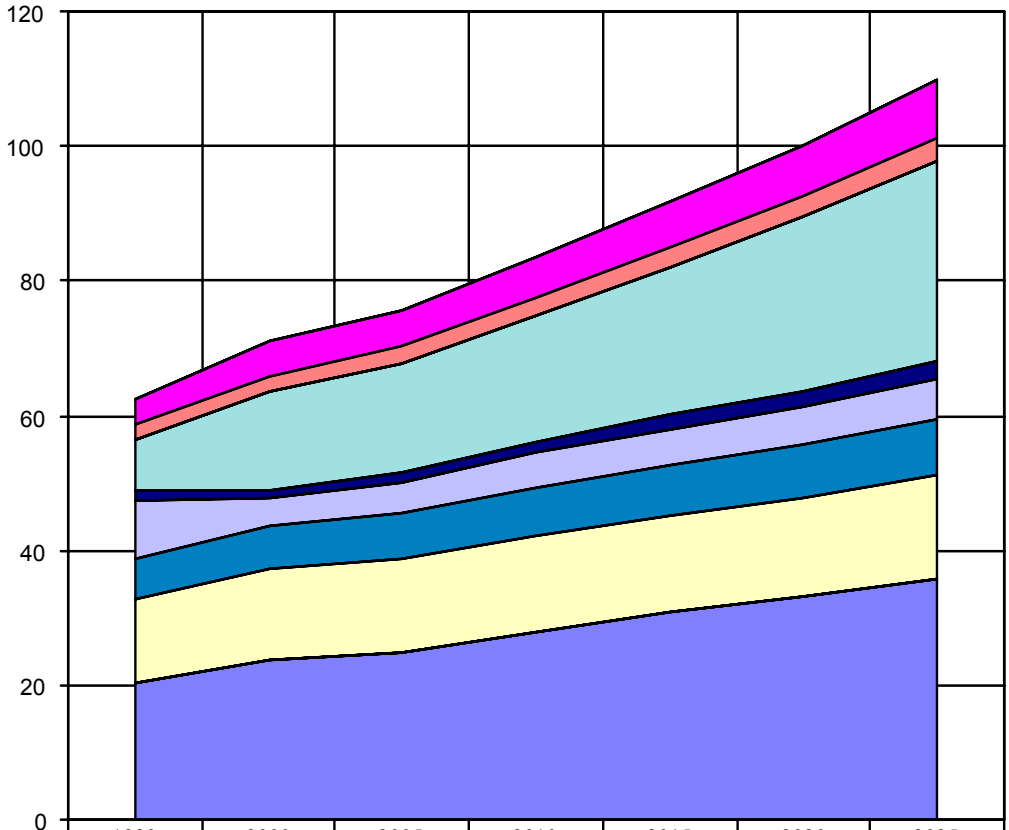
Once again, simply modeling uncertainty does not mean that the resulting conclusions establish the boundaries of the problem. Many in the oil industry feel that all of the EIA and IEA estimates of future production capacity are too high and that the countries in the region will be much slower to increase production. It should also be noted that several real-world trends do not conform to the EIA and IEA projections even in the short term. Iraqi oil production was only 800,000-1,200,000 MBD 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, and 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 it does mean that there are security as well as market risks, and that future production and export capacity is as much an energy risk as embargos or temporary interruptions in production.

Yet, such uncertainties have little strategic impact on the importance of the MENA region. The sources of current and increased oil production in other regions—the FSU, Latin America, and West Africa—are all subject to the same general uncertainties as those in the MENA area. The countries involved have been at least as affected by poor state planning and development, and conflict and internal instability, as the MENA area. Energy comes from a risk-filled worlds, and only truly massive and lasting shifts in the pattern of regional oil exports have true strategic importance.

Chart I.9

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

(EIA Reference Case in MMBD)



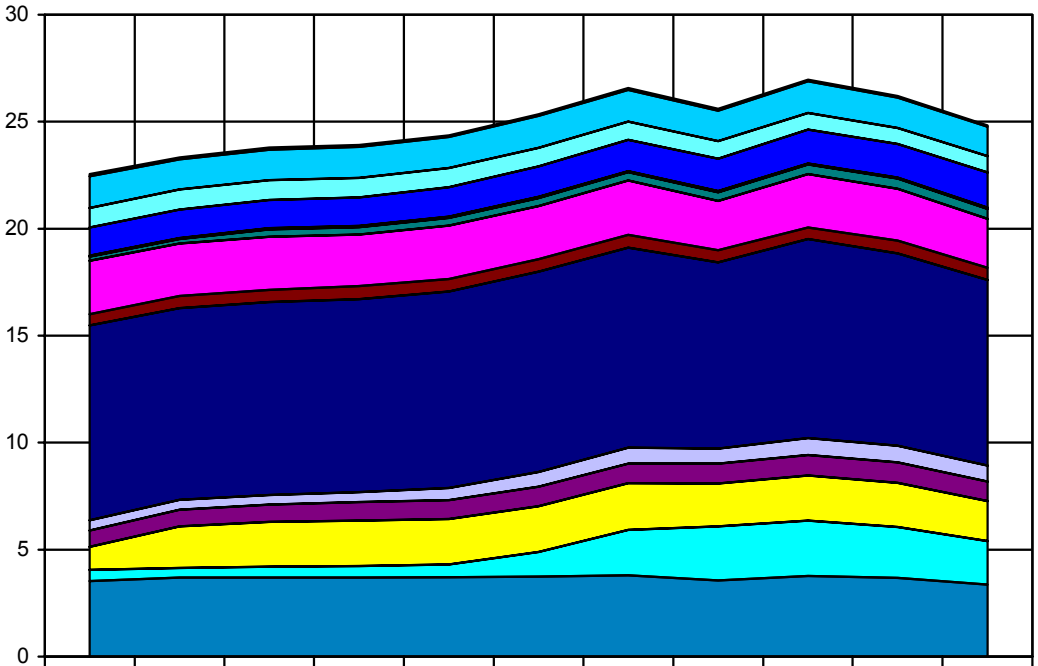
	1990	2000	2005	2010	2015	2020	2025
World	*66.1	*76.9	*81.1	*89.7	*98.8	*108.2	*118.8
Latin America	3.7	5.2	5.4	6	6.7	7.5	8.5
Africa	2.1	2.5	2.5	2.7	2.9	3.2	3.5
(China)	*2.3	*4.8	*50	*5.5	*6.5	*7.7	*8.9
Developing Asia	7.6	14.5	16.1	18.7	22	25.9	29.8
E. Europe	1.6	1.4	1.5	1.7	2	2.2	2.5
FSU	8.4	3.8	4.5	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.

Chart I.10

Middle Eastern Petroleum Production By Country: Part One: BP Estimate for 1992-2002

(MMBD of Crude Oil, Tar Sands, Shale Oil, and NGLs)



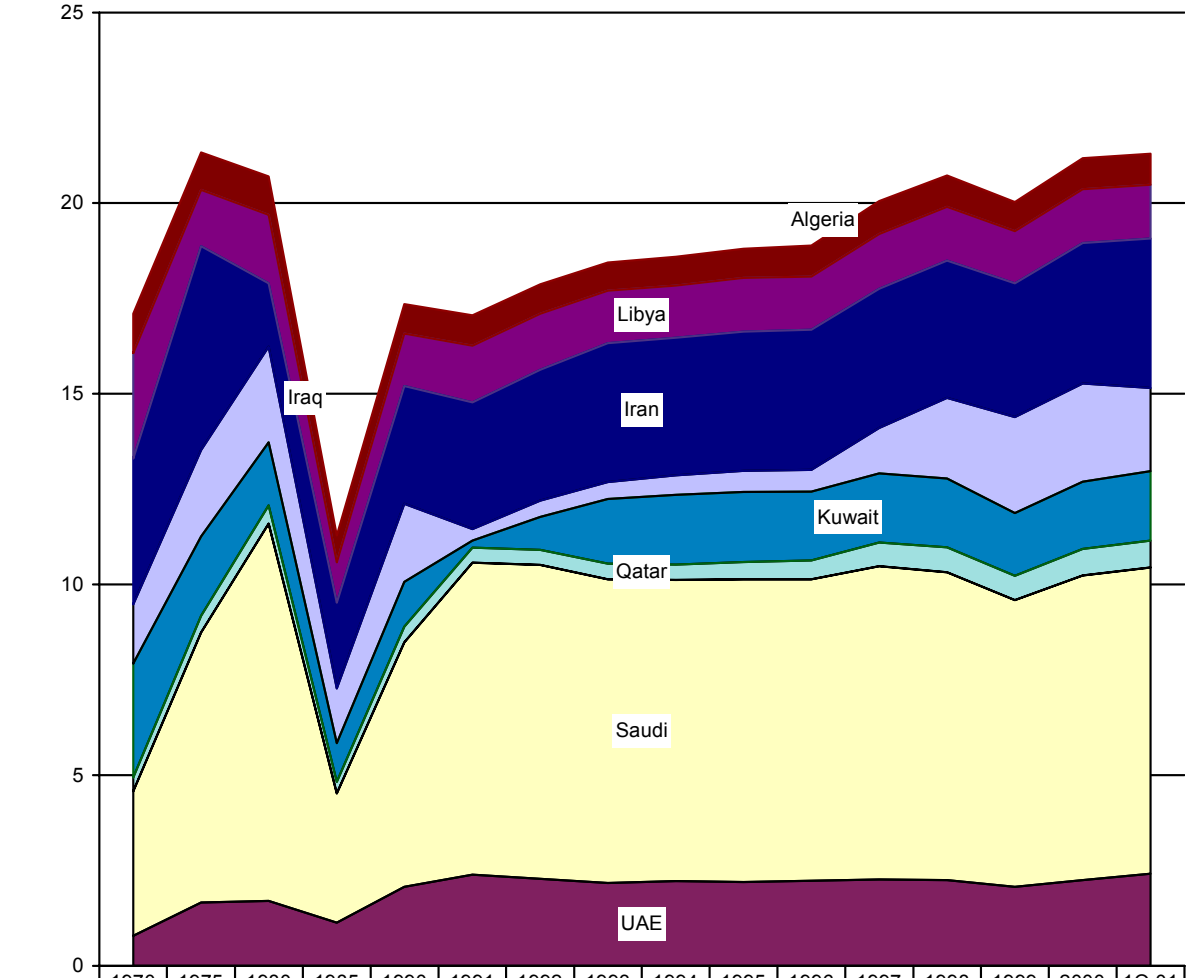
	92	93	94	95	96	97	98	99	0	1	2
Tunisia	0.11	0.099	0.093	0.09	0.089	0.081	0.085	0.086	0.08	0.073	0.076
Libya	1.473	1.402	1.431	1.439	1.452	1.489	1.48	1.425	1.475	1.425	1.376
Egypt	0.906	0.941	0.921	0.924	0.894	0.873	0.857	0.827	0.781	0.758	0.751
Algeria	1.323	1.329	1.324	1.327	1.386	1.421	1.461	1.515	1.579	1.562	1.659
Other	0.054	0.053	0.052	0.052	0.05	0.05	0.049	0.048	0.049	0.049	0.049
Yemen	0.184	0.209	0.346	0.351	0.357	0.375	0.38	0.405	0.45	0.471	0.473
UAE	2.51	2.443	2.482	2.41	2.495	2.49	2.556	2.299	2.492	2.429	2.27
Syria	0.518	0.57	0.568	0.601	0.591	0.582	0.58	0.583	0.554	0.587	0.576
Saudi	9.098	8.962	9.023	9.032	9.18	9.361	9.37	8.694	9.297	8.992	8.68
Qatar	0.495	0.46	0.451	0.461	0.568	0.694	0.747	0.724	0.796	0.779	0.755
Oman	0.748	0.785	0.819	0.868	0.897	0.909	0.905	0.911	0.959	0.961	0.902
Kuwait	1.077	1.945	2.085	2.13	2.129	2.137	2.176	2	2.105	2.069	1.871
Iraq	0.531	0.455	0.505	0.53	0.58	1.166	2.126	2.541	2.583	2.371	2.03

Source: Adapted by Anthony H. Cordesman from Source: British Petroleum, BP Statistical Review of World Energy, 2001, London, June 2003, pp. 7.

Chart I.11

Middle Eastern Petroleum Production By Country: Part Two: CEA Estimate of Historical Trends in Middle Eastern Oil Production: 1970-2001

($Current Billions)



	1970	1975	1980	1985	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	1Q 01
Algeria	1.03	0.98	1.01	0.7	0.77	0.8	0.77	0.74	0.75	0.76	0.82	0.86	0.83	0.76	0.81	0.82
Libya	2.76	1.48	1.79	1.06	1.38	1.48	1.47	1.37	1.37	1.41	1.39	1.44	1.41	1.38	1.41	1.41
Iran	3.83	5.35	1.66	2.25	3.09	3.33	3.43	3.65	3.61	3.65	3.67	3.64	3.6	3.5	3.69	3.92
Iraq	1.55	2.26	2.51	1.43	2.04	0.3	0.43	0.44	0.51	0.55	0.57	1.2	2.11	2.52	2.57	2.18
Kuwait	2.99	2.08	1.66	1.02	1.18	0.19	0.86	1.69	1.83	1.84	1.81	1.81	1.8	1.65	1.77	1.82
Qatar	0.36	0.44	0.47	0.3	0.41	0.39	0.4	0.42	0.4	0.45	0.49	0.62	0.66	0.63	0.69	0.71
Saudi	3.8	7.08	9.9	3.39	6.41	8.18	8.23	7.96	7.9	7.94	7.91	8.22	8.07	7.52	8	8.03
UAE	0.78	1.66	1.7	1.13	2.07	2.39	2.28	2.17	2.22	2.2	2.23	2.26	2.25	2.07	2.24	2.41

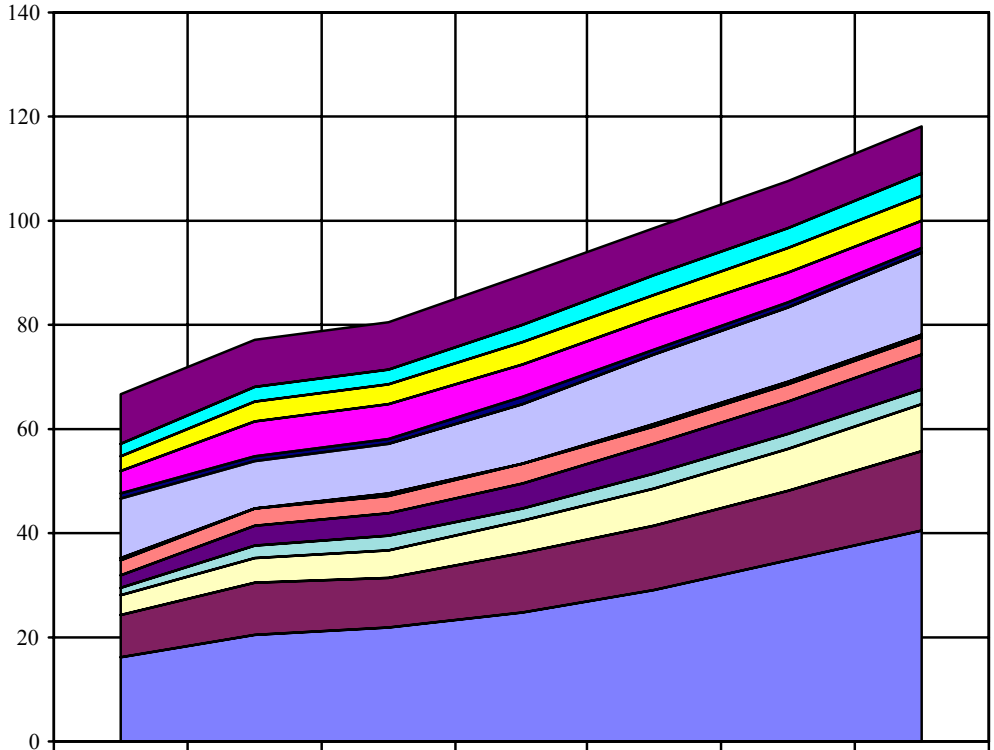
Total ME OPEC*	13.31	18.87	17.91	9.53	15.19	14.77	17.87	18.44	18.59	18.8	18.89	20.05	20.73	26.61	27.92	28.38
Total ME*	13.95	19.57	18.40	10.25	16.49	16.19							23.47			

Adapted by Anthony H. Cordesman from Cambridge Energy Associates, World Oil Watch, 2000, Cambridge, Mass., 2000, p. 26.
*Pre-1992 data: CEA, World Oil Trends, 1998, Cambridge, Mass., 1998, pp. 26-27. 1992-1998: the IEA, Oil Market Report, May 11, 2000, p. 45, After 1998: the IEA Oil Market Report, May 11, 2001, p. 52.

Chart I.11

EIA Projection of World Production Capacity By Region: 1990-2025

(EIA Reference Case in MMBD)



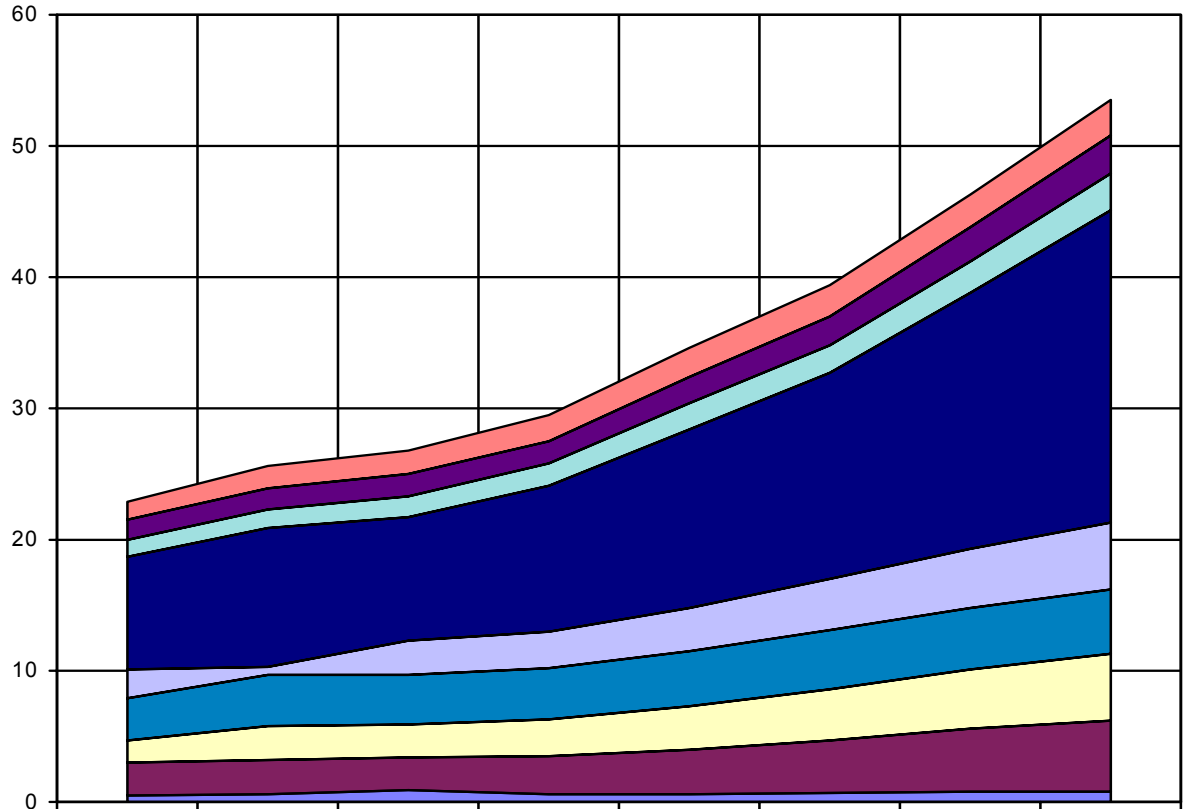
	1990	2001	2005	2010	2015	2020	2025
US	9.7	9	9	9.2	9	9.4	9.4
Canada	2	2.8	3.1	3.4	3.6	3.8	4.1
Mexico	3	3.6	3.8	4.2	4.5	4.6	4.8
W. Europe	4.6	6.9	6.6	6.5	6	5.6	5.1
Other Industrial	0.8	0.9	0.9	1	1	0.9	0.9
FSU	11.4	8.8	9.7	11.6	13.3	14.4	15.9
E. Europe	0.3	0.2	0.3	0.3	0.3	0.4	0.4
China	2.8	3.3	3.5	3.6	3.5	3.5	3.4
Other C&S America	2.4	3.8	4.3	4.7	5.7	6.2	6.7
Pacific Rim	1.7	2.5	2.5	2.6	2.8	2.7	2.6
Other Non-OPEC	3.5	4.8	5.3	6.1	7.3	8.1	9.4
Other OPEC	8.3	9.8	9.9	11.3	12.2	13.6	15.1
Persian Gulf	16.2	20.6	21.7	24.8	29.2	34.6	40.5
Total World	66.7	77.0	80.7	89.3	98.4	107.8	118.3
Gulf as Percent of World	24.6%	26.7%	26.8%	27.7%	29.6%	32.0%	43.1%

Source: Adapted by Anthony H. Cordesman from EIA, International Energy Outlook, 2003, DOE/EIA-0484 (2003), March 2003, Table D4, p. 238.

Chart I.12

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

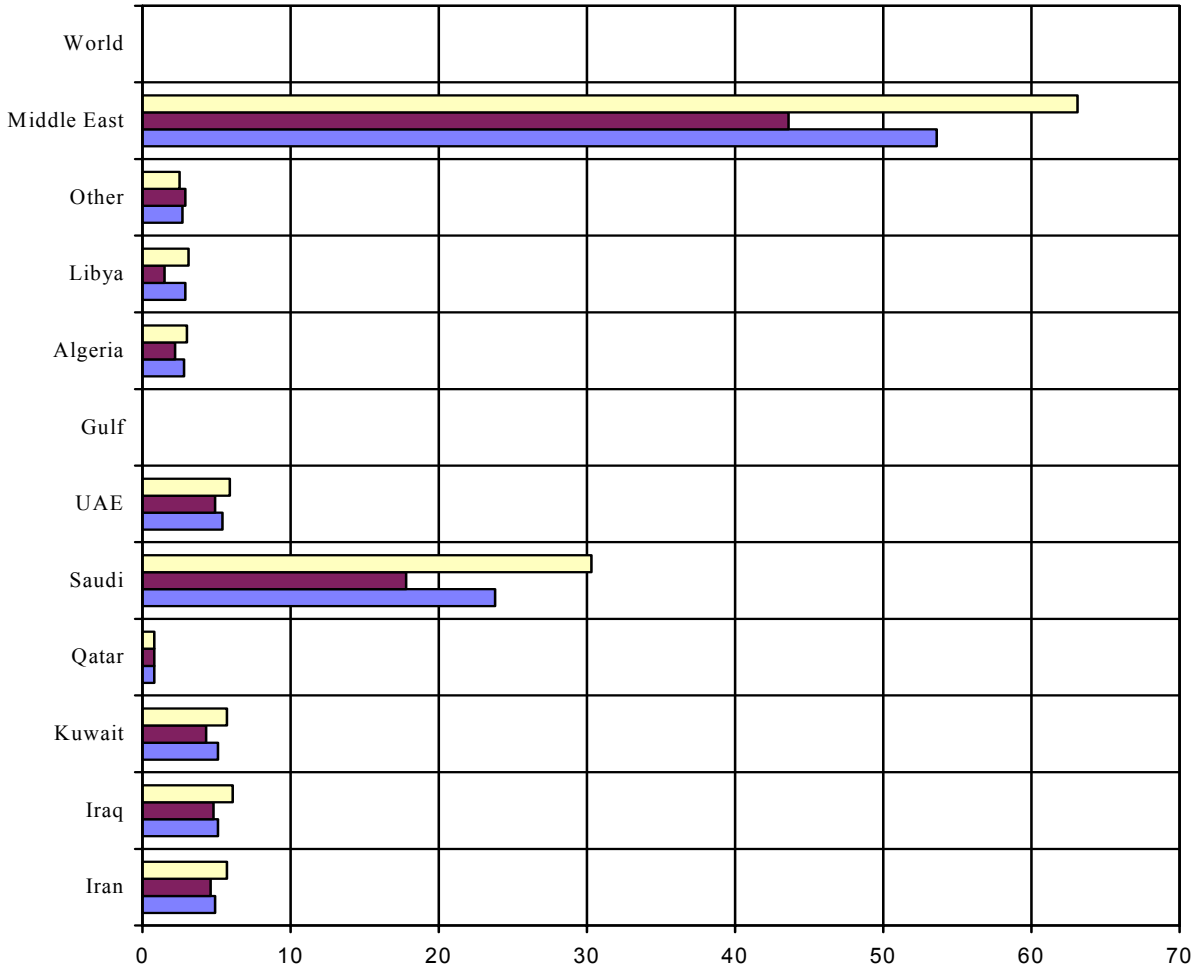
Total Gulf	18.7	-	22.4	24.5	28.7	33.0	38.9	45.2
Total ME	22.9	-	27.5	29.9	34.9	39.7	46.4	53.6
Total World	69.4	-	79.2	84.2	93.9	103.3	113.5	124.5
Gulf % of World	27.0	-	28.3	29.1	30.6	32.0	34.3	36.3
ME % of World	33.0		34.7	35.5	37.1	38.4	40.9	43.1

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.

Chart I.13

Variations in EIA Estimate of Middle Eastern Oil Production Capacity in 2025 By Economic Case

(In MMBD)



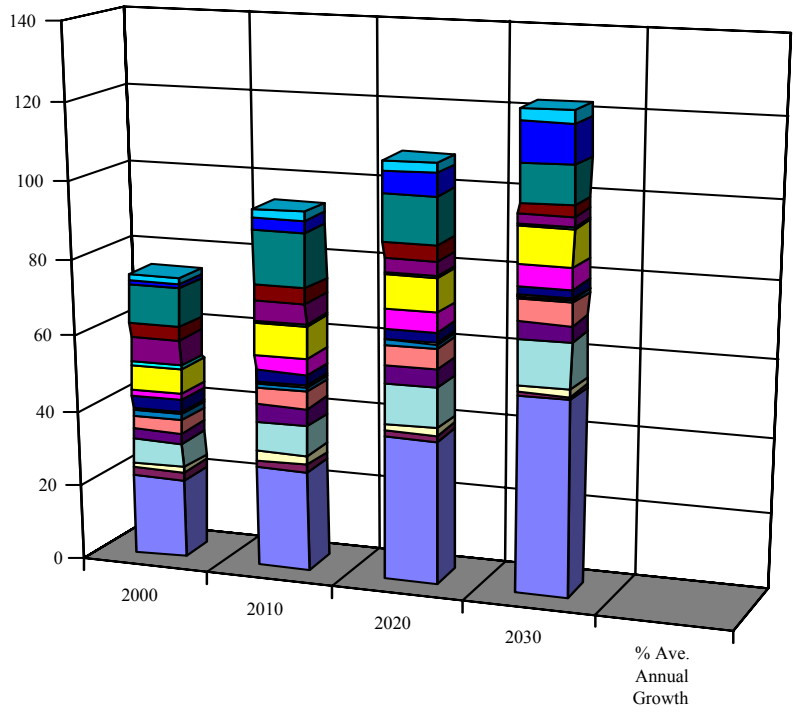
	Iran	Iraq	Kuwait	Qatar	Saudi	UAE	Gulf	Algeria	Libya	Other	Middle East	World
Low Oil Price	5.7	6.1	5.7	0.8	30.3	5.9	* 54.5	3	3.1	2.5	63.1	* 130.9
High Oil Price	4.6	4.8	4.3	0.8	17.8	4.9	*37.0	2.2	1.5	2.9	43.6	* 119.5
Reference	4.9	5.1	5.1	0.8	23.8	5.4	*45.2	2.8	2.9	2.7	53.6	*124.5

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, 2003, DOE/EIA-0484 (2003), June 2003, Tables D1 to D-4.

Chart I.14

IEA Projection of Petroleum Production Capacity By Region: 2000-2030

(EIA Reference Case in MMBD)



	2000	2010	2020	2030	% Ave. Annual Growth
Processing Gains	1.7	2.2	2.6	3.1	* 1.9
Non-Conventional Oil	1.1	3	5.6	9.9	* 7.7
US/Canada	10.1	14	12.3	9.9	* -1.1
Mexico	3.5	4.1	4	2.7	* -0.8
OEC Europe	6.7	5.2	3.5	2.5	* -3.3
OECD Pacific	0.9	0.5	0.5	0.5	* -1.8
Russia	6.5	8.6	9	9.5	* 1.3
Transition	1.6	4.1	4.9	5.4	* 4.1
China	3.2	2.8	2.5	2.1	* -1.4
India	0.7	0.5	0.4	0.3	* -2.5
Other Asia	1.6	1.4	1.1	0.7	* -2.8
Latin America	3.6	4.3	5.2	5.8	-
Africa	2.8	4.5	4.9	4.4	* 1.5
Other OPEC	6.3	7.9	10.7	11.8	* 1.9
Indonesia	1.4	2.5	1.7	1.7	* 0.6
Other Middle East	2.1	1.8	1.5	0.9	* -2.7
OPEC Middle East	21	26.5	37.8	51.4	* 3
Total World	75.0	88.8	104.0	120.03	1.6
OPEC	28.7	35.9	50.2	64.9	2.8
Non-OPEC	43.4	47.8	45.7	42.1	-1.7
ME OPEC as Percent of World	28.1	29.8	36.4	42.9	1.4

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

Source: International Energy Agency (IEA), World Energy Outlook 2002, Paris, IEA, 2002, p. 96.

Projected Increases in MENA Oil Exports Through 2025

The past and projected trends in oil exports follow a different pattern from increases in oil production because many producers consume most or large portions of their domestic production. The MENA region, however, retains massive surplus capacity relative to domestic demand, and this explains why its share of world exports is 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 million barrels of oil a day (MMBD) in 2002.[18] This was 28.5% of the world total of 73.94 MMBD. The Middle East exported an average of 18.1 MMBD in 2002, or 41.4% of the total world average of 43.63 MMBD in exports. [19]

If the four oil exporters in North Africa are added to the total to create a figure for the MENA region – Egypt, Algeria, Libya, and Tunisia would add an average annual production of 3.86 million barrels of oil a day (MMBD) in 2002.[20] This was 4.9% of a world total of 73.94 MMBD. The North African states exported an average of 3.1 MMBD in 2002, or 0.7% of the total world average of 43.63 MMBD in exports. The total Middle East and North African (MENA) region produced a total of 24.83 MMBD, or 33.6% of the world total. The total average oil exports were 21.2 MMBD in 2002, or 48.6% 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 MMBD, or 30% of a world total of 56.3 MMBD. If one includes the North African states, the exports climb to 19.5 MMBD, or 35%.[21] The DOE projects that Gulf OPEC exports will reach 35.8 MMBD by 2025, of 37% of the world total of 94.6 MMBD. If one includes North Africa, the level of exports climbs to 40.6 MMBD, or 43% of the world total. This is a climb of 7-8% in the Middle East's share of global oil exports between 2001 and 2025.[22]

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 (Figure 35). 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.

While estimates of export trends are no more able to predict the future with any precision than estimates of oil production capacity, it is again clear that it would take a massive breakthrough in technology or discoveries of reserves outside the Middle East to change these trends. These totals also understate the true importance of the MENA region because the EIA does not issue an estimate for entire the Middle East or MENA region as distinguished form the Gulf, and OPEC country estimates for the region exclude exports from Oman, Yemen and the Levant.

The Direction of MENA Oil Exports and Its Importance in a Global Economy

Under most conditions, the normal day-to-day destination of MENA oil exports is strategically irrelevant. Oil is a global commodity, which is distributed to meet the needs of a global market based on process bid by importers acting in global competition. With the exception of differences in price because of crude type and transportation costs, all buyers compete equally for the global supply of available exports, and the direction and flow of exports changes according to marginal price relative to demand. As a result, the percentage of oil that flows from the MENA region to the United States under normal market conditions has little strategic or economic importance. If a crisis occurs, or drastic changes take place in prices, and the U.S. will have to pay the same globally-determined price as any other nation, and the source of US imports will change accordingly. Moreover, the U.S. is required to share all imports with other OECD countries in a crisis under the monitoring of the International Energy Agency.

Dependence on Indirect Imports

The size of direct imports of petroleum is also only a partial measure of strategic dependence. The U.S. economy is dependent on energy-intensive imports from Asia and other regions, and what comes around must literally go around. While the EIA and IEA do not make

estimates of indirect imports of Middle Eastern oil in terms of the energy required to produce the finished goods, the US imports them from countries that are dependent on Middle Eastern exports, analysts guess that they would add at least 1 MMBD to total US oil imports. To put this figure in perspective, direct US oil imports increased from an annual average of 7.9 MMBD in 1992 to 11.3 MMBD in 2002, and 2.6 MMBD worth of US petroleum imports came directly from the Middle East in 2002.[23] If indirect US imports, in the form of manufactured goods dependent on imports of Middle Eastern oil were include, the resulting figure might well be 30-40% higher than the figure for direct imports.

Dependence on the Flow of Oil to the Global Economy

Moreover, the US and other industrialized states is increasingly dependent on the health of the global economy. US economic activity and growth is dependent on how well the economies of Europe, Asia, and Latin American 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, the Middle East and North Africa supplied 5.0 MMBD of 11.9 MMBD of European imports (42%). MENA exporters supplied 4.0 MMBD of Japanese imports of 5.1 MMBD (79%). While MENA countries supplied 0.8 MMBD out China's imports of 2.0 MMBD (39% and growing steadily in recent years), 0.2 MMBD of Australia's imports of 0.6 MMBD (33%), and 6.5 MMBD of some 8.6 MMBD in imports by other Asian and Pacific states (76%).[24]

The EIA and IEA project that 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 MMBD in 2025 – an increase of 85%, almost all of which will go to the US. The increase in exports to Western Europe will be from 4.7 MMBD to 7.4 MMBD, an increase of 57%. This assumes major increases in oil exports from the FSU and conservation will limit the scale of European imports from the Middle East. Industrialized Asia – driven by Japan – will increase its imports from 4.1 MMBD to 6.0 MMBD, or nearly 50%. China will increase its imports from 0.9 MMBD to 5.2 MMBD, or by nearly 500%; and Pacific Rim states will increase imports from 5.0 MMBD to 10.0 MMBD, or by 100%.

- Chart I.15 shows the EIA's estimate of just how critical increases in Gulf exports – only part of the MENA total – will be to the global economy in 2025.

- Table I.3 shows the EIA's estimate of the shifts in oil exports between 2000 and 2025 in more detail. Showing both the importance of increases to North America and the industrial economies, and the critical importance of such increases in meeting demand from developing economies.

- Chart I.16 provides similar data in graphic form.

These trends reflect the impact of the high rate of economic development in Asia, the limits to Asian oil reserves, and the fact the Middle East is the most economic supplier. In fact, total Asian imports are projected to increase from 18.2 MMBD in 2001 to 35,0 MMBD in 2025, an increase of nearly 100%, almost all of which will go to developing Asian states.[25] Furthermore, the EIA's 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.[26]

The trends projected by the IEA are very similar to the trends projected by the EIA. The IEA projects that total interregional trade in oil will increase from 32 MMBD in 2000 to 42 MMBD in 2010 and 66.1 MMBD in 2030, Middle Eastern exports (less north Africa) will increase from 19 MMBD in 2000 to 46 MMBD in 2030, Most of these additional exports will go to Asia, with China emerging as the largest market, followed by India, The rise in US imports will be limited by increased exports from Canada, because of production from tar sands, from Mexico, and from Sub-Saharan Africa.[27]

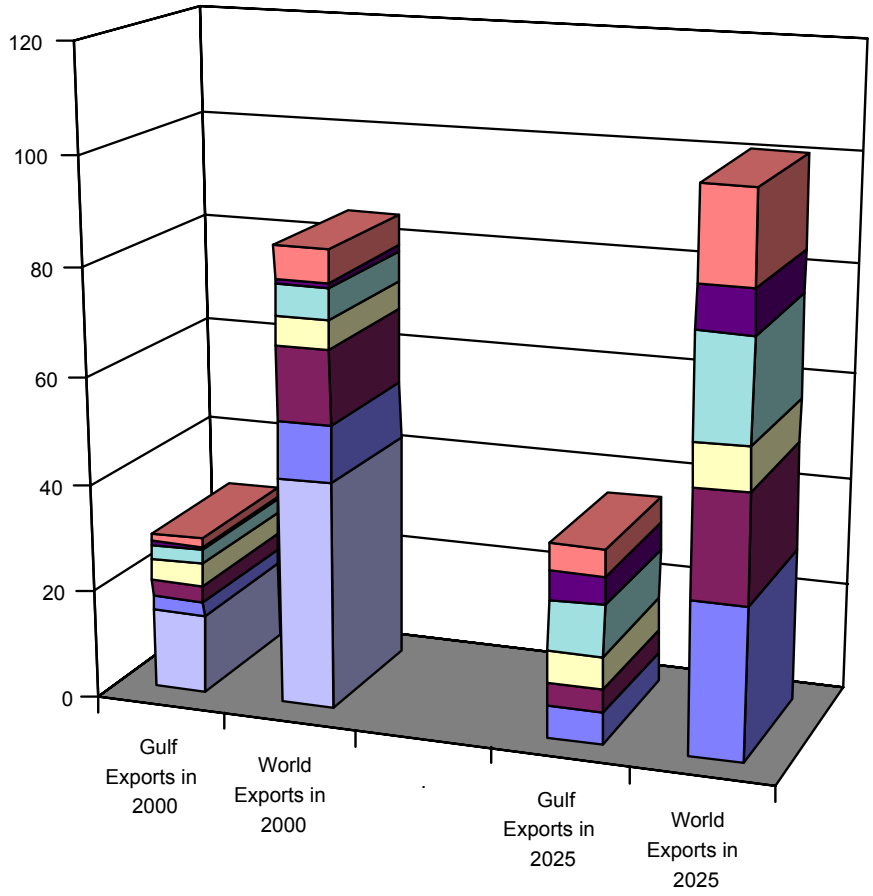
The IEA also provides the longest-term estimate of the share of Middle Eastern exports relative to other regions: It provides estimates to 2030 versus 2025 for the EIA. It estimates the interregional oil trade at 66.1 MMBD in 2030. The Middle East would provide 70% of that total. If another 4 MMBD were added for North Africa, the MENA region would provide 76%. In contrast, Central Asia and the Caspian would provide 4 MMBD. Russia would provide 5 MMBD, the rest of Africa would provide 4 MMBD, Brazil would provide 0.1 MMBD, and the rest of Latin America would provide 3 MMBD.[28]

- Chart I.17 shows the IEA's estimate of the interregional oil trade in 2030. The estimated total of Middle Eastern oil exports is notably higher than the EIA estimate, but the period is five years later, and the IEA estimate covers the entire Middle East and not just Gulf OPEC countries.

Chart I.15

US Projections of Gulf Petroleum Exports: 2001 versus 2025

(In Millions of Barrels Per Day)



	Gulf Exports in 2000	World Exports in 2000	.	Gulf Exports in 2025	World Exports in 2025
Rest of World	1.5	5.9		5	17.2
China	0.7	1.1		5.2	7.8
Pacific Rim	2.7	5.6		9.4	19.1
Industrial Asia	4.1	5.4		6	8.1
Western Europe	3.2	13.7		4.5	20.2
North America	2.6	10.7		5.7	28.3
TOTAL	14.8	42.4		*35.9	*94.6
Gulf as % of World		34.9%			37.9%

Source: Adapted by Anthony H. Cordesman from US Department of Energy, International Energy Outlook, 2003, Washington, Energy Information Agency, March 2003, Table 13, p. 38; and. US Department of Energy, International Energy Outlook, 2003, Washington, Energy Information Agency, March 2003, Table 14, p. 42.

Table I.3

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

(Millions of Barrels Per Day)

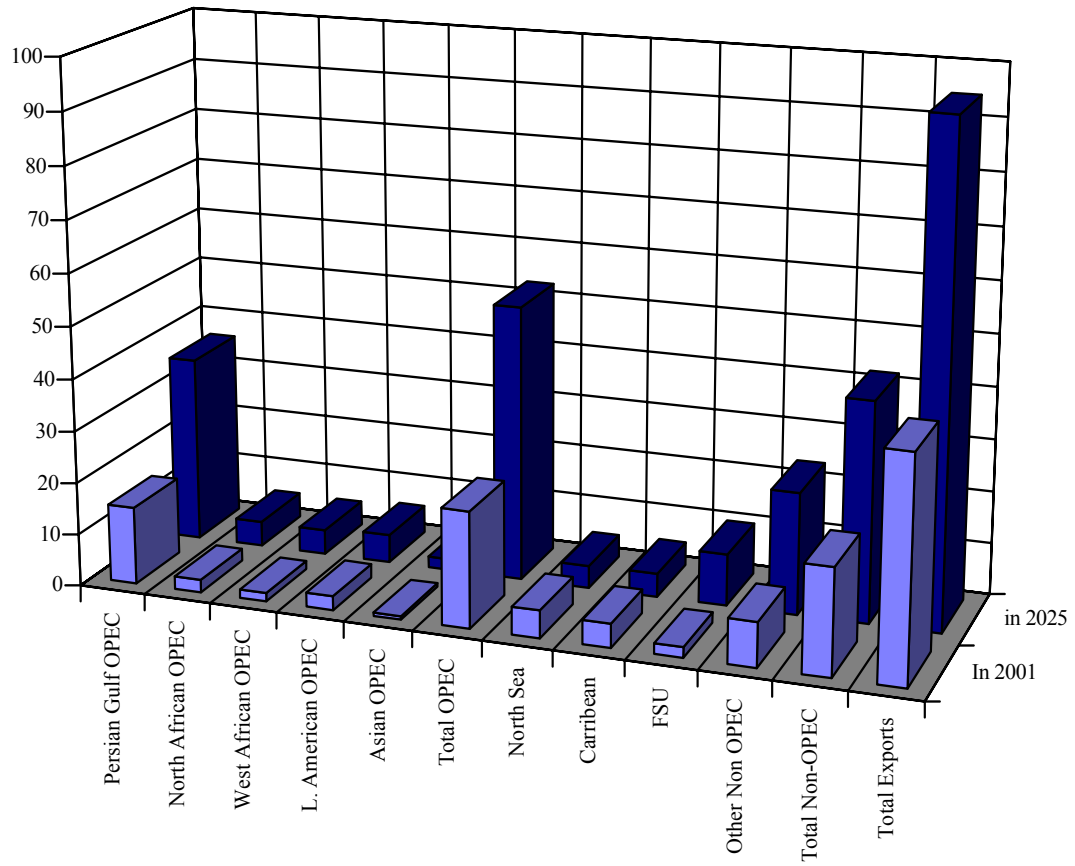
Exporting Region	**Importing Region**							
	Industrialized				Non-Industrialized			
	North America	Western Europe	Asia	Total Industrial	Pacific Rim	China	Rest of World	Total Non-Industrial
2000								
OPEC								
Persian Gulf	2.6	3.2	4.1	9.9	2.7	0.7	1.5	4.9
North Africa	0.3	2.0	0	2.3	0	0	0.1	0.1
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.

Chart I.16

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

(EIA Reference Case in MMBD)



	Persian Gulf OPEC	North African OPEC	West African OPEC	L. American OPEC	Asian OPEC	Total OPEC	North Sea	Carribean	FSU	Other Non OPEC	Total Non-OPEC	Total Exports
In 2001	14.8	2.4	1.6	2.7	0.6	22.2	5.3	4.6	2	8.5	20.3	42.4
in 2025	35.8	4.8	4.7	5.4	2.1	52.7	4.3	4.5	9.9	23.3	42	94.6

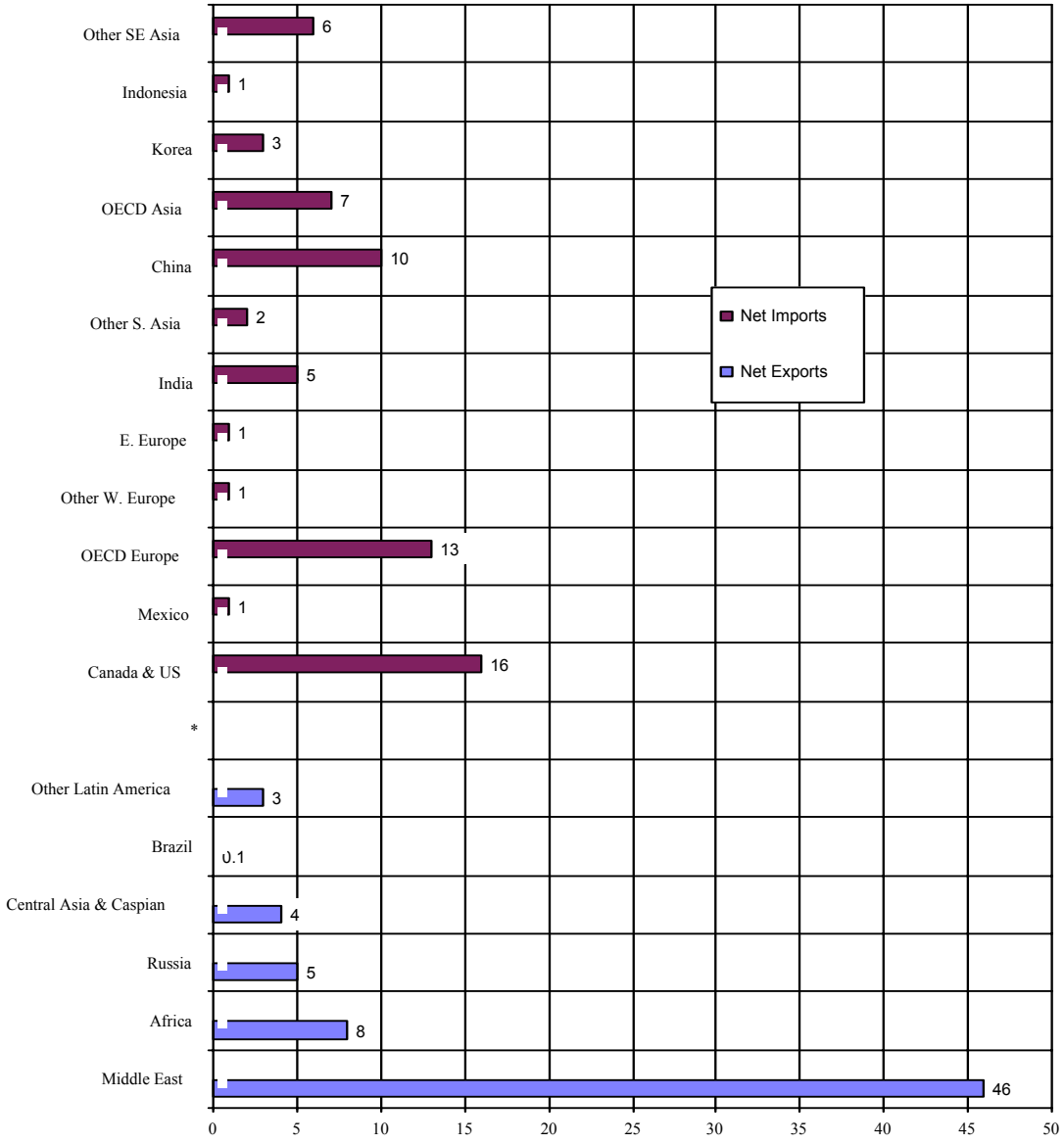
Source: Adapted by Anthony H. Cordesman from EIA, International Energy Outlook, 2002, DOE/EIA-0484 (2002), March 2002, Table 11, p. 38; and Source: Adapted by Anthony H. Cordesman from EIA, International Energy Outlook, 2003, DOE/EIA-0484 (2003), March 2003, Table 14, p. 42.

Chart I.17

IEA Projection of Interregional Oil Trade in 2030

(in MMBD)

.



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.

Changes in the Nature of Petroleum Imports from the MENA region

More is involved in analyzing the importance of MENA oil exports than estimating the export of crude oil. The Middle Eastern states and North Africa are steadily attempting to increase profit margins by producing and exporting refined oil products, rather than selling crude. At the same time, some countries – such as the US – have created major permitting and environmental barriers to creating new refineries. As a result, the nature of Middle East exports will shift sharply from crude oil to product over the coming decades.

Middle Eastern refinery capacity has already increased from 5.0 MMBD in 1990 (8% of world capacity) to 5.9 MMBD in 2000 (7%). The IEA projects that it will increase to 10.0 MMBD in 2010 (11%), 12.6% in 2020 (12%) and 15.6 % in 2030 (13%). 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.[29]

The IEA projects that total OECD demand for imports of refined product will increase from 2% of total product demand in 2000 to 11% by 2030. The IEA also projects that the Middle East (less North Africa) will export some 7 MMBD in refined oil products by 2030, versus 2 MMBD for all of Africa, 3 MMBD for all of the FSU, and 0.2 MMBD for Latin America. By this time, North America (virtually all going to the US) is projected to import 7 MMBD in refined product, China to import 2 MMBD, and the rest of Asia 3 MMBD.[30]

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 a given exporter produces the products given importers need for their economy and industries. It can reduce the flexibility of global markets in substituting for Middle Eastern oil because there may be no source of similar refinery or production capacity that can provide substitutes. A shift to product exports also reduces the total volume of product shipped, although it increases its value, making MMBD a less valid measure of dependence on oil imports.

- Chart I.18 shows the IEA's estimate of the interregional trade in refined products in 2030. The estimated total for Middle Eastern (less North African) exports approaches 7 MMBD. This is not critical in terms of total world refinery capacity, but will be critical to ensuring the stable flow of refined product at moderate prices.

- Chart I.19 shows how critical financing and executing increases in Middle Eastern (less North African) refinery capacity will be in meeting this future demand.

Chart I.18

IEA Projection of Interregional Trade in Refined Oil Products: 2030

(in MMBD)

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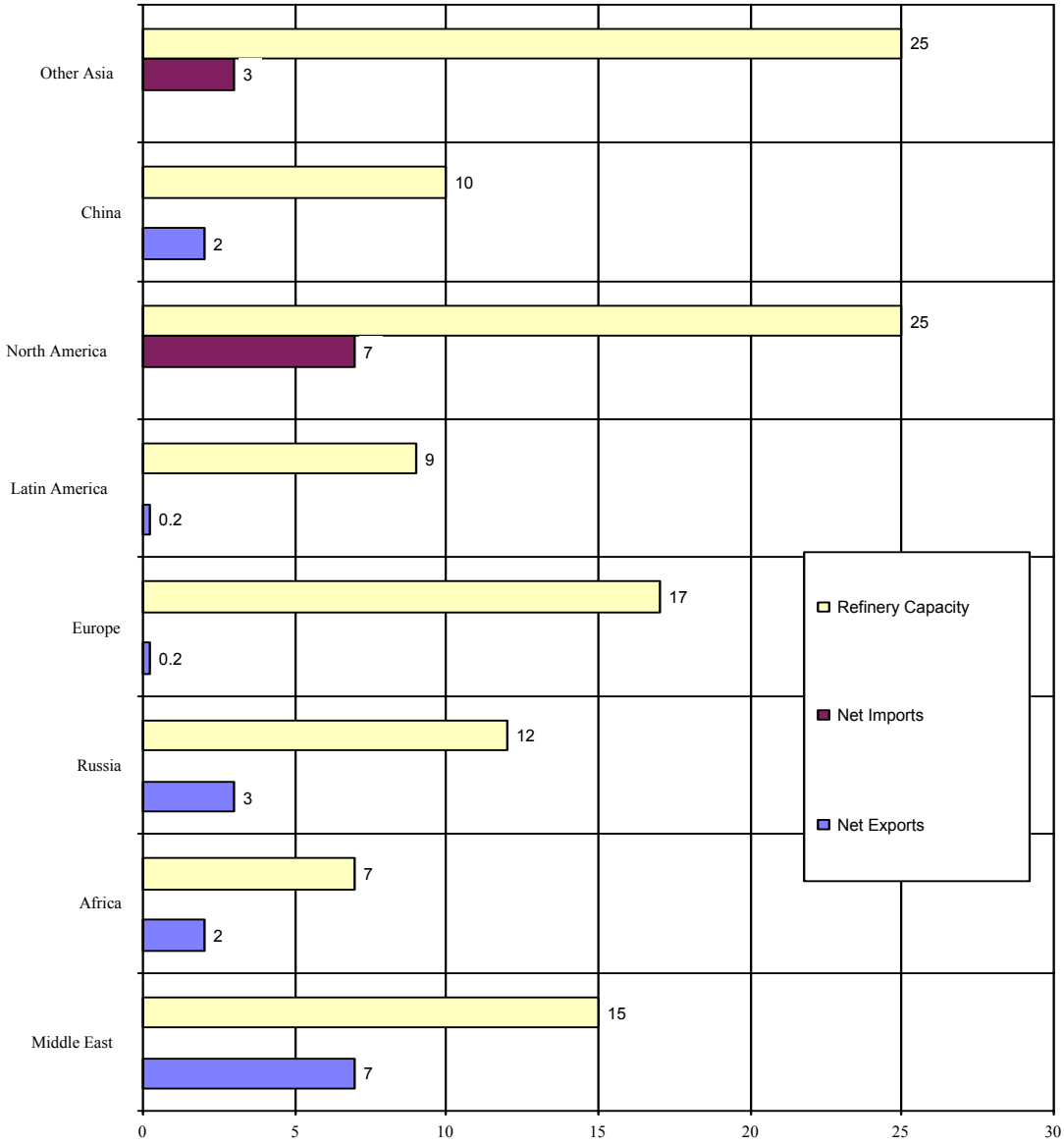

Note: Middle Eastern annual growth is 3.3% during 2000-2030, versus 1.3% for world, 0.6% for OECD North America, 0.4% for OECD Europe.

Source: International Energy Agency (IEA), World Energy Outlook 2002, Paris, IEA, 2002, p. 109.

Chart I.19

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

(in MMBD)

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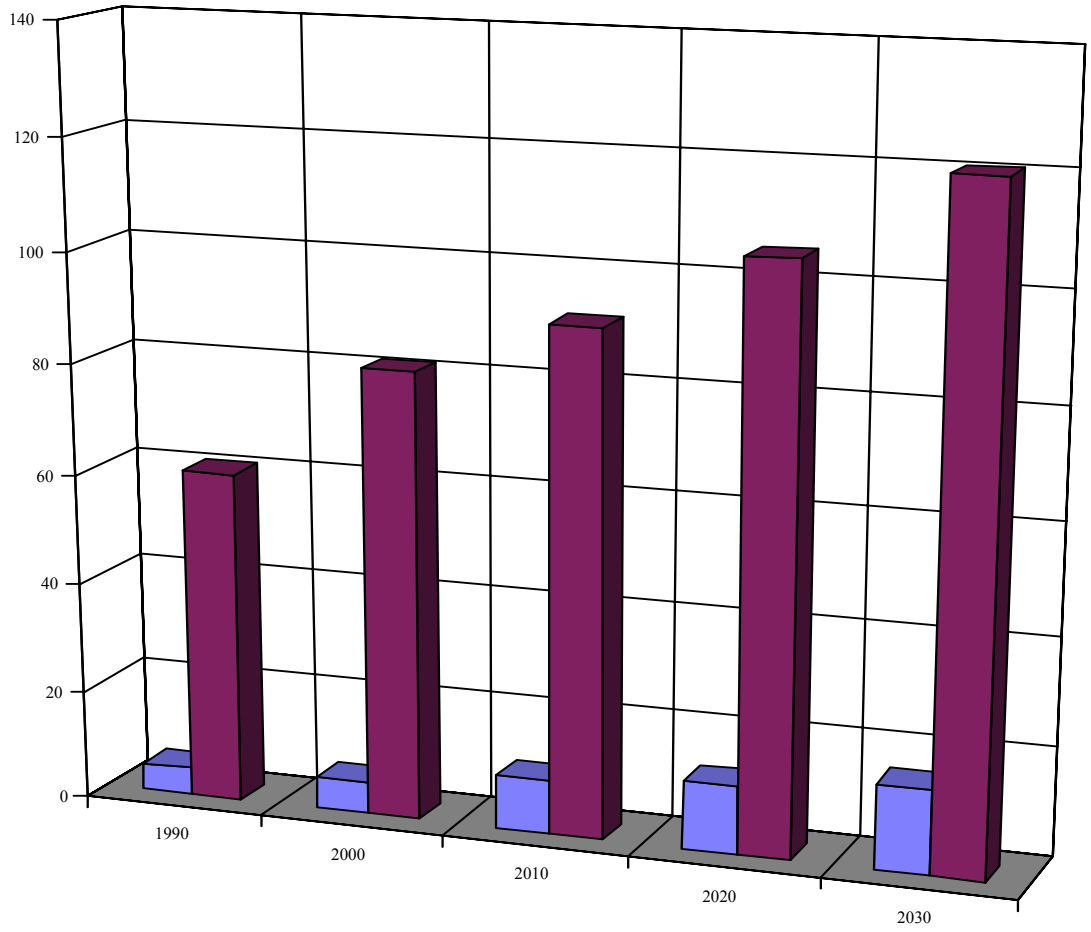

	1990	2000	2010	2020	2030
Middle East	5	5.9	10	12.6	15.6
World	60.6	81.5	91.5	105.2	120.6

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.

The Trends in US Petroleum Imports

US oil imports are only a subset of US strategic dependence on Middle East oil exports. As has been noted earlier, the US is dependent on the overall health of the global economy, and on large amounts of indirect energy imports in the form of manufactured goods from Asia and other nations that are dependent on Middle East oil. The US must also compete for the global supply of oil exports on market terms in any short term crisis, or longer term shortfall in MENA exports and it is the global supply of oil exports relative to global demand, not where the US gets oil at any given time, which determines availability and price to the US as well as all other importing nations.

These realities are reflected in the past patterns of US dependence on oil imports from the Middle East. The EIA reports wide fluctuations in US oil imports over time. If one looks only at total US imports of crude oil, imports from all sources reached 3.2 MMBD in 1973. They rose to a temporary peak of 6.6 MMBD in 1979, and then slowly declined until 1985, when they reached 3.2 MMBD. They then rose consistently, reaching 5.1 MMBD in 1988, 6.1 MMBD in 1992, 7.1 MMBD in 1994, 8.2 MMBD in 1997, 9.1 MMBD in 2000, and 9,6 MMBD in 2003. [31]

Imports include product as well as crude oil, however, and if both crude oil and product are counted, US net imports were 6.0 MMBD in 1973, rising to 8.6 MMBD in 1977, and then dropping to 4.3 MMBD in 1984. They then rose to 5.4 MMBD in 1986, 6.5 MMBD in 1988, 7.2 MMBD in 1989, 8.1 MMBD in 1994, 9.1 MMBD in 1997, 10.4 MMBD in 2000, and averaged over 10.5 MMBD in 2001-2003.[32] 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 report on US dependence on crude oil and product imports from the Middle East per se, or from the entire MENA region. It does, however, measure US dependence on imports from the Gulf – which dominate the vast majority of US imports from the MENA area.

The share Persian Gulf imports have of the US market at any given time is determined not by the price of crude in some abstract sense, but rather by the real-world market value of a given type of oil or product from a given exporter delivered to the US market versus the same or

similar crude or product delivered from any other source. In practice, even the smallest price differential – some times a few cents per barrel – leads a US importer to buy from the Middle East, Africa, or any other source.

It should not be surprising, therefore, that the patterns in US imports from the Persian Gulf (Bahrain, Iran, Iraq, Kuwait, Qatar, Saudi Arabia, and the UAE) do not reflect the same pattern as total US oil imports, particularly as Asian demand leads Asian countries to take advantage of the lower shipping costs from the Middle East, and the US seeks oil with lower transportation costs from Africa and Latin America. According to the EIA, US 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:[33]

- US imports from the Gulf totaled 0.85MMBD in 1973. They were 4.8 % of total products supplied, and 13.6 % of total imports,
- US imports from the Gulf rose steadily during 1974-1977. They totaled 2.44 MMBD in 1977. They then were 13.3 % of total products supplied, and 27.8 % of total imports.
- US imports from the Persian Gulf declined steadily after that time from 1978-1983, They totaled 1.5 MMBD in 1980, 1.2 MMBD in 1981, and then dropped sharply to 0.70 MMBD in 1982. They reached a low of 0.442 MMBD in 1982. They then were 2.9 % of total products supplied, and 8.8% of total imports. They "bottomed out" at only 0.311 MMBD in 1985, with 2.0% of product and 6.1% of total imports.
- Changes in Saudi and OPEC price strategy in 1986 led to an increase in US imports from the Gulf to 0.91 MMBD in 1986, 1.1 MMBD in 1987, and 1.87MBD in 1989. They were 10.7% of total product imports and 23.1% of total US imports in 1989.
- US imports from the Gulf fluctuated from 1.57 MMBD to 1.8 MMBD during 1990-1997, and ranged from 8.8-11.0 % of total products supplied, and from 16.9-24.5% of total imports.
- From 1998 onwards. US imports from the Gulf have been above 2.0 MMBD, reaching 2.1 MMBD in 1998, 2.5 MMBD in 1999, 2.5 MMBD in 2000, 2.8 MMBD in 2001, 2.3 MMBD in 2002, and averaging 2.8 MMBD in 2003. 1977. They totaled 2.44 MMBD in 1977. They have ranged from 11.5-14.10 % of total products supplied, and from 19.7-23.5% of total imports.

Once again, it must be stressed that such shifts in the source of US exports 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, and that it is the trend in both total global export, and in total US 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 any recent Congressional energy bills, are projected to have any meaningful strategic impact on US import dependence if they are ever passed into law and transformed into action. It takes massive shifts in US energy consumption and supply over extended periods of time to accomplish this and there are good reasons that neither the Bush Administration or Congressional advocates of different policies have either failed to make meaningful analysis of the impact of their proposals on US import dependence or have provided "blue sky" estimates that are little more than intellectual rubbish.

If one turns to the EIA estimates made since the Bush Administration came to office, it is clear that realistic models of US energy needs will lead to steady increases in US energy imports, although no one can predict the exact trends. In the short term, the EIA predicts that total US petroleum imports were 10.9 MMBD in 2001 and 10.54 MMBD in 2002, and will reach 11.0 MMBD in 2003 and 11.3 MMBD in 2004. Largely because of a dip in US economic activity, US imports dropped by 3.3% during 2001-2002, but they are projected to rise by 3.8% in 2002-2003 and by 3.3% in 2003-2004.[34]

What is most important, however, is the mid and long-term picture where temporary economic conditions have less impact, and trends tend to be more consistent over time. The EIA's 2003 Annual Energy Forecast reports that net imports of petroleum accounted for 55 percent of domestic petroleum consumption in 2001. US dependence on petroleum imports is projected to reach 68% in 2025 in the reference case. This is a rise in US net imports from 10.9 MMBD in 2021 to 19.8 MMBD in the reference case (+82%). In the low oil price case, net imports would rise to 21.1 MMBD. They would be 18.2 MMBD in the high oil price case, 17.8 MMBD in the low economic growth case, and 22.3 MMBD in the high economic growth case. [35]

The EIA's annual forecast for 2004 predicts that imports will he even higher. It reports that net imports of petroleum accounted 53 percent of domestic petroleum consumption in 2002. 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. Imports are expected to be 65 percent of total consumption. In the low oil price case this number is estimated to be 75 percent.[36] (The AEO2003 report indicated that estimated imports as a share of total oil consumption would be 65

percent in high price case in 2025, and 70 percent in the low price case.)

The share of US imports as a share of total consumption is expected to range from 65 percent in the high oil price case and 70 percent in the low oil price case by 2025. Crude oil is expected to continue as the major component of petroleum imports, but refined products are projected to growing as a share of total imports because the projected growth in demand for refined products will exceed the expansion of US domestic refining capacity. The EIA projects that refined products will increase from a 15% share of imports in 2001 to 34% in 2025 in the reference case, with 27 percent of net petroleum imports in 2025 in the low economic growth case and 39 percent in the high growth case.[37]In practice, this would mean that US imports of petroleum product would rise from 1.6 MMBD in 2021 to 6.7 MMBD in the reference case (+82%). In the low oil price case, net imports would rise to 7.1 MMBD. They would be 5.7 MMBD in the high oil price case, 4.8 MMBD in the low economic growth case, and 8.6 MMBD in the high economic growth case. [38]

Once again, the EIA does not estimate the share that MENA countries will provide of these US imports. Its forecast does indicate, however, that the share of U.S. imports from OPEC countries will increase substantially during 2003-2025. As for other sources of imports, the EIA indicates that, [39]

> 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 US energy supply and demand that include relatively high estimates of US domestic oil and gas production, nuclear power, coal use, increases in energy efficiency, increases in renewable energy, and increases in the domestic production of ethanol. They are conservative in nature, and may well underestimate the need for imports.

- Chart I.20 shows the EIA estimate of the rise in US imports since 1973, and the estimate level of US imports in 2025, depending on different economic conditions.

Chart I.20

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

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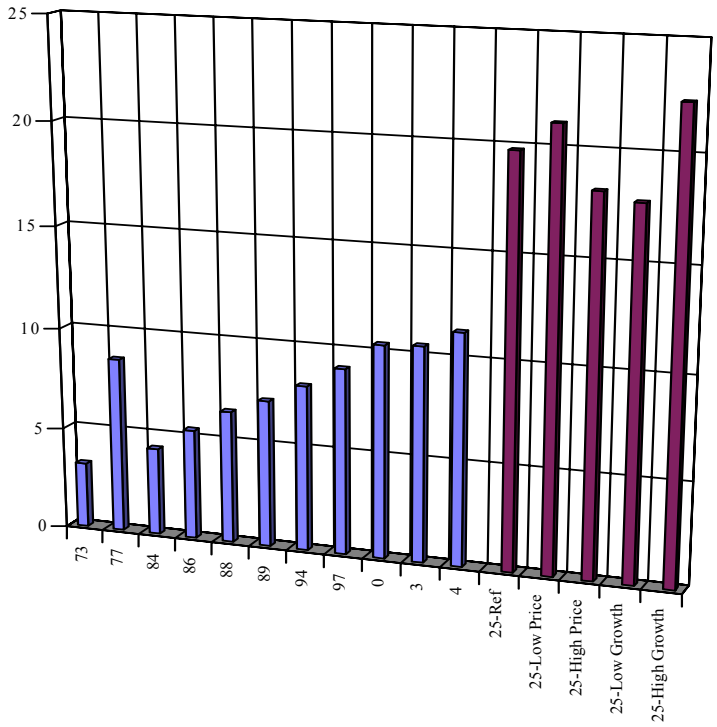


	73	77	84	86	88	89	94	97	0	3	4	25-Ref	25-Low Price	25-High Price	25-Low Growt	25-High Growt
Actual	3.2	8.6	4.3	5.4	6.5	7.2	8.1	9.1	10.4	10.5	11.3					
Estimated												19.8	21.1	18.2	17.8	22.3

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

The Importance of MENA Gas, Resources and Exports

At present, Middle Eastern gas reserves are more important as a means of meeting local energy needs and reducing domestic MENA consumption of crude oil, than as a source of global energy exports.,. This may change in the future, however, as world demand for gas rises, and gas is used more often to provide the raw material for gas-based petrochemicals.. The EIA estimates that global demand for natural gas has increased from 36 trillion cubic feet or 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% between 2001 and 2025.[40]

MENA Gas Reserves

The Middle East and North Africa now have a total of 40.8% of the world's proven gas reserves (36% 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.[41] They did so in spite of major limitations in oil and gas exploration and development because of war and internal conflict in such critical states as Algeria, Iran, Iraq, and Libya.

There is no firm consensus as to how to estimate proven gas reserves. Many MENA countries are just beginning to make serious efforts to fully characterize their gas reserves, and have little experience with the costs of real world development of massive gas production efforts and the necessary distribution systems. Estimates of proven gas reserves are significantly more controversial than estimates of proven oil 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% of the world total, Iran has 23 TCM (812.3 TCF) or 14.8%, Oman has 0.83 TCM (29.35 TCF) or 0.5%, Qatar has 14.4 TCM (508.5 TCF) or 9.2%, Saudi Arabia 6.4 TCM (224.7 TCF) or 4.1%, the UAE has 6.01 TCM (212.1 TCF) or 3.9%, Iraq has 3.1 TCM (109.83 TCF) or 2.0%, and Yemen has 0.48 TCM (16.9 TCF) or 0.3%.[42]

Syria has 0.24 TCM (8.5 TCF) or 0.2% 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%, Egypt has 1.66 TCM (58.5 TCF) or 1.1 %, and Libya has 1.31 TCM (46.4 TCF) or 0.8%.[43]

- Table I.3 shows the BP estimate of Middle Eastern gas reserves and their share of the world total,. As well as of world production in 2000. It indicates that MENA countries have some 40% of all world reserves.
- Chart I.21 shows the recent trend in estimates of MENA gas reserves and the growth in estimates of the resources of many countries.
- Chart I.22 shows how MENA gas reserves are distributed by country and how they compare to the reserves in states outside the region.
- Chart I.23 shows how proven MENA reserves compare to probable total world reserves. The Middle East's share is smaller, but still extremely significant.

The EIA and IEA do not provide detailed projections of probable discoveries of new gas reserves by country, but many Middle Eastern states have only begun to fully explore their gas reserves, and most are likely to make major additional discoveries. The EIA also does indicate that total global reserves now total 5,501 TCF and undiscovered reserves total 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% of the world's undiscovered reserves. Some 2,347 TCF in reserves are expected to be discovered during 2000-2025, and more than one-half is estimated to be found in the FSU and MENA areas.[44]

The International Energy Agency (IEA) estimates that the Middle East has 34 percent of the world's remaining reserves and probably has at least 19.% of its undiscovered reserves.[45] CEDIGAZ, a respected source of energy estimates, indicates that the Middle East has 53.9 TCM of proven gas reserves, and some 115-136 TCM of the world's ultimate reserves. Are in the Middle East. This is 34% of the worlds proven reserves, and 25.4-25.8% of its undiscovered reserves.[46]

In contrast, the US is one of the world's largest gas consumers, but is estimated to have less than 10% 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% of its natural gas by 2020.[47]Japan and most developing Asia states have little or no significant reserves.

Table I.3

MENA and World Gas Reserves and Production

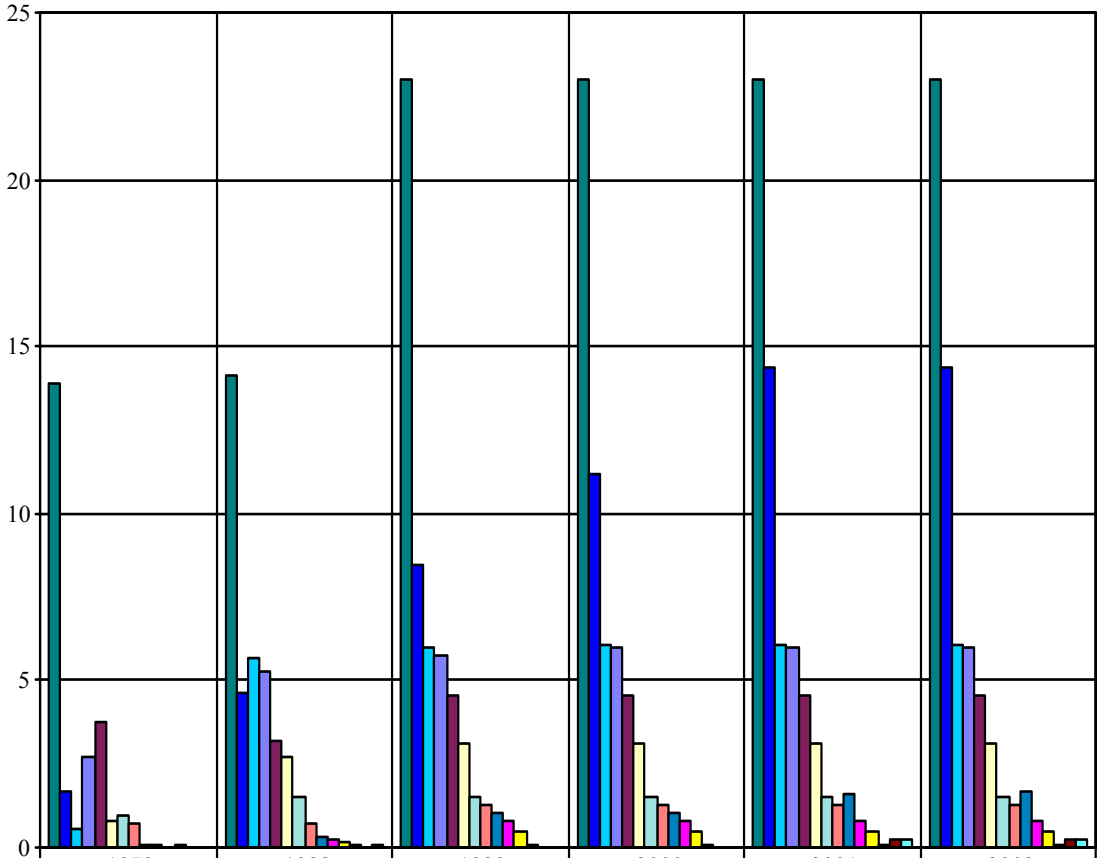
Nation	Reserves in 2000 TCM	TCF	Percent of World Reserves	Production in 2000 (% of World)
Bahrain	0.09	3.3	0.1%	0.4%
Iran	23.00	812.3	14.6%	2.65%
Iraq	3.11	109.8	2.0%	0.3%
Kuwait	1.49	52.7	1.0%	0.6%
Oman	0.82	29.3	0.5%	0.4%
Qatar	14.40	508.5	9.2%	1.2%
Saudi Arabia	6.36	224.7	4.1%	2.2%
Syria	0.24	8.5	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

Chart I.21

Total Proven Gas Reserves of the MENA States 1979-2002: BP Estimate

(In Trillions of Cubic Meters)



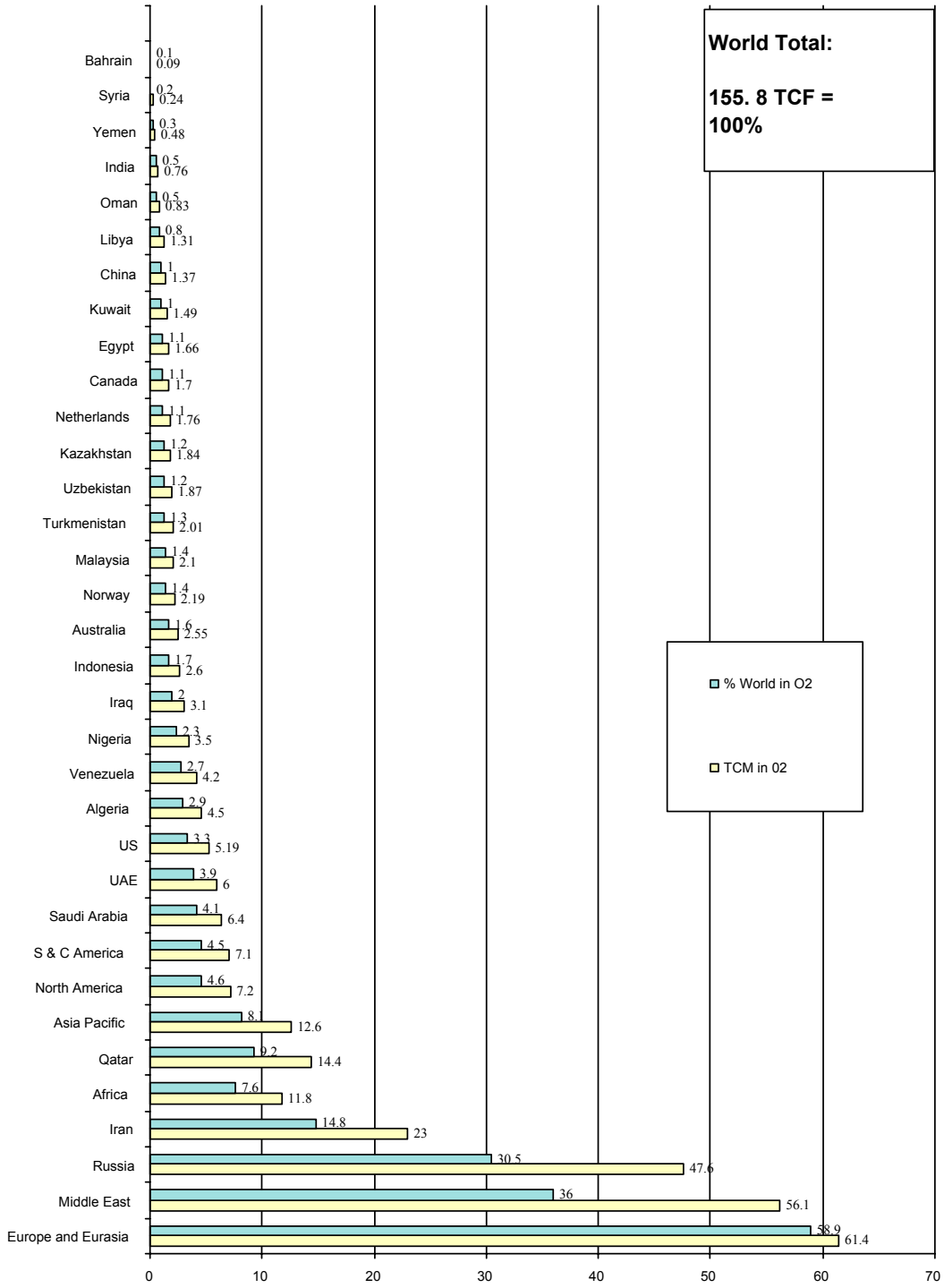
	1979	1988	1999	2000	2001	2002
Iran	13.88	14.16	23	23	23	23
Qatar	1.7	4.62	8.49	11.15	14.4	14.4
Saudi Arabi	0.58	5.69	6	6.05	6.05	6.05
UAE	2.71	5.3	5.79	6.01	6.01	6.01
Algeria	3.74	3.23	4.52	4.52	4.52	4.52
Iraq	0.76	2.69	3.11	3.11	3.11	3.11
Kuwait	0.95	1.55	1.49	1.49	1.49	1.49
Libya	0.68	0.72	1.31	1.31	1.31	1.31
Egypt	0.09	0.33	1	1	1.56	1.66
Oman	0.06	0.26	0.8	0.83	0.83	0.83
Yemen	-	0.16	0.48	0.48	0.48	0.48
Bahrain	0.11	0.11	0.11	0.11	0.09	0.09
Syria	.	-	-	-	0.24	0.24
Other ME	-	0.1	-	-	0.24	0.24

Source: British Petroleum, BP Statistical Review of World Energy, 2001, London, June 2001, pp. 20-21, and BP Statistical Review of World Energy, 2003, London, June 2003, pp. 20.

Chart I.22

Key Nations in Percent of Total Proven World Gas Reserves in 2002

(Quantity in Trillion Cubic Meters; Percent is Percent of Total World Reserves)



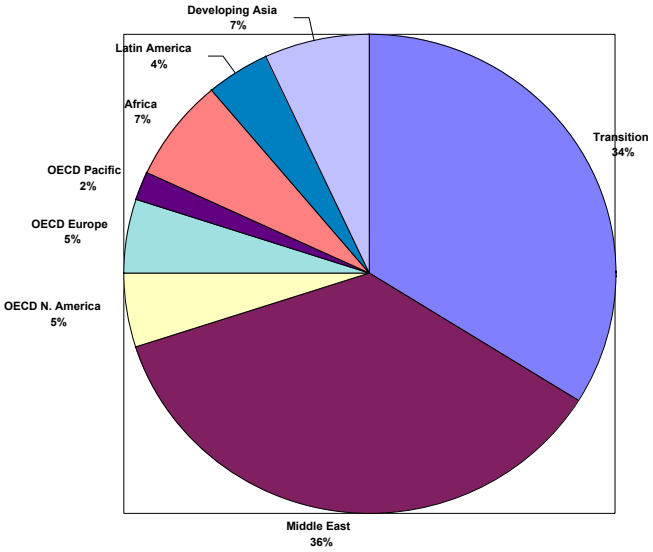
Source: British Petroleum, BP Statistical Review of World Energy, 2003, London, June 2003, pp. 20.

Chart I.23

IEA Projection of Remaining Proven Natural Gas Reserves and Total Resources

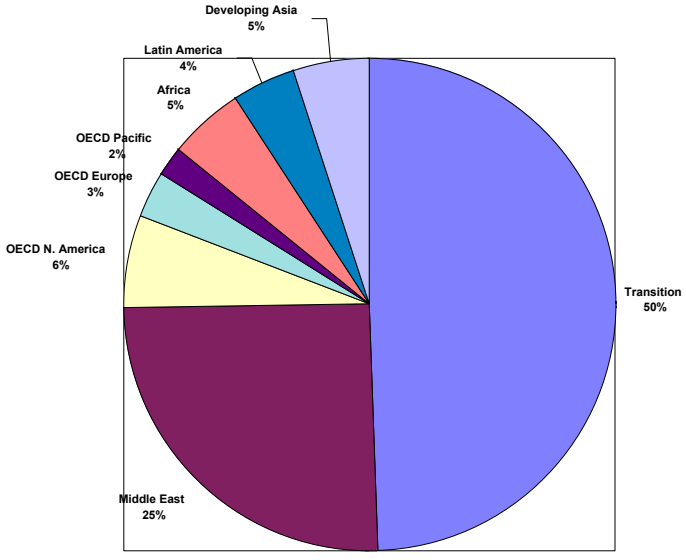
(in Trillions of Cubic Meters)

Reserves = 165 TCM



Resources = 500 TCM

.



Note: Transition = Russia, Caspian, Central Asia, E. Europe, Cyprus, and Malta
Source: International Energy Agency (IEA), World Energy Outlook 2002, Paris, IEA, 2002, p. 114.

MENA Gas Consumption and Oil Exports

The importance of MENA gas reserves is illustrated in part by their ability to limit the growth of Middle Eastern consumption of crude oil. During the decade between 1992 and 2002, regional consumption increased from roughly 1.0 MMBD to 1.3 MMBD, although this still left the Middle East consuming only 5.9% of the world's use of oil. North African consumption increased from 0.67 MMBD to 0.77 MMBD.[48] 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 BCM in 1992 to 205.7 BCM in 1992, and this increase was driven by the creation of more effective national gas distribution systems in key exporters like Iran, Kuwait, and Saudi Arabia.[49] Similarly, key North African states like Algeria and Egypt increased their use of national gas from 29.1 BCM in 1982 to 47.4 BCM in 2002.

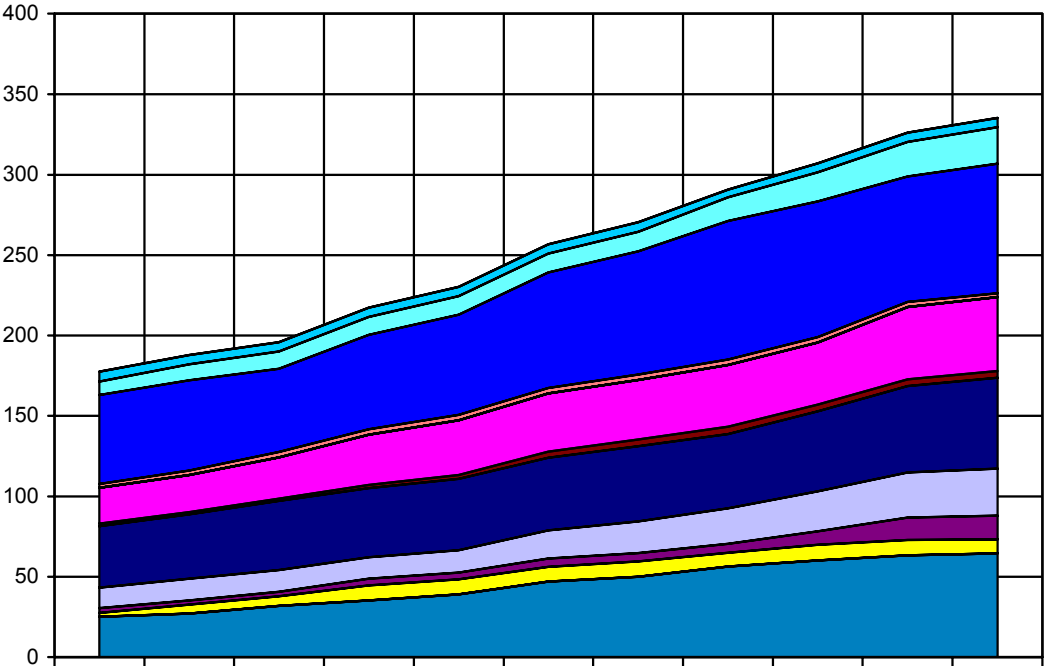
Current plans call for major further increases in domestic use of gas in most of the Gulf states. The IEA also projects that total Middle East use of gas will increase from 3.6 TCF in 1990, and 6.8 TCF in 2000, to 8.8 TCF in 2010, 11.1 TCF in 2020, and 13.9 TCF in 2025. This is an average annual increase in consumption of 2.3%.[50] In contrast, the EIA projects that MENA will increase domestic oil consumption from 3.4 MMBD in 1990 and 5.2 MMBD in 2000 to 5.2 MMBD in 2010, 6.7 MMBD in 2020, and 7.6 MMBD in 2025.[51] This is an average annual increase in consumption of 2.0%, and would be at least 4% higher without regional domestic use of gas.

- Chart I.24 shows the steady increase in MENA gas production in recent years.
- Chart I.25 shows how critical gas is to future MENA energy needs and to allowing the Middle East to maximize oil exports.

Chart I.24

MENA Natural Gas Production By Country: 1992-2002

(Billions of Cubic Meters, excluding Gas Flared or Recycled))



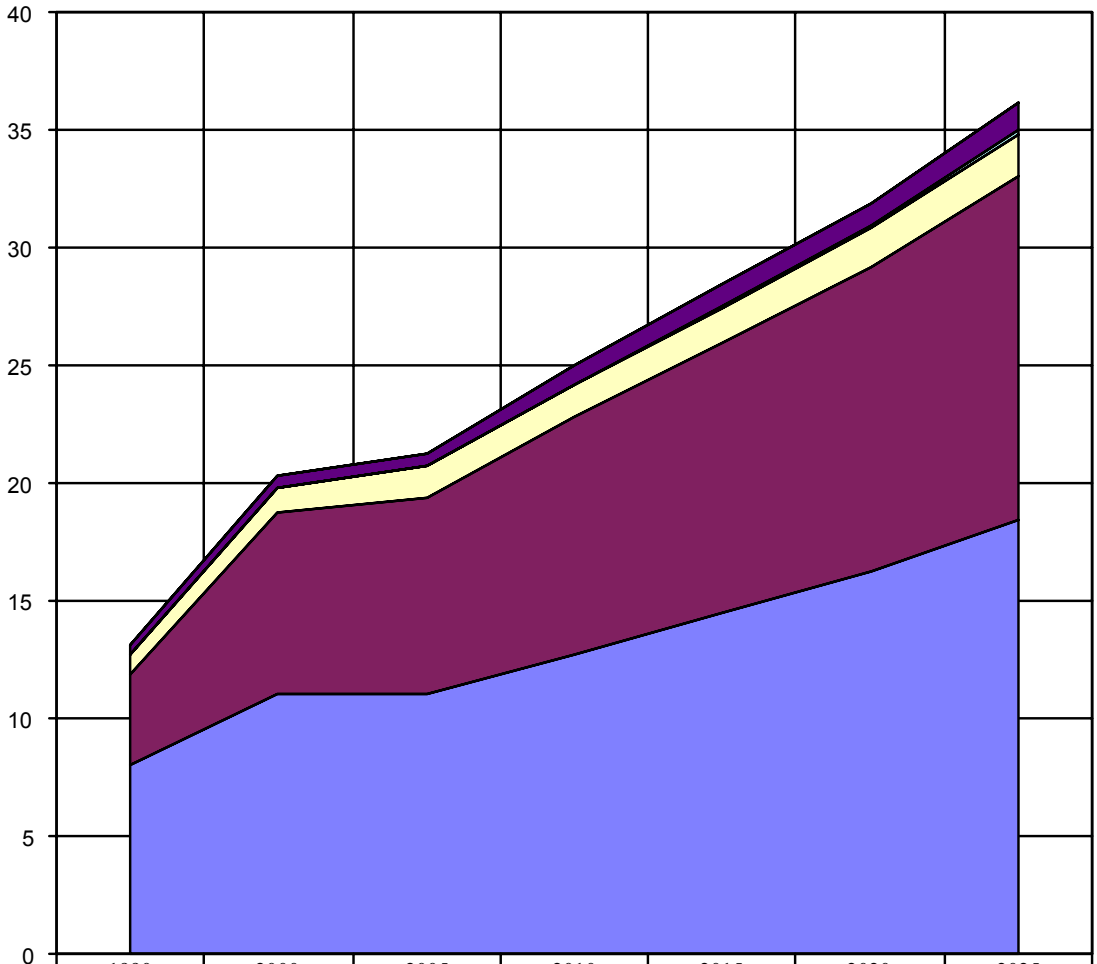
	92	93	94	95	96	97	98	99	0	1	2
Tunisia											
Libya	6.1	5.8	5.8	5.8	5.8	6	5.8	4.7	5.4	5.6	5.7
Egypt	8.4	10	10.6	11	11.5	11.6	12.2	14.7	18.3	21.5	22.7
Algeria	55.3	56.1	51.6	58.7	62.3	71.8	76.6	86	84.4	78.2	80.4
Other	2.4	2.8	3.4	3.4	3.5	3.3	3.2	3.4	3.4	3	2.6
Yemen											
UAE	22.2	23	25.8	31.3	33.8	36.3	37.1	38.5	38.4	45	46
Syria	1.6	1.4	1.5	1.9	2.5	3.8	4.3	4.5	4.2	4.3	4.1
Saudi	38.3	40	42.8	42.9	44.4	45.3	46.8	46.2	49.8	53.7	56.4
Qatar	12.6	13.5	13.5	13.5	13.7	17.4	19.6	22.1	24.9	27.9	29.3
Oman	2.9	2.8	2.9	4.1	4.4	5	5.2	5.5	8.4	14	14.8
Kuwait	2.6	5.4	6	9.3	9.3	9.3	9.5	8.6	9.6	9.5	8.7
Iraq											

Source: Adapted by Anthony H. Cordesman from Source: British Petroleum, BP Statistical Review of World Energy, 2001, London, June 2003, pp. 22.

Chart I.25

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.

MENA Gas Exports

An analysis of the MENA region's role in gas exports is more speculative than an analysis of its role in oil exports. While the MENA area has long exported some gas, gas exports are just beginning to become a major part of world energy exports and 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% versus 1.8% for oil.[52] Much of this increase will be met by an increase in domestic production or by major increases in exports from the FSU.

The US may well, however, have to make major increases in gas imports by ship, Korea and Japan already rely heavily on tankers to deliver MENA 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% and much of it will have to come from the MENA area.[53] The projections of the IEA are somewhat different, but estimate a 2.1% annual average increase in OECD Europe consumption between 2000 and 2030, a 2.3% average increase in OECD Asia, and a 5.5% average annual increase in China, a 3.7% increase in East Asia, and a 4.7% increase in South Asia,[54]

At present, MENA gas production lags far behind the level of production by the FSU and Eastern Europe. The MENA region has one-third of their total production, although the MENA region has slightly larger total gas reserves. All Gulf gas 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, 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, plus new gas-to-liquid plants, and is 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, and its consumption of gas is outstripping supply).[55] 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.

The situation is somewhat different outside the Gulf. Algeria is already the second largest LNG producer in the world, and has significant exports by pipeline. It is Western Europe's second-largest supplier of exports and delivers supplies 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 US. It exports about 0.8 TCF via the Transmed pipeline through Tunisia to Italy, and 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 to 0.6 TCF. Egypt is creating gas trains to export to France, and Spain, and Libya is planning to increase its export capability by building a pipeline from Melita to Sicily with a capacity of 0.3 TCF.[56]

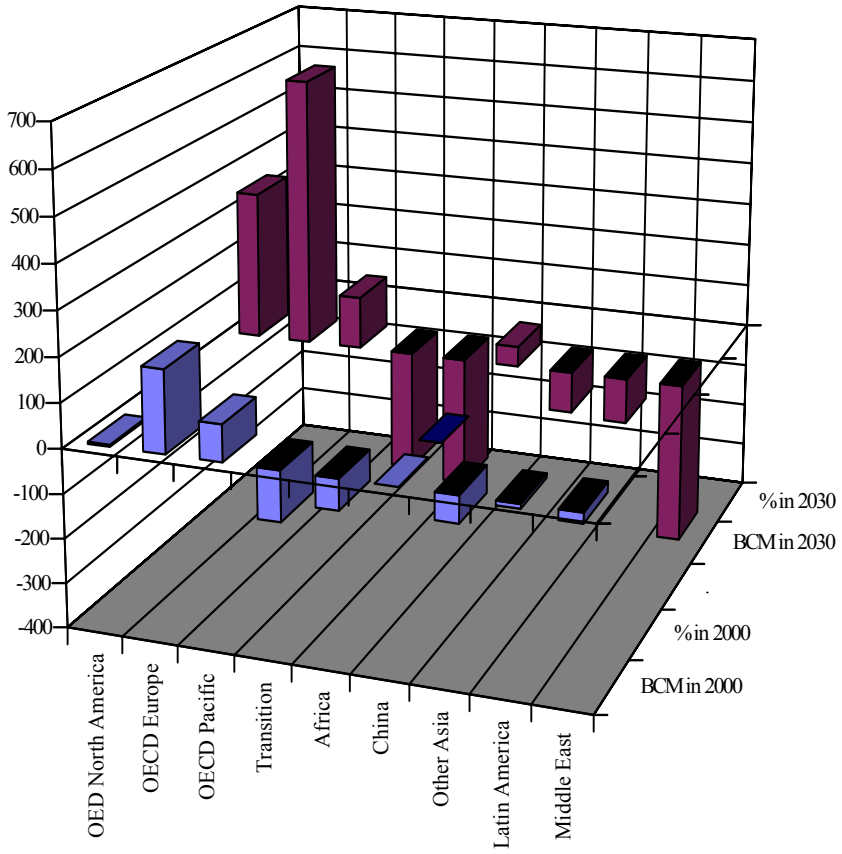
The IEA does project a massive increase in world dependence on gas imports. It is projects an increase in Middle Eastern exports from 23 BCM in 2000 to 365 BCM in 2030.[57] While it is careful to qualify the major uncertainties involved, the IEA projects that interregional flows from the Middle East 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, 0.0 BCM to 27 BCM to South Asia, 21 to 60 BCM to Japan and Korea, and 0 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 fifteen fold 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.[58]

- Chart I.26 shows the IEA estimate of massive increases in global gas imports between 2000 and 2030.
- Chart I. 27 shows how critical Middle Eastern exports will be to meeting this demand.

Chart I.26

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, Gibraltar, and Malta.

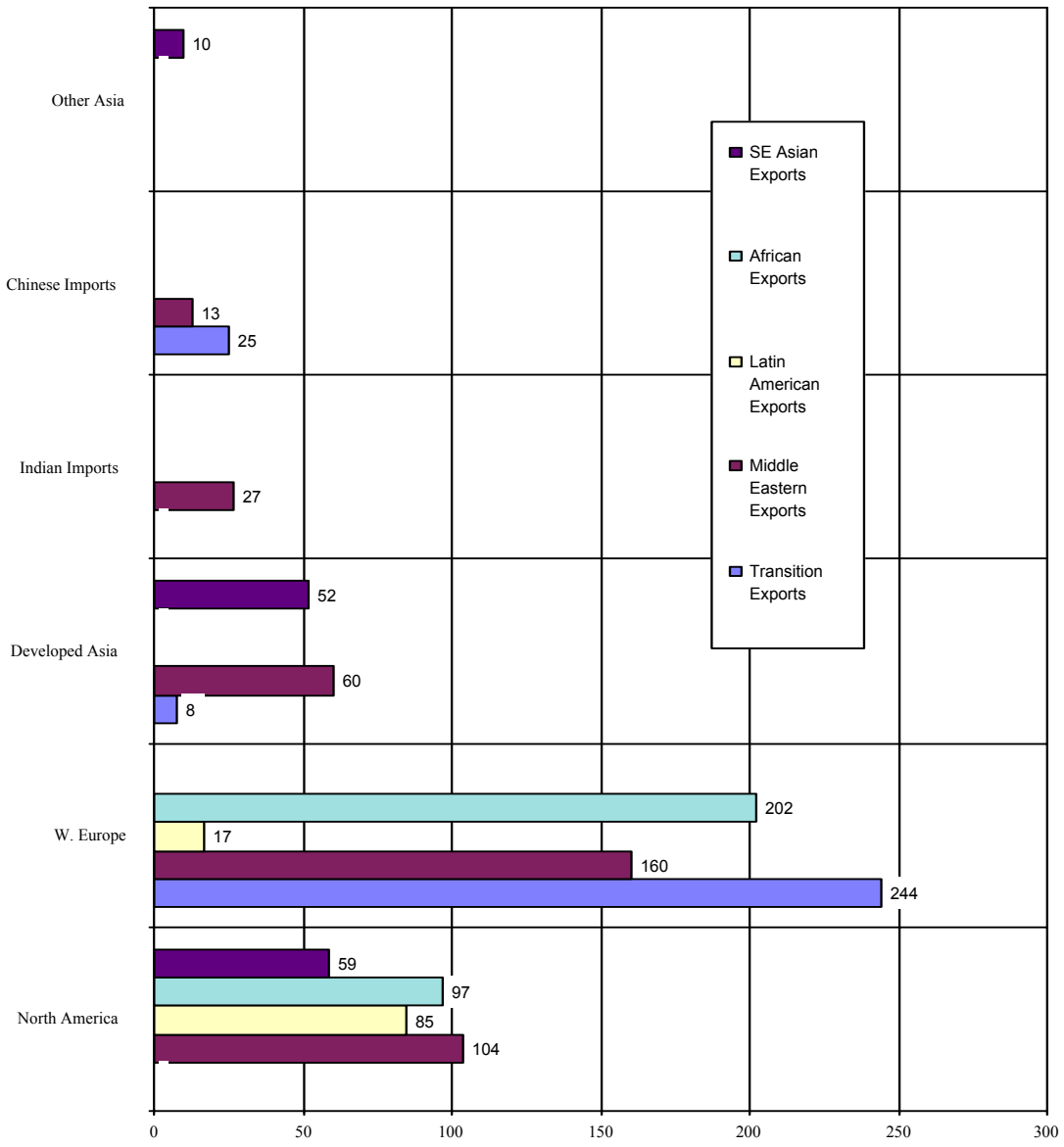
Source: Adapted by Anthony H. Cordesman from IEA, World Energy Outlook, 2002, International Energy Agency, Paris, 2002, p. 117.

Chart I.27

IEA Projection of Interregional Gas Trade in 2030

(in Billions of Cubic Meters)

.



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

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

Dealing with an Uncertain Future

Details and facts often seem boring. So do statistics and tables, and the results of complex models. The moment one actually looks in detail at the numbers projected by the most respected sources of energy data and future estimates, however, it becomes clear that such details really count. Such estimates and models make it clear that there are no near or mid-term developments in the real world 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 alternative energy supplies, it might well take a decade for such changes to really have a decisive global impact. The world has simply invested too much in vehicles, facilities, homes, and industrial process that use oil, and few breakthroughs could take the form of supplies that could be cheaply and quickly produced on a global basis.

These realities may not be apparent when the numbers that lie behind global energy balances are ignored, or when policymakers and analysts look at only part of the problem – such as the size of today's direct US 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 radically affect the pattern of world energy consumption, world energy exports, or global dependence on the Middle East.

II. The Geopolitics and Security Dimension of Middle Eastern and North African Energy Exports

The many uncertainties affecting the international energy market, the discovery and exploitation of energy reserves, and competition between fuels are only part of the forces shaping Middle East energy supply. The analysis in the preceding chapter discussed estimates that assume that market forces will dominate the future development of energy exports in the Middle East and North Africa. The MENA region, however, has been the scene of many internal crises and external conflicts. There have been several past occasions on which these crises have affected either the flow of MENA energy exports, and the development of Middle Eastern energy production and export capacity.

The MENA region is anything but stable today, and there are a wide range of external and internal forces that may become major future threats to Middle Eastern energy exports. The politics, economics, and social dynamics that shape these threats are complex. They are driven by political and security issues, but they are also driven economic and demographic factors, and a wide range of cultural factors. It is also dangerous to generalize. The MENA area includes at least twenty-two nations, located in an arc that sweeps from North Africa to the edge of Central Asia and the Red Sea. As of 2000, these states had a total population of some 295 million, and a GNP of some $651 billion, and each had different political, economic, demographic, and security conditions and needs..[59]

Most MENA states are Arab and Muslim, but a common ethnic and religious background has never meant that they do not go to war with each other or do not have internal sectarian, ethnic, and political conflicts. The MENA region is also divided into at least four sub-regions, each of whose nations have different interests and present different risks. These four sub-regions include the Maghreb, with Mauritania, Morocco, Algeria, Libya, and Tunisia; the Levant and the Arab-Israeli confrontation states: Egypt, Israel, Jordan, Lebanon, and Syria; the Gulf: Iran, Iraq, Kuwait, Bahrain, Qatar, Saudi Arabia, the UAE, and Oman; and the Red Sea states like Yemen, the Sudan, and Somalia.

Each subregion includes states that have been the source of recent terrorism or conflicts, although many states have been comparatively sable and have regimes with a long history of friendship to the West. The economics of every MENA state relies on strong trading partners outside of the region, and these links also differ by subregion and nation. The nations of North Africa are linked closely to Southern Europe, and also have ties to the Sub-Saharan states. The states of the Levant trade primarily with Europe and the U.S. The Southern Gulf states trade with the West and increasingly with Asia and the developing world. Iran is in many ways a Central Asian state that exports through the Gulf. It has good reason to be deeply concerned about security issues in Afghanistan and proliferation in India and Pakistan.

Treating the Middle East as a "region," rather than as a group of disparate actors, often conceals far more than it reveals. The future development of energy supply in each nation and subregion will be affected by exporting different political, security, ethnic, and sectarian fault lines. The internal character and strategic interests of given nations differ sharply from state to state. In many cases, regional or national tensions, have already led to war or could lead to future conflicts. In other cases, internal tensions have already produced civil conflicts. Violent religious extremism is an ongoing problem in many MENA countries, and the events of September 11th, 2001 have only dramatized internal security problems and terrorism on global level that long existed on a national and regional level.

A History of Conflict and Tension

MENA nations have a long history of violence and conflict. The Arab-Israeli Wars of 1948, 1956, 1967, 1970, 1973, 1982, and the first and second Intifada are all cases in point. So are the Iran-Iraq War, the Iraqi invasion of Kuwait, the Gulf War and the Iraq War. There is little chance that the region will avoid new conflicts between the present and 2020. Many Middle Eastern states still dispute at least one border with one of its neighbors, and most countries have serious religious and/or ethnic divisions. Low-level conflicts and internal unrest are virtual certainties.

In several cases, Middle Eastern states are either currently at war, or there is a serious risk of future conflict. Mauritania has long been the scene of a low-level race war between Arabs and Black Africans. Morocco is still in the process of a long war with the Polisario for control of the Western Sahara. Algeria is involved in a bitter civil war between its ruling military junta and

Islamic extremists. Tensions have grown between Libya's leader, Muammar Qadhafi and Libya's Islamists and there has been low-level fighting in a number of areas. The Egyptian government and a number of other regional governments are fighting low-level wars against Islamic terrorists.

A "war process", or "Second Intifada," has replaced the Arab-Israeli peace process. Israel is still formally at war with Syria and Lebanon, and faces a serious potential threat from outside terrorists. Israel may become involved in a broader conflict with its Arab neighbors and Iran, and has clashed on its northern border with the Hezbollah – a Shi'ite Islamic movement with strong Iranian and Syrian sponsorship. Lebanon remains under Syrian, and its factions still present the threat of another round of civil war.

The Southern Gulf states are relatively stable, and have resolved many of their border disputes in recent years, but there has been civil violence in Bahrain between Sunni and Shi'ite. Saudi Arabia has growing problems with Al Qaida and Islamic extremists, and there are extremist elements in every Southern Gulf state. Islamic extremism, and terrorism are at least low-level problems in Yemen, and many southern Gulf states are heavily dependent on foreign workers to the extent this raises serious issues about their future stability.

While Iran may be becoming more moderate, there is little sign that the Khatami faction or Iranian moderates will gain firm control of the country. Khatami expressed deep dissatisfaction about his ability to accomplish meaningful reform in August 2003, and there still a serious risk of internal clashes between its "moderates" and "traditionalists." Iran also presents major problems in terms of proliferation, its opposition to the Arab-Israeli peace process, and continued hostility to any U.S. presence in the Gulf.

The fall of Saddam Hussein in 2003 has removed one major source of instability in the region, but the war and the looting that followed have seriously damaged some aspects of Iraq's oil industry. There is also a risk that the aftermath to Saddam's repressive regime could be some form of lingering civil conflict or a long period of internal stability. Iraq is divided along sectarian lines between Sunni and Shi'ite, and Arab, Kurd, and Turkmen. Nation building in Iraq presents major challenges and risks, and there is a threat of that the US and Britain will face a growing threat from guerrilla attacks and sabotage. The Iraq War has already serious cut Iraq's

oil exports and there is no current way to predict the future development of its Petroleum industry and exports.

The civil war in the Sudan has entered its second decade, and the death toll from fighting and starvation will probably exceed well over one million. Yemen faces tensions between its government and key political and tribal groups in the South, and has clashed with Eritrea over the control of islands in the Red Sea.

None of these tensions and conflicts poses immediate threats to the flow of MENA oil exports, but they have affected the development of energy supply in Algeria, Iran, Iraq, Libya, and Yemen, and new outbreaks of violence could occur in many MENA states with little or no warning. Most MENA states suffer from internal political, economic, and demographic problems that compound intra-regional conflicts and tensions. Virtually all Middle East states have regimes with a high degree of authoritarianism – regardless of whether the ruler is called a King, Sheik, Sultan, President, General, or Ayatollah. Virtually all suffer from weak or failed economic development, high rates of population growth and a virtual youth explosion, aging and largely authoritarian regimes, and serious problems with internal stability.

The MENA region also suffers from a process of creeping proliferation that may ultimately change the nature of conflicts and the balance of power, in the region. Algeria, Egypt, Iraq, Iran Israel, Libya, Syria, and Yemen have all created missile programs and have at least conducted research into weapons of mass destruction. Israel is a major regional nuclear power and has chemical and biological programs. Egypt has chemical and biological research programs. Iran, Libya, and Syria are either trying to develop biological and chemical weapons or have already deployed them, and Iran seems to have made a major effort that it may or may not have halted in late 2003. Iraq continue to seek nuclear weapons. So far, such weapons have only been used in the Yemeni civil war and the Iran-Iraq War, but there is little doubt that the Middle East is acquiring far more lethal chemical, biological, radiological, and nuclear (CBRN) weapons and delivery systems than it has possessed in the past.

Militarism, Military Expenditures, and Arms Imports

One of the problems in analyzing trends in the MENA area is the tendency to separate the analysis of the overall trends in the economy and state spending from the trends in energy

spending and from military spending and arms imports. This often suits the regimes involved, who do not want serious public or external debate over their use of energy revenues or military spending and arms purchases, and who often seek to avoid close examination of any aspect of their overall level of state spending or "statism." The fact remains, however, that their failure to invest in economic development, to modernize their economies and to privatize state industry, often interacts in embarrassing ways with a lack of any clear mid-term to long-term energy investment strategy and their overspending on military forces and arms imports.

The level of waste in MENA military efforts, and the burden they place on economic and energy development, is difficult to put in perspective -- particularly because reliable data are not always available for recent years. It has long been clear, however, that the region's militarism poses serious dangers to its peoples as well as to its stability as an energy supplier.

Several factors are involved. One is the history of crises escalating into serious conflicts, some of which have led to energy interruptions. Another is a level of total expenditure –often without a clear threat and/or producing any effective defense capability – that is so high that it seriously limits the funds available for development, including energy investment. Finally, many MENA countries are finding it harder and harder to sustain their present conventional force structures. At least in some cases, this adds to the pressures to acquire weapons of mass destruction and proliferate. Such weapons present a major potential future threat to MENA energy facilities and exports.

The Overall Level of Military Efforts

There has been a decline in MENA military expenditures and arms imports since the end of the Cold War, Middle Eastern military expenditures dropped from $93.0 billion in 1985 to $38.4 billion during 1997-2000. [60] Nevertheless, the region still spends nearly 6.8% of its GNP on military expenditures, and this compares with an average of only 2.3% and for the developed world and 2.7% for the developing world. Militarism remains a serious problem and the MENA area. It remains the largest arms market in the developed world. It currently and accounts for roughly half of the world's conventional weapons purchase agreements. [61]

Once again, numbers and trends often speak louder than words:

- Table II.1 illustrates the scale of MENA military efforts in terms of demographics. This table also provides some of the best data currently available on the number of males entering the labor forces, and in the age groups most needing jobs and most prone to terrorism and violent political action.

- Table II.2 summarizes the present strength of MENA military forces.

- Chart II.1 shows why the MENA region is described in various assessments as the most militarized area in the world. While current data are not available in a directly comparable form, the CIA World Factbook indicates that the basic trends shown in this Chart, and the other charts based on US State Department, Bureau of Verification and Compliance, World Military Expenditures and Arms Transfers, 1989-1999, do reflect valid current trends.

- Chart II.2 shows that the overall level of military effort in the region has dropped since the end of the Gulf War. This chart does not reflect the impact of the Israeli-Palestinian conflict that began in September 2000, but other data indicate that the decline in overall regional military efforts has continued and even accelerated in some cases. The fall of Saddam Hussein's regime in April 2000 is also likely to result in further cuts in military efforts in the Gulf area.

- Chart II.3 shows that economic growth, and overall central government expenditures, are outpacing military expenditures and arms imports.

- Chart II.4 shows that military expenditures represent far too large a portion of central government expenditures in many MENA states, limiting the funds available for development and energy investment. In some cases, military expenditures are so large that they either compound the burden excessive state spending puts on the entire economy or come close to dominating that burden as the largest single aspect of "statism." This combination of excessive military spending, state spending, and inefficient state industrial blocks the growth and diversification of the economy as well as the work of market forces.

- Chart II.5 shows a declassified US estimate of the long-term trend in Middle Eastern (less North Africa) military spending and arms imports in current dollars. It reflects the massive swings that can occur in a time of war, but also a trend towards smaller defense expenditures and more limited arms imports.

- Chart II.6 shows more recent trends in current dollars. The capping of military expenditures and limits to arms imports emerge more clearly. One key implication of these data, however, is that most Middle Eastern states are not spending enough to recapitalize their force structures and maintain modern forces at anything like their present equipment strength. The slope of arms imports would have to have risen steadily from 1991 onwards and spending levels would have had to nearly double in constant dollars to both maintain the force size shown in Table II.2 and force quality.

- Chart II.7 shows the trends in current dollars for military expenditures and arms transfers in North Africa. It is clear from the decline in North African arms imports that North African countries have not come close to spending what they need to replace the equipment in their military forces. The end result is large, wasteful, force structures that are incapable of fighting any advance enemy – although the low overall standard of military modernization means that fighting can be sustained among North African states. The rise in military spending toward the end of the 1990s reflects the growing internal threat in several states, and the cost of the ongoing civil war in Algeria.

- Chart II.8 shows how these trends in North Africa spending relate to the overall trends in the regional economy. There has been a decline in the burden of military spending, but it is still high. The burden of arms imports is far lower, but has been heavily offset by internal security spending.

Table II.1

The Military Demographics of the Greater Middle East

Country	Total Population	Males Reaching Military Age Each Year	Males Between the Ages of 13 and 17	18 and 22	23 and 32	Males Between 15 and 49 Total	Medically Fit
Egypt	70,712,345	712,983	3,707,000	3,313,000	5,150,000	19,030,030	12,320,902
Gaza	1,225,911*	-				-	-
Israel	6,029,529	51,666	284,000	272,000	535,000	1,542,835	1,262,973
Jordan	5,307,470	57,131	280,000	247,000	454,000	1,517,751	1,073,991
Lebanon	3,677,780	-	216,000	194,000	397,000	1,003,174	618,129
Palestinian	2,900,000*	-	163,000	140,000	233,000	-	-
Syria	17,155,814	200,859	1,076,000	883,000	1,274,000	4,550,496	2,539,342
West Bank	2,163,667*	-				-	-
Iran	66,622,704	823,041	4,735,000	3,960,000	5,959,000	18,868,571	11,192,731
Iraq	24,001,816	274,035	1,472,000	1,270,000	1,899,000	6,135,847	3,430,819
Bahrain	656,397	5,926	35,000	26,000	40,000	222,572	121,955
Kuwait	2,111,561	18,309	124,000	107,000	148,000	812,059	486,906
Oman	2,713,462	26,470	163,000	140,000	233,000	780,292	434,026
Qatar	793,341	6,797	26,000	22,000	38,000	316,885	166,214
Saudi Arabia	23,513,330	233,402	1,391,000	1,177,000	1,725,000	6,007,635	3,359,849
UAE	2,445,989	25,482	87,000	87,000	143,000	773,938	419,851
Yemen	18,701,257	238,690	1,008,000	803,000	1,328,000	4,272,156	2,397,914
Algeria	32,277,942	388,939	1,986,000	1,834,000	2,962,000	9,016,048	5,513,317
Libya	5,368,585	61,694	387,000	320,000	492,000	1,503,647	890,783
Morocco	31,167,783	348,380	1,780,000	1,612,000	2,726,000	8,393,772	5,289,283
Tunisia	9,815,644	105,146	529,000	505,000	869,000	2,806,881	1,597,565
Chad	8,997,237	82,003	408,000	332,000	518,000	1,881,769	985,094
Mauritania	2,828,858	-	149,000	121,000	194,000	644,294	312,276
Western Sahara	256,177	-	-	-	-	-	-
Afghanistan	27,755,775	252,869	1,499,000	1,194,000	2,053,000	6,896,623	3,696,379
Djibouti	472,810	-	42,000	35,000	57,000	110,221	64,940
Eritrea	4,465,651	-	252,000	210,000	320,000	-	-
Ethiopia	67,673,031	703,625	3,977,000	3,172,000	4,780,000	14,925,883	7,790,977
Somalia	7,753,310	-	626,000	511,000	726,000	1,881,634	1,040,662
Sudan	37,090,298	398,294	1,990,000	1,693,000	2,542,000	8,739,982	5,380,917
Turkey	67,308,928	674,805	3,264,000	3,251,000	6,242,000	19,219,177	11,623,675

Note: Totals include non-nationals, Total population, males reaching military age, and Males between 15 and 49 are generally CIA data, the rest are IISS data. * Totals for Palestinians are IISS, totals for Gaza and West Bank are CIA.
Source: Adapted by Anthony H. Cordesman, CIA, World Factbook, 2002, IISS, The Military Balance, various editions,

Table II.2

The "Perceptual Balance": Military Forces of the Greater Middle East

Country	Total Active Manning	Total Active Army Manning	Tanks	OAFVs	Artillery	Combat Aircraft	Armed Helicopters
Egypt	443,000	320,000	3,860[a]	4,179	1,415[a]	608	128
Israel	161,500	120,000	3,750	7,808	1,653	454	135
Jordan	100,240	84,700	1,101[a]	1,545	531	101	22
Lebanon	71,830	70,000	327	1,463	183	0	0
Palestine[b]	(35,000)	(35,000)	-	-	-	-	-
Syria	319,000	215,000	3,500	5,025	2,560	611	106
Iran[c]	520,000	450,000	1,565	1,455	3,284	306	69
Iraq	389,000	350,000	2,600	3,400	2,300	316	62
Bahrain	10,700	8,500	140	306	93	34	40
Kuwait	15,500	11,000	293	561	95	81	20
Oman[c]	41,700	31,400	117	349	126	40	0
Qatar	12,400	8,500	35	302	44	18	19
Saudi Arabia[c]	199,500	150,000	710	5,057	390	294	33
UAE	41,500	35,000	381	1,305	343	101	49
Yemen[a]	66,500	60,000	790	1,040	695	76	8
Algeria	136,700	120,000	1,089	1,964	729	222	63
Libya	76,000	45,000	985	2,383	1,921	400	48
Morocco	196,300	175,000	520	1,279	452	95	24
Tunisia	35,000	27,000	84	391	117	29	15
Chad	30,350	25,000	60	203	5	2	2
Mauritania	15,750	15,000	35	75	75	8	0
Afghanistan[b]	-	-	-	-	-	-	-
Djibouti	9,850	8,000	0	31	6	0	0
Eritrea	172,200	170,000	100	80	155	17	0
Ethiopia	252,500	250,000	300	400	360	55	30
Somalia[b]	(35,900)	(35,900)	-	-	-	-	-
Turkey	514,850	402,000	4,205	4,543	2,990	485	53

Notes: Totals count all "active" equipment, much of which is not operational. They do not include stored equipment, but are only approximate estimates of combat-ready equipment holdings. Light tanks, APCs, AIFVs, armored recce vehicles, and misc. AFVs are counted as OAFVs (Other Armored Fighting Vehicles). Artillery counts towed and self-propelled tube weapons of 100-mm+ and multiple rocket launchers, but not mortars. Only armed or combat-capable fixed wing combat aircraft are counted, not other trainers or aircraft.

a: Egypt has 100 additional M-1A1 Abrams MBT, 179 M-109A2/A3 SP ARTY on order. Jordan is awaiting 47 additional Challenger 1 MBT. Yemen has an additional 5 MiG-29S/UB on order.

b: No current data available for Palestine, Afghanistan and Somalia due to recent combat.

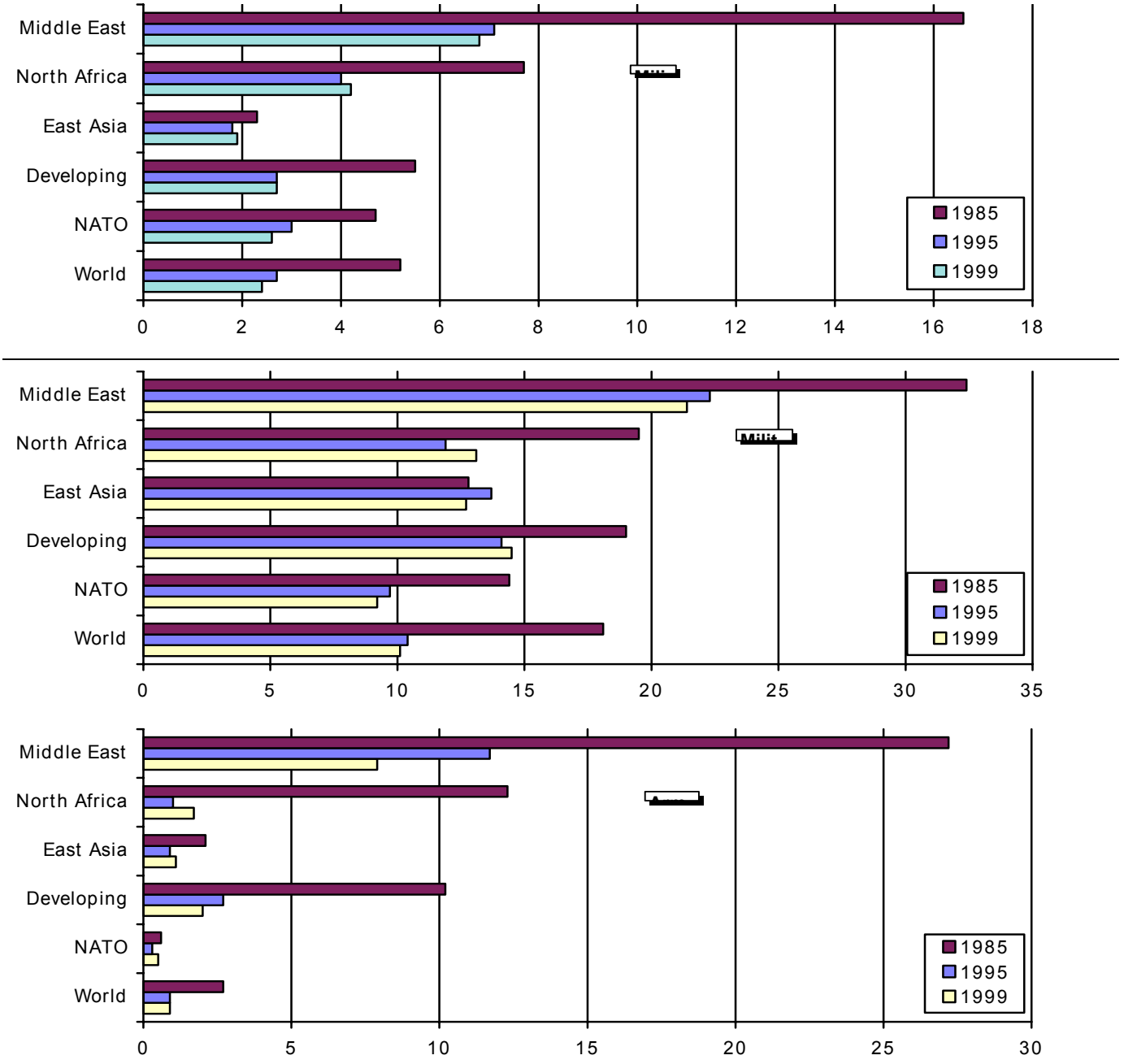
c: Iranian totals include Revolutionary Guard Corps, Saudi totals include the Saudi National Guard and Omani totals include the Royal Household Guard.

Source: Adapted by Anthony H. Cordesman, CIA, World Factbook, various editions and IISS, The Military Balance, various editions

Chart II.1

"The Most Militarized Region in the World"

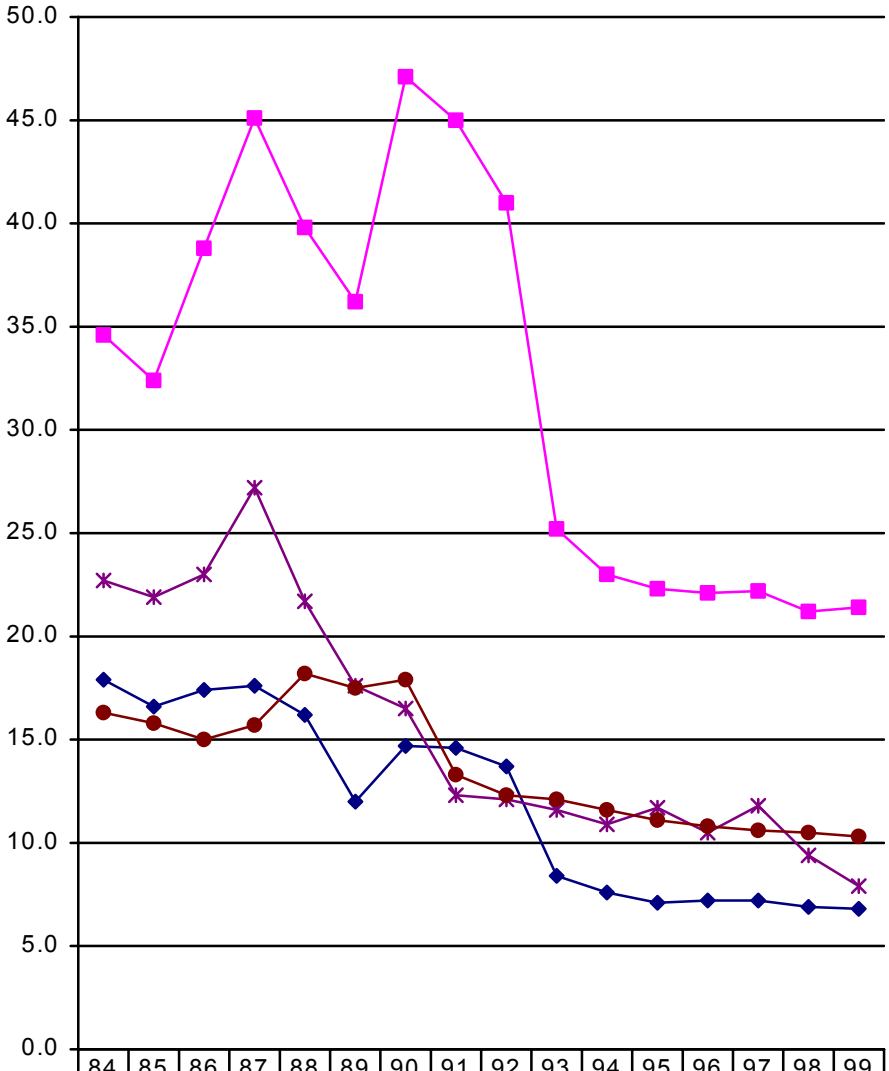
(Military Expenditures and Arms Imports as an Economic Burden in the Middle East Relative to Other Regions)



Source: Adapted by Anthony H. Cordesman from US State Department, Bureau of Verification and Compliance, World Military Expenditures and Arms Transfers, 1989-1999. Middle East does not include North African states other than Egypt.

Chart II.2

Middle Eastern Military Efforts Have Also Dropped Sharply as a Percent of GNP, Government Expenditures, Total Population, and Arms Imports: 1984-1999



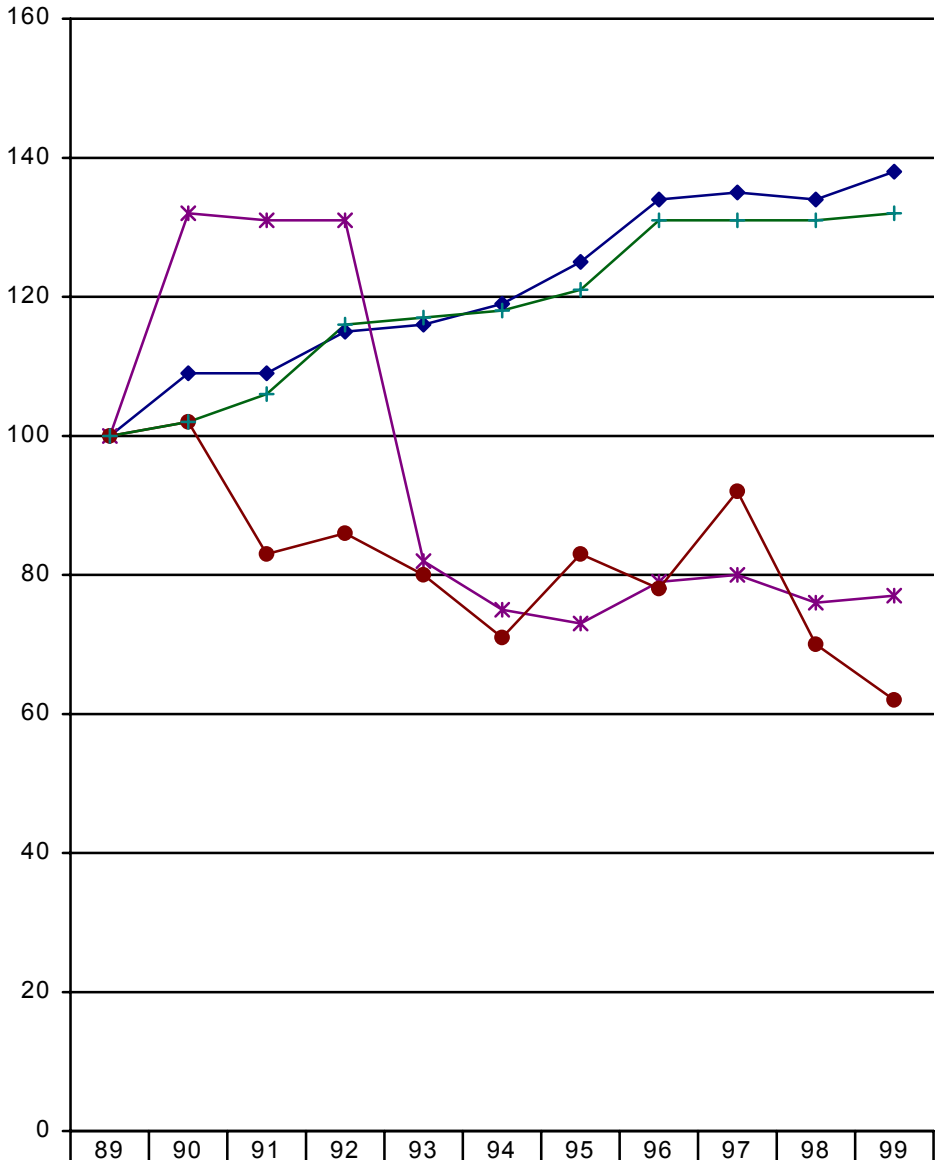
	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99
Military Spending as a Percent of GNP	17.9	16.6	17.4	17.6	16.2	12.0	14.7	14.6	13.7	8.4	7.6	7.1	7.2	7.2	6.9	6.8
Military Spending as a Percent of Central Government Expenditures	34.6	32.4	38.8	45.1	39.8	36.2	47.1	45.0	41.0	25.2	23.0	22.3	22.1	22.2	21.2	21.4
Arms Imports as a Percent of Total Imports	22.7	21.9	23.0	27.2	21.7	17.6	16.5	12.3	12.1	11.6	10.9	11.7	10.5	11.8	9.4	7.9
Active Military Manpower per 1,000 People	16.3	15.8	15.0	15.7	18.2	17.5	17.9	13.3	12.3	12.1	11.6	11.1	10.8	10.6	10.5	10.3

Source: Adapted by Anthony H. Cordesman from US State Department, World Military Expenditures and Arms Transfers, various editions. Middle East does not include North African states other than Egypt.

Chart II.3

Middle Eastern Military Expenditures and Arms Imports Dropped Sharply Relative to Economic Growth and Government Spending During 1989-1999

(1989=100, and all following years are percentages of 1989 as base year. All expenditure totals are measured in constant 1989 US dollars.)



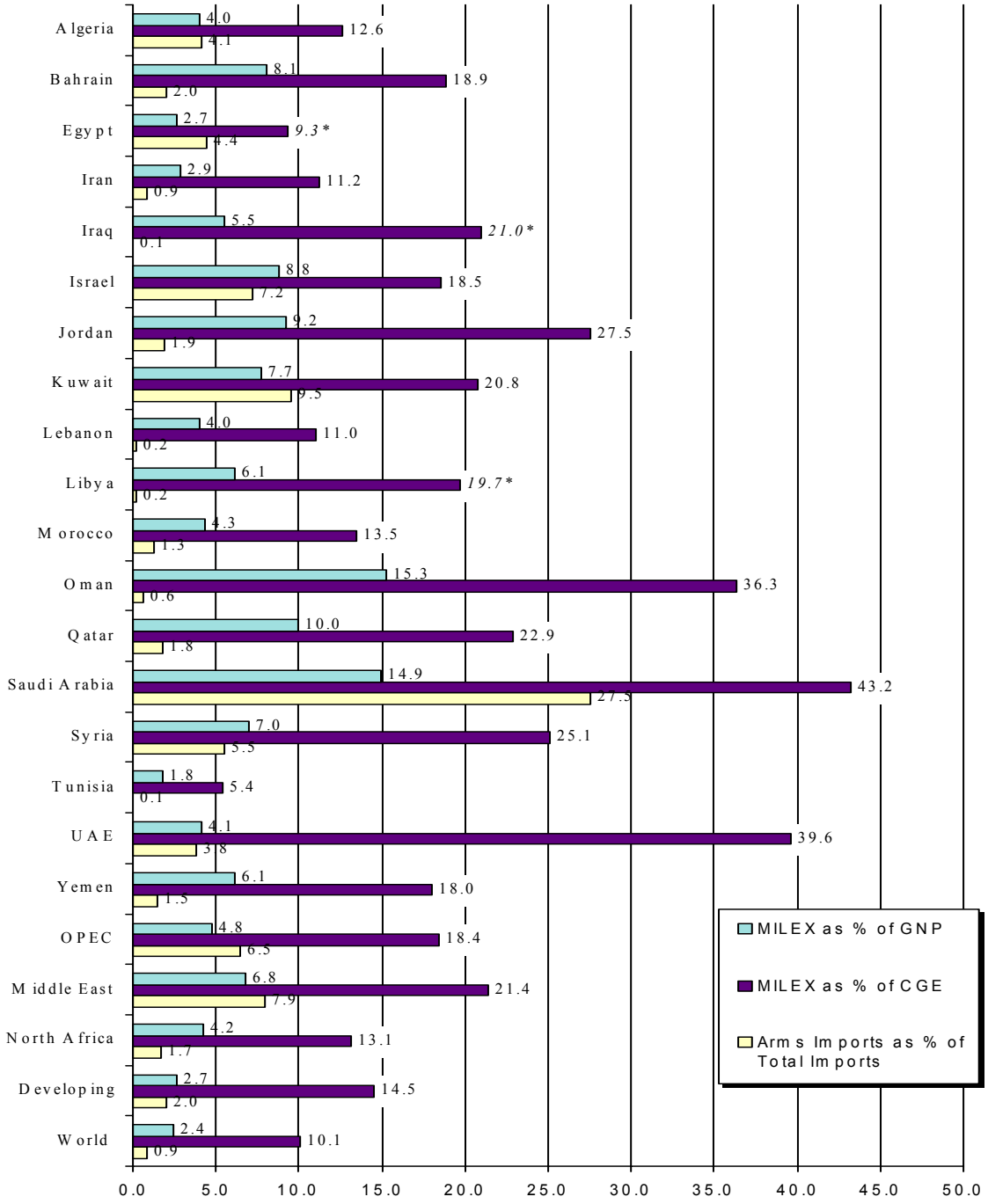
	89	90	91	92	93	94	95	96	97	98	99
Gross National Product	100	109	109	115	116	119	125	134	135	134	138
Military Expenditures	100	132	131	131	82	75	73	79	80	76	77
Arms Imports	100	102	83	86	80	71	83	78	92	70	62
Central Government Expenditures	100	102	106	116	117	118	121	131	131	131	132

Source: Adapted by Anthony H. Cordesman form US State Department, Bureau of Verification and Compliance, World Military Expenditures and Arms Transfers 1999-2000. Middle East does not include North African states other than Egypt.

Chart II. 4

Military Expenditures and Arms Transfers as an Aspect of "Statism" in Individual Middle Eastern Countries in 1999

(Military spending as a percent of Central Government Expenditures (CGE) and Gross National Product (GNP), and Arms Imports as a Percent of Total)

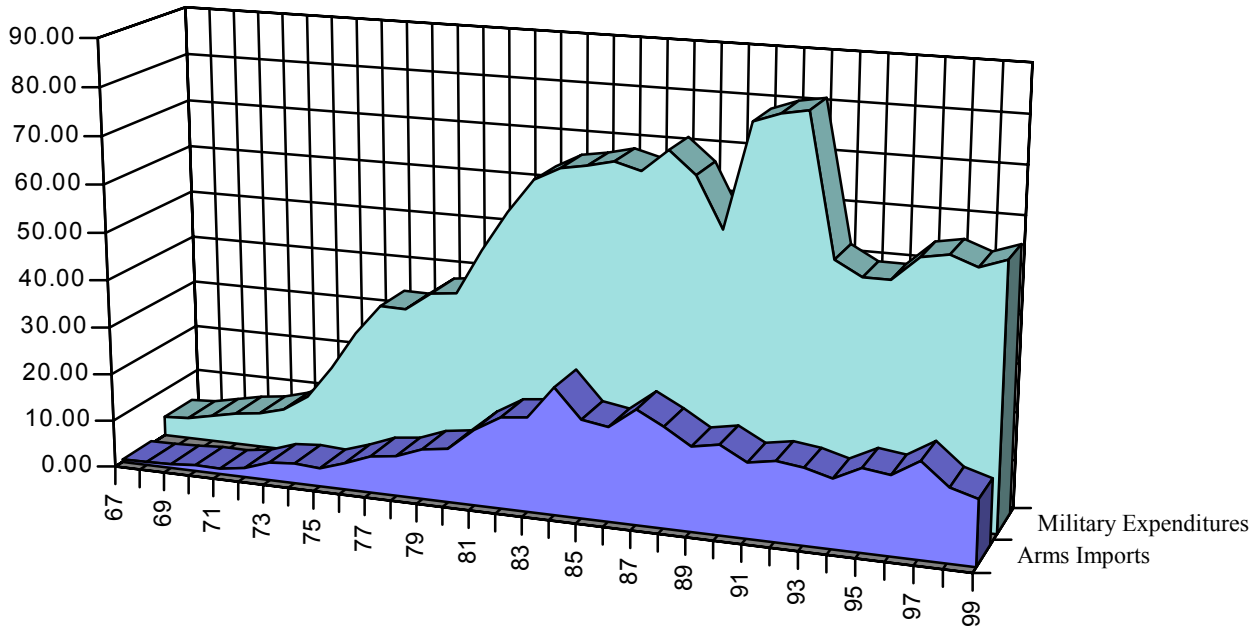


Note: Figures marked with asterisks are estimated or older data.
Source: Adapted by Anthony H. Cordesman from US State Department, Bureau of Verification and Compliance, World Military Expenditures and Arms Transfers, various editions.

Chart II.5

The Trend in Middle Eastern Military Expenditures and Arms Transfers Since the October War

(1967-1999 in $Current Billions)

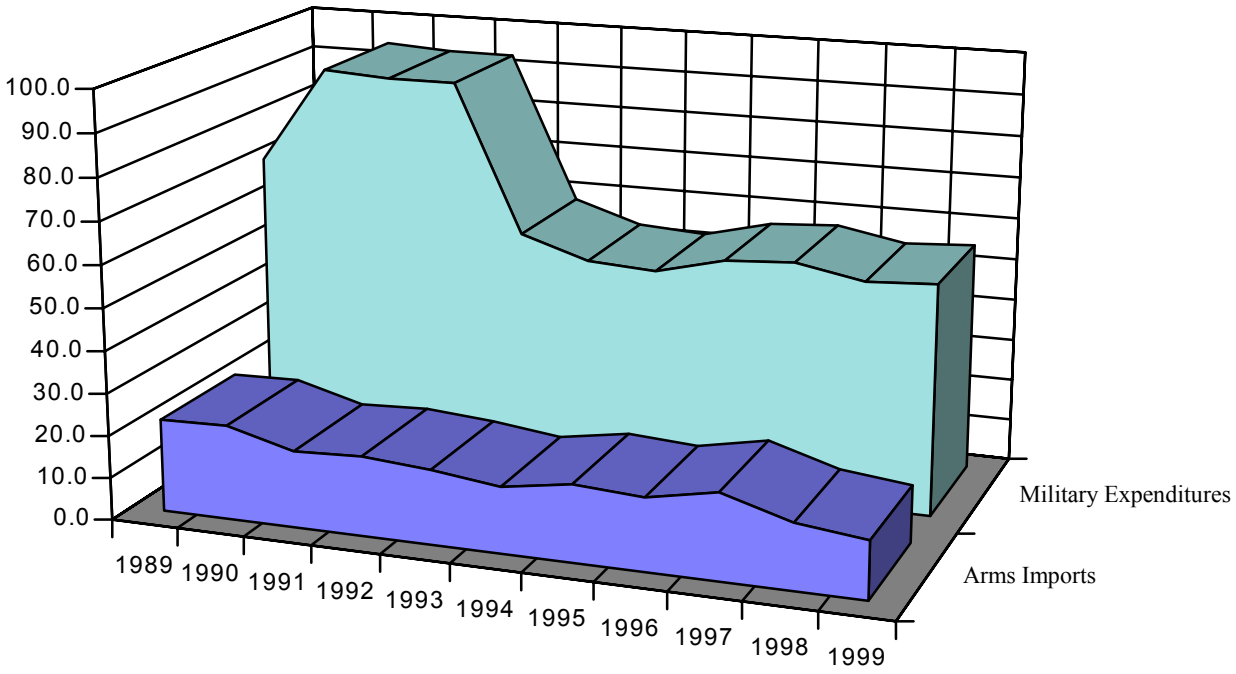


Source: Adapted by Anthony H. Cordesman from US State Department, Bureau of Arms Control, World Military Expenditures and Arms Transfers, various editions. Middle East does not include North African states other than Egypt.

Chart II.6

The Trend in Middle Eastern Military Expenditures and Arms Transfers in Constant Dollars Since 1989

(1989-1999 in $US 1999 Constant Billions)



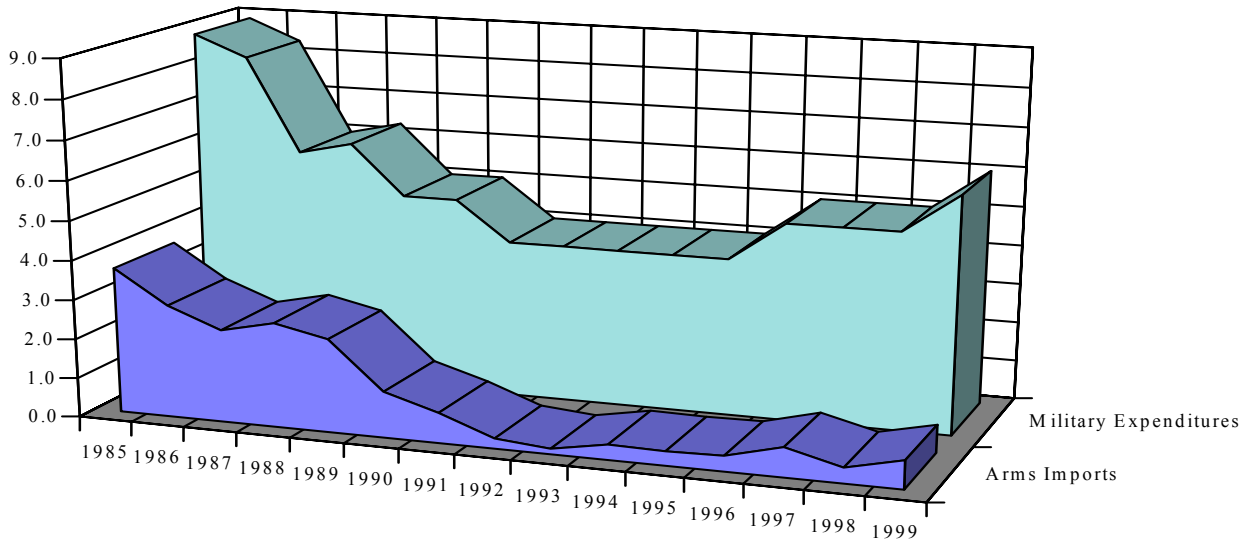
	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Arms Imports	22.0	22.3	18.1	18.8	17.5	15.5	18.2	17.1	20.3	15.4	13.5
Military Expenditures	71	94	93	93	58	53	52	56	57	54	55

Source: Adapted by Anthony H. Cordesman from US State Department, Bureau of Verification and Compliance, World Military Expenditures and Arms Transfers 1999-2000. Middle East does not include North African states other than Egypt.

Chart II.7

North African Military Expenditures and Arms Transfers in Constant Dollars Have Dropped to Low Levels by Global Standards

(Algerian, Libyan, Moroccan, and Tunisian spending in Constant $US 1999 Billions)

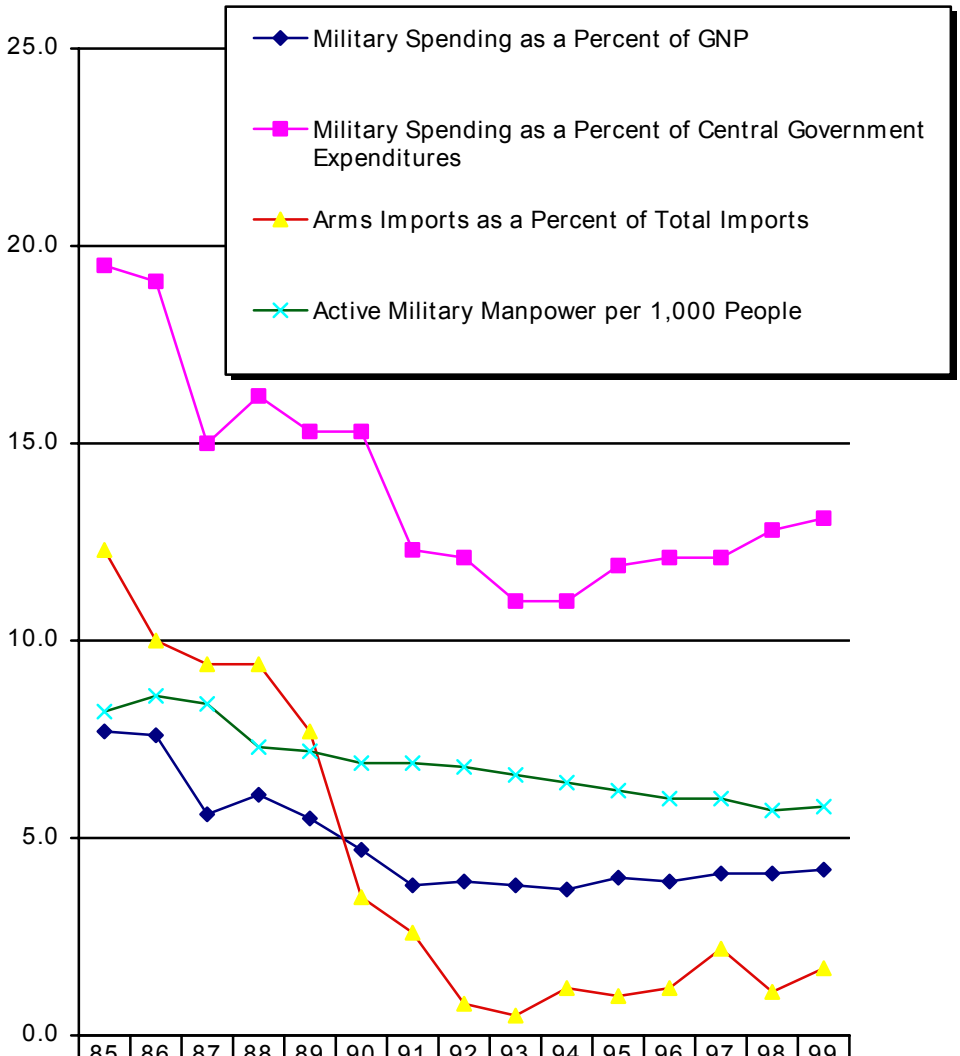


	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Arms Imports	3.7	2.9	2.3	2.6	2.4	1.2	0.8	0.3	0.1	0.4	0.4	0.4	0.7	0.4	0.7
Military Expenditures	8.9	8.3	6.0	6.3	5.0	5.0	4.0	4.0	4.0	4.0	4.0	5.0	5.0	5.0	6.0

Source: Adapted by Anthony H. Cordesman from Bureau of Arms Control in the US State Department (formerly US State Department, Bureau of Arms Control), World Military Expenditures and Arms Transfers, various editions.

Chart II.8

North African Military Efforts Declined Sharply as a Percent of GNP, Government Expenditures, Imports, and Total Population: 1985-1999



	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99
Military Spending as a Percent of GNP	7.7	7.6	5.6	6.1	5.5	4.7	3.8	3.9	3.8	3.7	4.0	3.9	4.1	4.1	4.2
Military Spending as a Percent of Central Government Expenditures	19.5	19.1	15.0	16.2	15.3	15.3	12.3	12.1	11.0	11.0	11.9	12.1	12.1	12.8	13.1
Arms Imports as a Percent of Total Imports	12.3	10.0	9.4	9.4	7.7	3.5	2.6	0.8	0.5	1.2	1.0	1.2	2.2	1.1	1.7
Active Military Manpower per 1,000 People	8.2	8.6	8.4	7.3	7.2	6.9	6.9	6.8	6.6	6.4	6.2	6.0	6.0	5.7	5.8

Source: Adapted by Anthony H. Cordesman from US State Department, World Military Expenditures and Arms Transfers, various editions, GPO, Washington. Middle East does not include North African states other than Egypt.

The Problem of Arms Imports

The decline in MENA arms imports summarized in the previous charts often has not been a matter of choice on the part of the individual nations involved. It has been forced on by them by the need to spend far more on internal security and counterterrorism, the end of concessionary arms transfers by the FSU, growing regional economic problems, and a range of sanctions on key states like Iran, Iraq, and Libya.

The recent drop in spending on arms imports must also be kept in careful perspective. Spending on arms is still high enough to divert important sums away from economic and energy development. The cumulative impact of the resulting drop in force quality is broad enough so that it limits the ability of MENA countries to fight powers like the US, but it does not affect their ability to fight each other – since most regional states are left at nearly the same level of force quality. Moreover, the more the trend in arms imports is analyzed, the more clear it is why the problems in modernizing conventional forces have been a factor leading some nations to shift their resources away from conventional forces to the acquisition of weapons of mass destruction, long-range delivery systems, and carefully selected advanced conventional weapons.

- Chart II.9 puts the MENA level of arms imports in global perspective. It should be noted, however, that this table also shows that MENA arms deliveries still cost some $15 billion a year, and these figures do not include the cost of military related imports of civilian and dual-use equipment likes trucks, communications, etc. The true cost is clearly in excess of $20 billion that could otherwise be used for economic or energy development.

- Chart II.10 shows how cumulative trends relate to the impact of given wars. Presumably, the fall of Saddam Hussein will cause a further cut in regional arms imports, although no Gulf country has yet announced since plans. It should also be noted that the data are somewhat skewed by the fact the Israeli-Palestinian War does not involve major arms imports, and Israel's true level of imports is grossly understated in any case because only complete weapons sales – not components for military industries – are counted. Similarly, Algeria's imports relating to its civil war are often civilian or dual use goods. The graph also sharply understates spending for nations like Iran and Syria because the costs do not include proliferation and imports for WMD.

- Chart II.11 shows in more detail just how dramatic the impact of end of the Iran-Iraq War, and the sanctioning of Iraq and Libya, were in leading to the cuts in arms imports. The data for Syria do not reflect the real nature of its arms transfers because it was obtaining arms at concessionary price or through loans through most of the 1980s, and these ceased to be available after the start of the 1990s. As a result, the number of arms per dollar dropped precipitously.

- Chart II.12 uses declassified US data on arms sales to show the trend by major Middle Eastern country for both new arms orders and deliveries. The dominant role of two critical energy exporters – Saudi Arabia and the UAE – is clearly apparent. The Saudi data are particularly striking because many of the nation's economic and energy development problems could be solved if it cut its arms imports to more rational levels.

- Chart II.13 shows similar data on North African arms imports. The militaristic character of Algeria is clearly apparent. So is the impact of UN sanction in producing a sharp decline in Libyan arms imports, effectively putting an end to Qaddafi's dreams of becoming a serious regional military power.

The Threat to Energy Facilities

War and military forces have long affected the development and security of MENA energy supplies. The Arab-Israeli wars of 12956 and 1967 each affected the flow of exports to some degree, although at a time the world as far less dependent on the MENA region. The October War of 1973 triggered an oil embargo that led to a drastic strategic reappraisal of the importance of energy exports and imports. The Iran-Iraq War of 1980-1998, and the closely related US-Iranian tanker war of 1997-1998, involved deliberate and systematic attempts to target energy production and export capabilities in a prolonged conflict. Iraq burned Kuwait's oil fields and looted the country during its withdrawal, oil, and sabotage and looting seriously reduced Iraq's oil production and export capacity during the Iraq War of 2003.

The net impact of such wars, however, has so far been relatively limited. As yet, no country has had both the motive and capability to launch well-planned precision strikes against an opponent's energy facilities and exports, although Iran and Iraq at least attempted to carry out such attacks during 1980-1988. The overthrow of Saddam Hussein's regime has removed one of the few governments in the MENA region that was willing to conduct such attacks without extreme provocation, and it is unclear that any other government has an incentive to conduct some form of energy war in the near future. If anything, it is terrorism, not state-vs.-state conflicts, which is likely to be the future threat.

The downward trend in MENA military forces, spending, and arms transfers does not, however, mean that MENA energy facilities and exports are necessarily becoming safer. Both MENA nations and extremist movements are learning a great deal more about asymmetric war with time, and states are using their remaining funds to acquire more precision weapons and better platforms to launch them from. These weapons include air launched weapons that can be used against such key targets as export facilities, major energy processing and distribution facilities and as-oil separators, desalination and war injection facilities, power plants, gas train refineries, and petrochemical plants. MENA countries are also buying better maritime

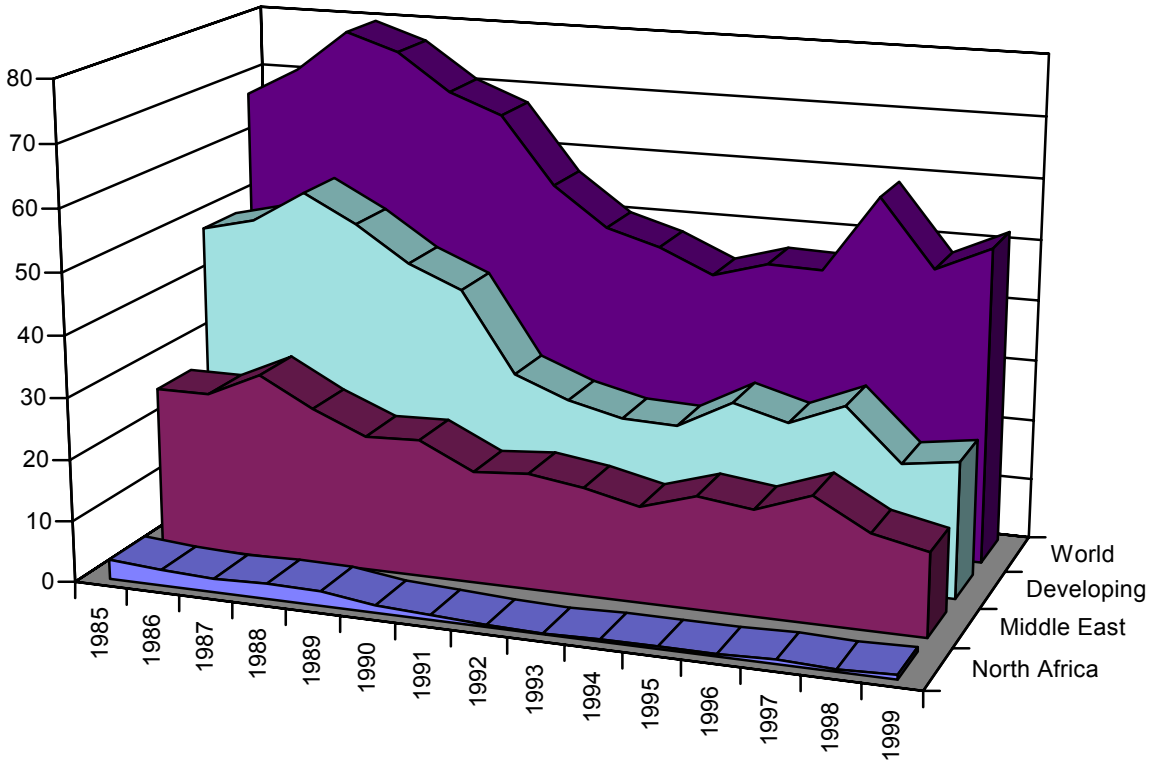
surveillance systems and longer range anti-ship missiles, better mines, and submarines also allow MENA states to do a better job of attacking tankers and offshore facilities.

The history of war is also the history of sudden explosive crises, and unplanned escalation. There is no way to predict whether one MENA state will launch such attacks on another's energy facilities, or whether such attacks will then be well planned and well executed. What does need to be understood, however, is that the broader trends in MENA military forces do not necessarily affect the security of energy facilities. In fact, it is at least possible that MENA nations with limited overall capability for conventional war would lash out at high value targets to try to defeat , intimidate, or punish their neighbors. If so, they will continue to acquire the means to conduct such attacks over time.

Chart II.9

MENA Arms Deliveries Are Declining: 1985-1999

(Arms Deliveries in Constant $US 1999 Billions)



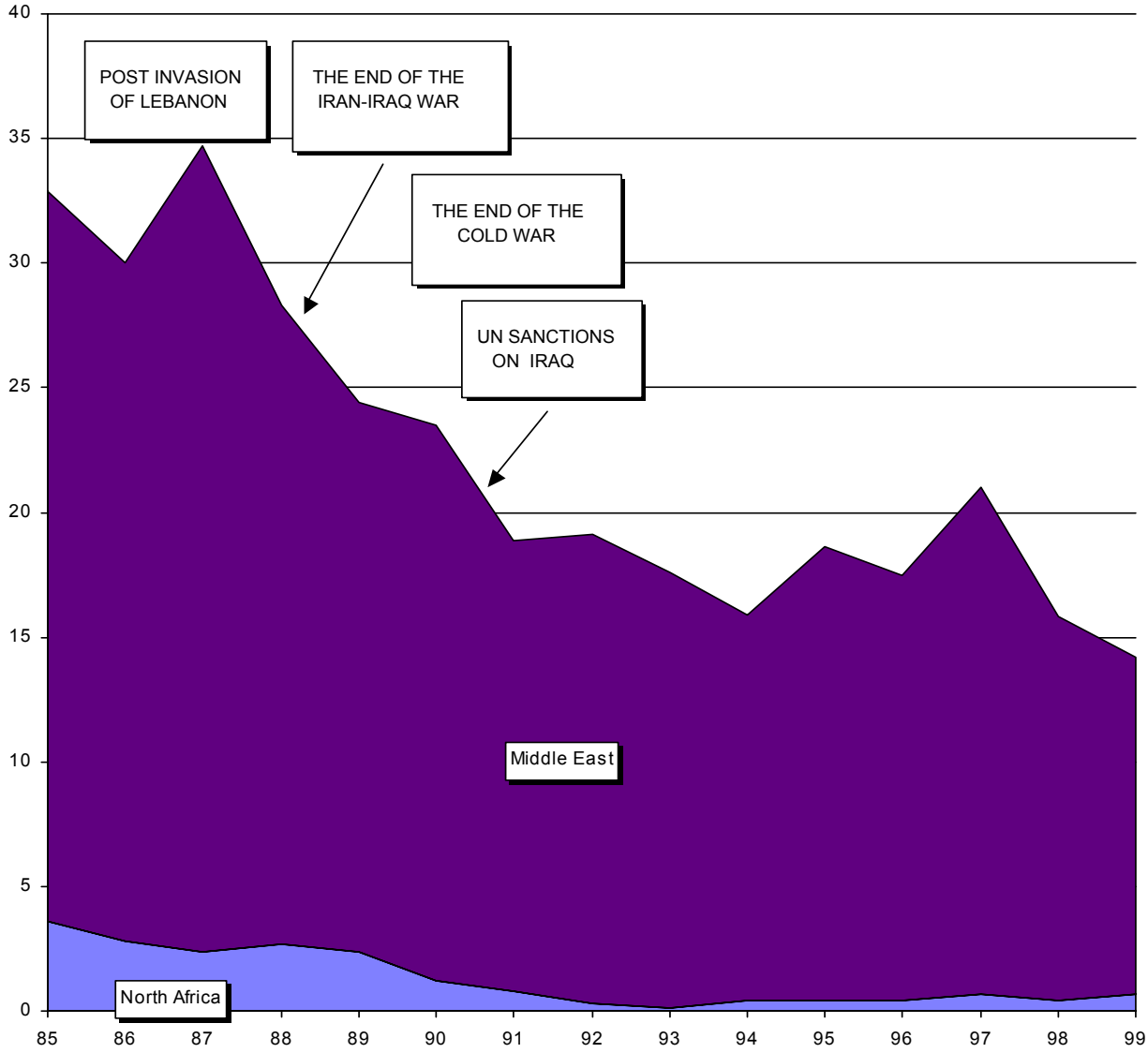
	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
North Africa	3.2	2.6	2.2	2.5	2.4	1.2	0.8	0.3	0.1	0.4	0.4	0.4	0.7	0.4	0.7
Middle East	26.2	26.2	30.2	25.6	22	22.3	18.1	18.8	17.5	15.5	18.2	17.1	20.3	15.4	13.5
Developing	48.7	50.7	56	51.5	45.8	42.2	29.1	25.7	23.6	23.3	28	25.6	29.3	20.9	22.2
World	67.9	72.5	79.3	76.5	70.5	67.2	56.2	49.9	47.4	43.5	46.1	45.8	58.4	47.5	51.6

Source: Adapted by Anthony H. Cordesman from Bureau of Arms Control in the US State Department, World Military Expenditures and Arms Transfers, various editions. Middle East does not include North African states other than Egypt.

Chart II. 10

The Cumulative Impact of the Arab-Israeli Peace Accords, Sanctioning of Libya, End of the Iran-Iraq War, End of the Cold War, Gulf War, and Economic Recession: 1985-1999

(Arms Deliveries in Constant $US 1999 Billions)



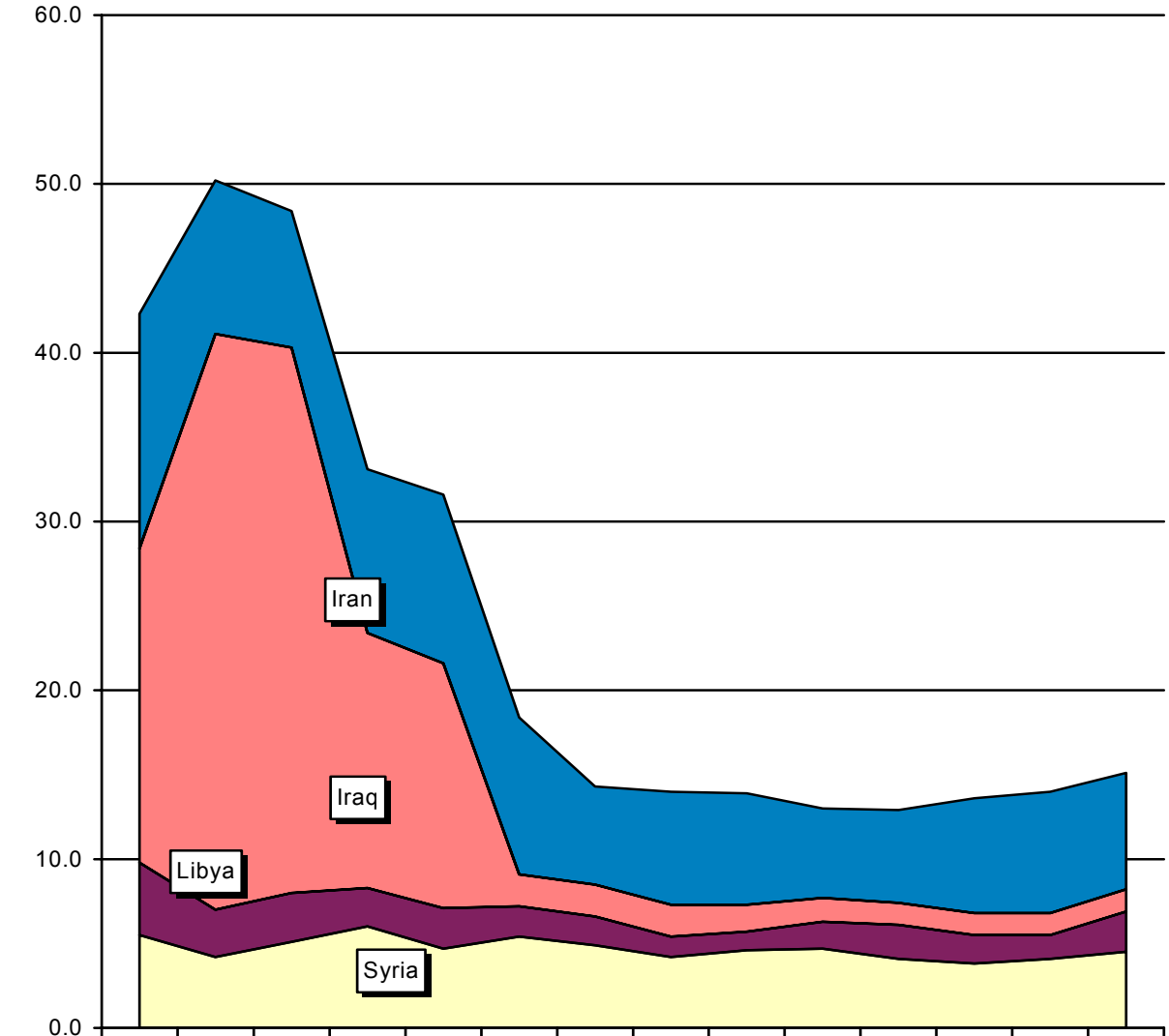
	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Oceania	1.5	1.1	1.3	1.7	1.7	1.6	1.4	1.2	1.4	1.5	1.5	1.5	1.9	1.7	1.7
South America	1.5	1.4	1.6	1.7	1.4	0.9	1.5	0.8	0.8	0.8	1.6	1.3	1.5	1.2	0.8
North Africa	3.6	2.8	2.4	2.7	2.4	1.2	0.8	0.3	0.1	0.4	0.4	0.4	0.7	0.4	0.7
Central America	4.2	3.4	3.4	3.3	2.2	2.0	0.9	0.3	0.3	0.1	0.2	0.2	0.1	0.1	0.1
Sub-Saharan Africa	4.2	4.1	7.1	5.8	3.9	2.5	1.3	0.9	1.0	1.4	0.7	0.7	0.7	1.0	1.2
South Asia	5.5	6.9	6.6	8.2	9.4	7.9	4.2	1.5	1.2	0.8	1.4	0.8	1.4	1.2	1.8
East Asia	8.8	8.4	10.3	9.6	8.6	8.4	8.5	8.3	7.5	9.1	9.8	10.3	17.2	12.3	11.4
Developed World	21.7	20.7	26.6	24.8	24.7	25.1	27.0	24.3	23.7	20.3	18.1	20.2	29.1	26.4	29.5
Middle East	29.3	27.2	32.3	25.6	22.0	22.3	18.1	18.8	17.5	15.5	18.2	17.1	20.3	15.4	13.5

Source: Adapted by Anthony H. Cordesman from US State Department, Bureau of Verification and Compliance, World Military Expenditures and Arms Transfers, various editions. Middle East does not include North African states other than Egypt.

Chart II.11

The Cumulative Decline in Military Spending by Selected Major Buyers in Constant Dollars: 1984-1999

(Constant $US 1999 Billions)



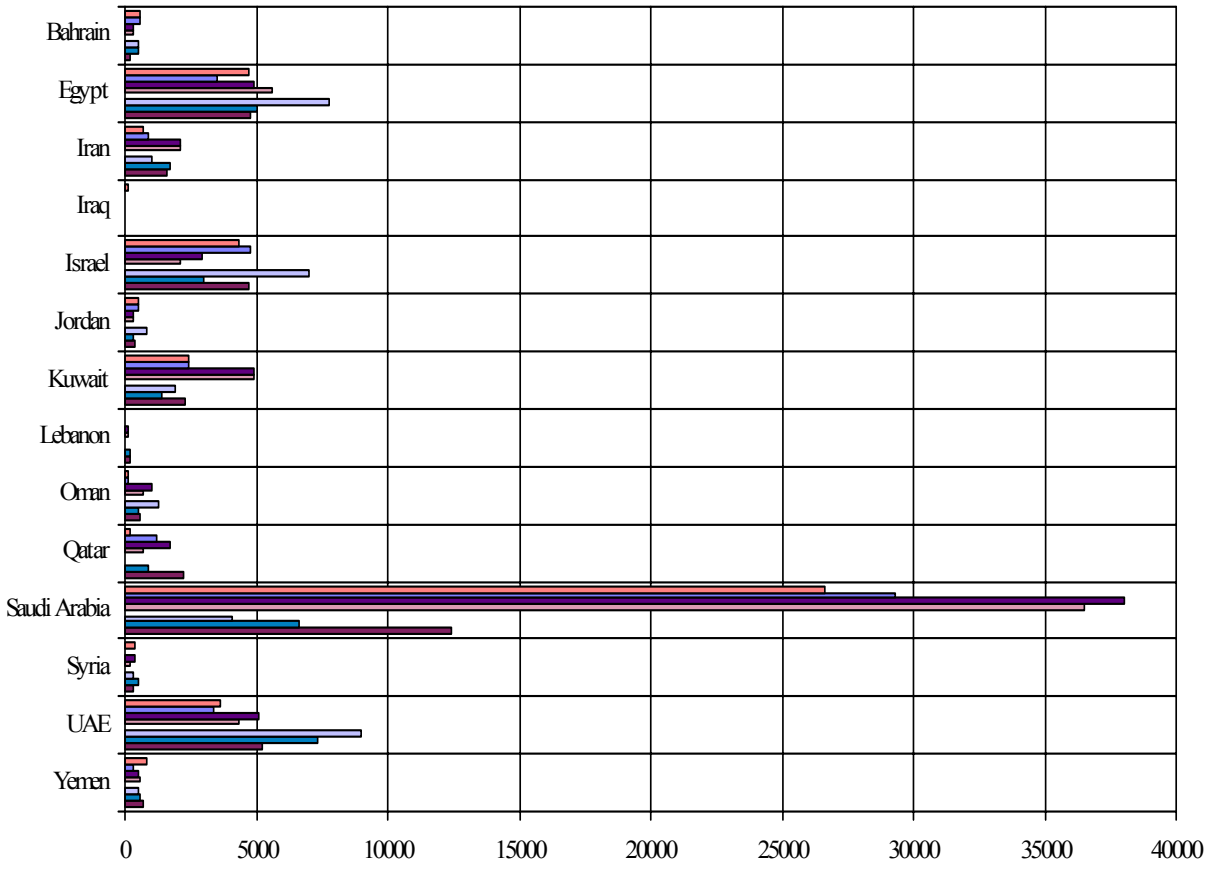
	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Iran	13.9	9.1	8.1	9.7	10.0	9.3	5.8	6.7	6.6	5.3	5.5	6.8	7.2	6.9
Iraq	18.6	34.1	32.3	15.1	14.5	1.9	1.9	1.9	1.6	1.4	1.3	1.3	1.3	1.3
Libya	4.3	2.8	2.9	2.3	2.4	1.8	1.7	1.2	1.1	1.6	2.0	1.7	1.4	2.4
Syria	5.5	4.2	5.1	6.0	4.7	5.4	4.9	4.2	4.6	4.7	4.1	3.8	4.1	4.5

Source: Adapted by Anthony H. Cordesman from US Arms Control and Disarmament Agency, World Military Expenditures and Arms Transfers, various editions. Some data adjusted or estimated by author.

Chart II.12

Middle Eastern Agreements and Deliveries by Country: 1994-2002

(Arms Agreements and Deliveries to North African nations in $US Current Millions)



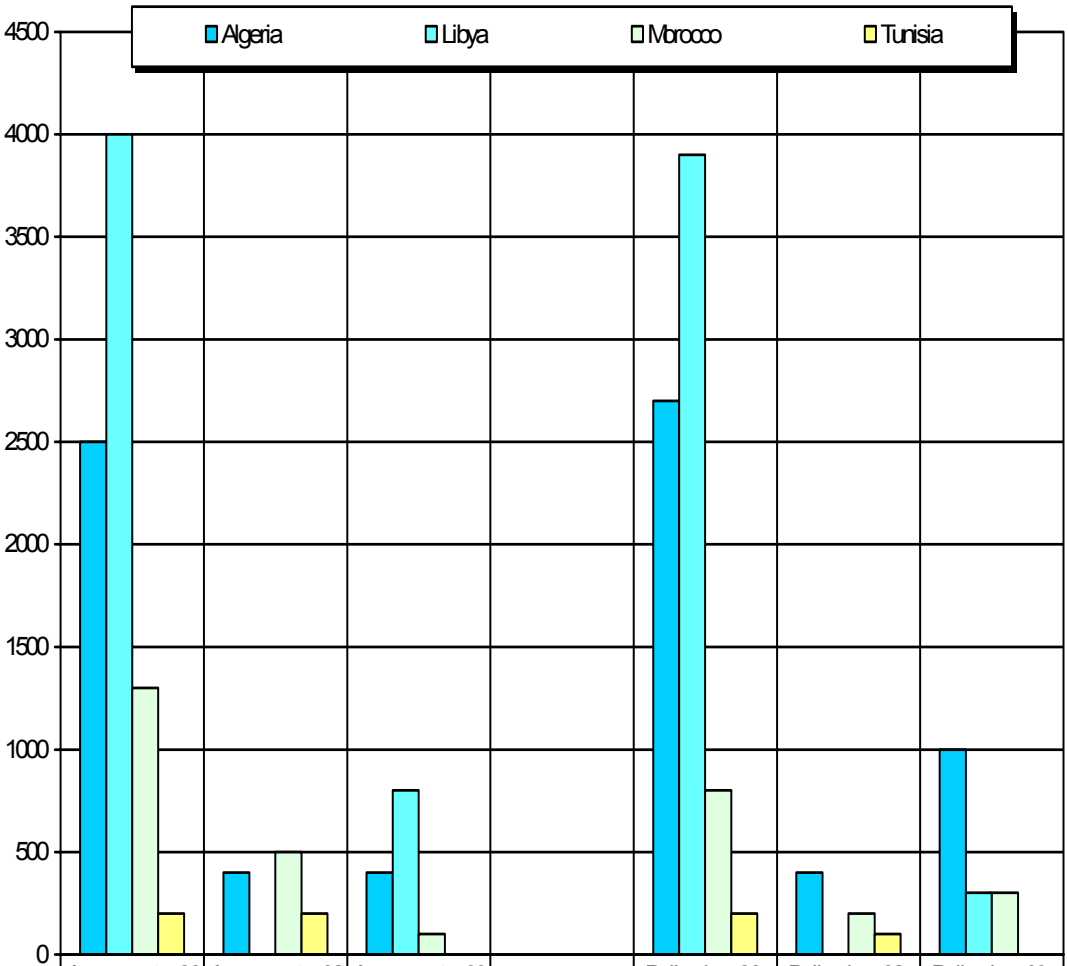
	Yemen	UAE	Syria	Saudi Arabia	Qatar	Oman	Lebanon	Kuwait	Jordan	Israel	Iraq	Iran	Egypt	Bahrain
Deliveries: 99-02	800	3600	400	26600	200	100	*	2400	500	4300	100	700	4700	600
Deliveries: 98-01	300	3400	*	29300	1200	100	*	2400	500	4800	*	900	3500	600
Deliveries: 95-98	500	5100	400	38000	1700	1000	100	4900	300	2900	*	2100	4900	300
Deliveries: 92-95	600	4300	200	36500	700	700	100	4900	300	2100	*	2100	5600	300
Agreements: 99-02	500	9000	300	4100	*	1300	*	1900	800	7000	*	1000	7800	500
Agreements: 95-98	600	7300	500	6600	900	500	200	1400	300	3000	*	1700	5000	500
Agreements: 92-95	700	5200	300	12400	2200	600	200	2300	400	4700	*	1600	4800	200

0 = Data less than $50 million or nil. All data rounded to the nearest $100 million.
Source: Richard F. Grimmett, Conventional Arms Transfers to the Developing Nations, Congressional Research Service, various editions.

Chart II.13

Trend in North African Agreements and Deliveries by Country: 1986-2002

(Arms Agreements and Deliveries to North African nations in $US Current Millions)



	Agreements: 86-89	Agreements: 92-95	Agreements: 99-02		Deliveries: 86-89	Deliveries: 92-95	Deliveries: 99-02
Algeria	2500	400	400		2700	400	1000
Libya	4000	0	800		3900	0	300
Morocco	1300	500	100		800	200	300
Tunisia	200	200	0		200	100	0

0 = Data less than $50 million or nil. All data rounded to the nearest $100 million.

Source: Richard F. Grimmett, Conventional Arms Transfers to the Developing Nations, Congressional Research Service, various editions.

Proliferation

Proliferation is serious problem in the Middle East, and one that is not likely to diminish in the near future. There is a complex pattern of proliferation in the region, and the range of delivery systems is steadily expanding. Algeria, Egypt, Iran, Iraq, Israel, Libya, the Sudan, and Yemen have all been involved in past efforts to acquire weapons of mass destruction – albeit at very different levels and with different goals and intentions. Algeria, Iraq, the Sudan, and Yemen are no longer part of the list of serious proliferators, but Iran, Israel, and Syria are.Israel has large nuclear forces, and Iran has a rapidly maturing nuclear program, Iran and Syria have significant biological warfare programs, and Egypt and Israel have conducted significant research and development activity. All of the proliferators in the Middle East are working on – or have --chemical weapons; Iran, Libya, and Syria probably have a stockpile of such weapons. Algeria, Egypt, and Israel have the technical capability to produce them. Egypt, Iran, Iraq, Israel, Libya, and Saudi Arabia have long-range missiles or programs to acquire them.

Terrorist movements like Al Qaida have also sought weapons of mass destruction and there is no way to predict how asymmetric wars or terrorism using CBRN weapons could damage oil and gas production and petroleum export facilities, or the level and duration of any interruption in exports. It is all too clear, however, that the threat posed by future wars and terrorism is becoming far more serious than in the past.

Proliferators in the Middle East

Table II.3 shows the list of MENA proliferators and the current estimated status of their efforts. The nations listed in Table II.3 are so different in terms of regime, goals, and behavior that it is obvious that there is no regional threat to the West, but rather the possibility that individual states might pose a threat to individual Western nations or interests. Two major proliferators – Iran and Libya – are of special interest. These are nations that have posed a threat to the West in the past and which have also sponsored attacks of state terrorism against Western targets and/or on Western soil.

Iran currently poses the most significant near-term threat in terms of acquiring biological and nuclear weapons, and long-range missiles that might strike Europe or the United States. In spite of Iranian denials, there is little doubt that Iran has an active nuclear and biological weapons program, and has already begun to test long-range missiles. Iran’s capabilities, however, will remain highly limited for the next decade, and Iran faces a strong regional threat

from Israel. While Iran's regime may or may not become truly moderate in character, it has become more pragmatic since the death of Khomeini, and it is far from clear that it would take "existential" risks of the kind posed by such an attack on the West.

There has, however, been growing international pressure on Iran to cutback on its nuclear program. The discovery of two major undeclared underground facilities in 2003 that included a centrifuge plant suitable for producing fissile Uranium, and a heavy water plant for a reactor fuel cycle that could produce weapons grade Plutonium, led to broad international pressure on Iran to permit full-scale inspection on the terms provided to the protocol for the Nuclear Non-Proliferation Treaty. So did a follow on analysis by the International Atomic Agency that investigated Iran's nuclear program in depth and reported a number of forbidden research and development activities; and confirmation of the fact that Pakistan had secretly sold nuclear weapons technology to Iran. the a protocol to the Nuclear Nonproliferation Treaty that allows the International Atomic Energy Agency broader rights of access to sites in the country on December 18, 2003, but this does not preclude Iran from going on with covert R&D activity. Iran is also proceeding with long-range missile developments that have little military meaning unless the missiles are armed with weapons of mass destruction, and there are no effective limits on its chemical and biological weapons programs.[62]

Libya has the dubious distinction of being the only MENA state to have fired a long-range missile on a Western target – it fired on the Italian island of Lampadusa following the U.S. raid on Tripoli. At the same time, a lot of Libya's grandiose military plans have so far ended in failure. Libya has some chemical weapons capability, but has failed to develop ballistic missiles with longer ranges than the Scud. It has explored biological and nuclear weapons programs, but there is little evidence of success. Moreover, the interception of a ship carrying nuclear centrifuge and weapons technology to Libya in the fall of 2003 led to political pressure that resulted in Libya's declaration in December 2003 it would give up all its programs for developing missiles and weapons of mass destruction and allow unconditional inspections. This was followed by both US and IAEA inspections, and the transfer of much of Libya's technology to the US.

Given this background, it currently seems unlikely that even the most radical MENA power would readily take the risk of directly confronting a combination of its neighbors, the US, and other Western states, given the relative military weakness of key potential threats, and the risk of massive retaliation. No Middle Eastern state can disregard the fact that any use of a biological or nuclear weapon that produced massive casualties could trigger devastating conventional strategic strikes or even the use of nuclear weapons by the West.

At the same time, there are dangers in assuming that Middle Eastern states will always behave as "rational actors," and terrorist and extremist movements are far harder to deter than states. The history of the region is filled with miscalculations, erratic behavior, and risk taking. Behavior can alter rapidly in a crisis, and the most threatening states have rulers or ruling elites that may choose to escalate in ways that are far less conservative than what Western planners would consider under similar conditions. Extremist movements like Al Qaida have also shown that they will take extreme risks to take extreme action, and they may either cooperate with proliferating states or act as their covert proxy.

The following scenarios could involve either the more radical proliferators in the region or terrorist attacks and may not represent even moderate probability cases, but they are possible enough so they deserve serious consideration:

- Weapons of mass destruction might be used against key energy and energy export facilities in intra-regional conflicts to pose a major economic threat to a regime or put pressure on the West.
- Attacks might be carried out on Western power projection forces in the region, or the threat of such attacks might be used to try to force a regional power to expel Western power projection forces, or deprive regimes of Western support.
- Threats against the West, demonstrative long-range missile attacks against targets in the West, or low-level use of weapons of mass destruction might be used against targets in the region or the West to try to force Western nations to support the policies of a given Middle Eastern state, or intervene in a regional conflict. The escalation of an Israeli-Syrian conflict, or future Iranian-Iraqi conflict might lead to such a threat.
- A regional power might set up a launch on warning or launch-under-attack system targeted on the West in an effort to deter Western intervention or military action. Such a system might be created to prevent Western counterproliferation strikes.
- The threat, demonstrative use, or larger scale use of such weapons might be utilized in an effort to force an end to sanctions or containment.

- A regime on the edge of collapse might lash out, feeling it had nothing to lose and accepting the risk of broader retaliation against the nation. Alternatively, a nation under nuclear attack by Israel might feel that attacks were justified against Western targets, particularly U.S. bases.

- Terrorists could use such weapons in the West to try to further divide the West and Arab world, building on the tensions caused by the Second Intifada and hostility growing out of September 11, 2001.

- Middle Eastern states are not limited to conventional forms of warfare. While a great deal of attention focuses on long-range missiles, a Middle Eastern state might use unconventional delivery means or a terrorist proxy to deliver such weapons – hoping that it would not be identified as the source or that enough ambiguity would exist to prevent a decisive response.

- Technology or fissile material transfers might suddenly destabilize the balance. This might include the transfer of long-range missiles or fissile material, or key components and technology for missiles and weapons. This could suddenly alter the regional balance and the perceived risk in threatening the West or Western interests.

Once again, the problem is to balance possible risks against probable risks over a period as long as 2003-2030, knowing that new proliferators can emerge and many regional powers could acquire missiles, cruise missiles, or better strike aircraft. Most MENA states and leaders are normally cautious and self-preservation is normally the highest single priority. There is no question, however, that a combination of creeping proliferation, and having to rely on the judgment and stability of at least five major proliferators, presents risks.

The Threat to Energy Facilities

Proliferation represents the most serious potential threat to MENA energy facilities in terms of lethality. Even a small nuclear weapon could destroy any energy production or export complex in the Middle East, although oil and gas fields are too dispersed and "hardened" for such attacks to have much effect. Radiological weapons are far harder to produce in effective lethal form than many analysts seem to understand, but are probably within the state of the art of the more advanced Middle Eastern economies, and even small, relatively non-lethal, radiological weapons might keep workers from entering a site or facility,

Biological weapons can be more lethal than nuclear weapons, and have the advantage of leaving facilities intact. Persistent biological weapons are possible, and can be used to contaminate facilities in much the same way as radiological weapons. Once again, their psychological effect might be more important than their lethality or killing effect.

Large amounts of chemical weapons are needed to achieve high lethality against large energy facilities, but such attacks are within the state of the art for countries like Syria and Iran, -- which seem to have cluster munitions and persistent nerve gas. Advances in warhead and weapons design are also improving the capability to disseminate both chemical and biological weapons from missiles, cruise missiles, bombs, and UCAVs. There is no way to know how advanced MENA countries now are, or how much progress they will make in the future, but it is clear that some could have a limited capability now and that they could all potentially acquire relatively sophisticated capabilities during 2005-2010.

Proliferating MENA nations may never use weapons of mass destruction against energy facilities, but there are incentives that could lead to making such threats or to actually using such weapons in a crisis. Energy facilities are a natural hostage in a strategic confrontation, and involve far less provocation than attacks on civilian populations. The threat of such attacks might offset a major conventional advantage on the part of an opponent or be used to deter military action or the support/basing of outside powers like the US. The effective destruction of a key energy facility could also produce a serious mid to long-term blow in economic terms.

In any case, it is dangerous to assume that crises and escalation are handled in rational terms or from a common set of perceptions. Proliferating nations know that even the threat of such strikes can have a powerful deterrent or intimidating impact, and threats can lead to use. Moreover, world energy markets might well panic at the very threat of the use of WMD and might take days or weeks to stabilize after even a token use of a weapon whose effects would be difficult to estimate and understand.

Independent or proxy action by terrorist groups presents a further problem, as does the risk of covert attack. Extremist groups cannot present the same range of military threats as states, but this might not matter if they picked the right target. State use of a terrorist group as a proxy, or covert attack, could achieve significant results in some scenarios with far less fear of retaliation or some kind of serious action by the international community.

Table II.3

Nations with Weapons of Mass Destruction

Country	Type of Weapon of Mass Destruction		
	Chemical	Biological	Nuclear
		East-West	
Britain	Breakout	Breakout	Deployed
France	Breakout	Breakout	Deployed
Germany	Breakout	Breakout	Technology
Sweden	-	-	Technology
Russia	Residual	Residual	Deployed
US	Residual	Breakout	Deployed
		Middle East	
Algeria	Technology	Technology	Interest
Egypt	Residual	Breakout	-
Israel	Breakout	Breakout	Deployed
Iran	Deployed?	Breakout	Technology
Iraq	?	?	Technology
Libya	Deployed	Research	-
Syria	Deployed	Technology?	-
Yemen	Residual	-	-
		Asia and South Asia	
China	Deployed?	Breakout?	Deployed
India	Breakout?	Breakout?	Deployed
Japan	Breakout	Breakout	Technology
Pakistan	Breakout?	Breakout?	Deployed
North Korea	Deployed	Deployed	Deployed (?)
South Korea	Breakout?	Breakout	Technology
Taiwan	Breakout?	Breakout	Technology
Thailand	Residual	-	-
Vietnam	Residual	-	-
		Other	
Argentina	-	-	Technology
Brazil	-	-	Technology
South Africa	-	-	Technology

Terrorism and State Terrorism

Many of the regimes in the region are repressive, and state terrorism is endemic. A lack of representative government, a failure to establish a sound rule of law, and human rights abuses have led human rights groups and the US state Department to cite a continuing pattern of arbitrary arrests, abuse of internal security efforts, and corruption. These problems have often helped to breed extremist and terrorist opposition groups.

Many other forces are at work, however, and terrorism is scarcely limited to attacks on the most repressive regimes. As Chapter III describes, the MENA area is filled with serious economic, cultural, and demographic problems. Many moderate regimes face problems with internal and external terrorism, much of it directed against their secular character and often against progressive change and reform.

The Problem of Islamic Extremism and Violence

Islamist extremist violence has proved to be exceptionally dangerous and destabilizing. Every nation in the Middle East, no matter how moderate, faces some level of internal and external threat from such movements. Active internal fighting has taken place in Algeria, Libya, Egypt, Lebanon, Syria, Saudi Arabia, and Yemen. Iran is torn between Islamic "hardliners" and "moderates," and the fall of Saddam Hussein has unleashed new Islamist forces in Iraq. Every other MENA country has had to establish new security procedures, and cope with its own Islamist extremists. The problem is also an international one that reaches far outside the MENA area. It now involves Central Asia, South Asia, the Islamic countries of Southeast Asia, and movements in Europe and North America.

While militarism and proliferation pose potential threats to the region's development and energy exports, the most active threat of violence now comes from this violent extremism. It does not, however, have one source or represent one cause. Some have arisen in response to state terrorism, in response to regional conflicts like the Israeli-Palestinian War, but other elements have developed in part due to the pressures of social change. The end result is a complex mix of threats mixes national movements, regional movements, and truly international movements like Al Qaida.

The ideology and goals of these movements differ from group to group, but there are often loose alliances of groups with different goals. What most do have in common is that their ideology is based on an extremist version of Shi'ite, Sufi, Salafi, and Wahhabi Islam and that the religious goals of each movement are mixed with an antisecular political agenda and a rejection of modern economic priorities and reform. So far, they are all small extremist groups that do not represent the views and hopes of the vast majority of the people in their country of the MENA region, but several have already proven to be dangerous both inside and outside the Middle East.

The Regional and Global Impact of Islamic Extremist Terrorism

Long before 9/11, the attacks on Al Khobar, the USS Cole, and the World Trade Center showed that terrorism posed a threat to the moderate regimes in the Middle East and a transnational threat to the West. There have been many serious terrorist attacks on Western targets in the Middle East in the past, such as the bombing of the Marine Corps Barracks in Beirut.[63]

The November 13, 1995 truck bombing of the National Guard Headquarters in Riyadh killed five U.S. service men and two Iranians. The June 25, 1996 bombing of the Khobar Towers killed 19 U.S. servicemen. The attacks on the U.S. Embassies in Kenya and Tanzania involved large numbers of innocent casualties – 247 dead and over 5,000 wounded in the case of Kenya, and 10 dead and more than 75 wounded in the case of Tanzania. These attacks involved truck bombs with 600-800 pounds of explosive.

Civil tension in the Middle East has made tourists a target. For example, the worst terrorist attack in Egypt's history occurred on November 17, 1997. Six gunmen belonging to the Egyptian terrorist group al-Gama'at al-Islamiyya (Islamic Group or IG) entered the Hatsheput Temple in Luxor. For nearly half an hour, they methodically shot and knifed tourists trapped inside the Temple's alcoves. Fifty-eight foreign tourists were murdered, along with three Egyptian police officers and one Egyptian tour guide. The gunmen then fled the scene, although Egyptian security forces pursued them and all six were killed. Terrorists launched a grenade attack on a tour bus parked in front of the Egyptian National Antiquities Museum in Cairo on September 18, 1997, killing nine German tourists, an Egyptian bus driver, and wounding eight others.

The West began to respond long before "9/11." The U.S. cruise missile attacks on targets in Afghanistan and the Sudan on August 20, 1998 reflected the fact that U.S. intelligence had reliable information that Osama Bin Laden, a leading sponsor and financier of terrorism, planned large-scale attacks on U.S. targets. The U.S. attack on the Shifa Pharmaceutical Plant in Khartoum was a preemptive attempt to prevent the production and use of VX nerve gas by Bin Laden's organization. These attacks, however, show that the wrong use of military power can do more to provoke than deter.

Nevertheless, the attack that truly globalized Middle Eastern terrorism was the series of attack on the World Trade center and the Pentagon on September 11, 2001. There have been many previous attempts at such attacks, and many smaller successful attacks on targets in Europe. It was "9/11," however, that showed the US that its territory and civil population could be as vulnerable as the nations of the Middle East.

While Al Qaida emerged as the most important current threat, there were many causes of transnational terrorism in the Middle East, and many different targets:

- The U.S. is a major target because it projects the most power into the region, because of its close ties to Israel, because attacks on the U.S. produce the most world-wide publicity, and because the U.S. can often be used as a proxy for less popular attacks on Middle Eastern regimes.

- The breakdown in the Arab-Israeli peace process has triggered a wave of Palestinian "terrorism" in response to steadily escalating Israeli "excessive force." It is a tragedy that could trigger a broader Arab-Israeli conflict and make Americans a target, both out of frustration and in an effort to break up the peace process.

- The failures of Middle Eastern secular governments, state terrorism and authoritarianism, economic hardship, social dislocation, and the alienation of youth, combine to create extremist groups that not only attack their governments, but use Western targets as proxies. Motives can include attempting to drive out the Western military forces that provide Middle Eastern countries with security, cripple the economy to weaken governments, or win public recognition in the region. While some of these groups are secular, most are Islamic in character. Some totally reject both secularism and any ties to the West or Western values.

- The West can be attacked on the basis of its values, and for corrupting Islamic countries and supporting secular regimes. While the U.S. is the primary target of such attacks, figures like the Saudi terrorist financier Osama Bin Laden want to drive the West out of the region. Unlike more conventional forms of terrorism, such attacks deliberately seek to create a "clash of civilizations" and to build on other regional problems and tensions to divide the West and Arab worlds.[64]

- European nations can become the scene of attacks by opposition groups on the Embassies of Middle Eastern regimes, or by opposition groups attacking each other. Iran has sponsored state terrorist attacks on the People's Mujahideen and Kurdish opposition groups in France, Germany, Switzerland and Turkey. Israel has killed Palestinians in nations like Norway. France has become the scene of fighting between Algerian factions.

- Western tourists and businessmen can be the targets of terrorists in the Middle East, as such groups seek to put economic pressure on local regimes, or prove their status and power. For example, an Algerian terrorist group called the GIA (Armed Islamic Group) killed seven foreigners in Algeria in 1997, bringing the total number of foreigners the GIA has killed in Algeria to 133 (since 1992). Bombs have been used in civilian areas in Bahrain, although Westerners have not been major targets. Four U.S. employees, of Union Texas Petroleum, and their Pakistani driver were shot and killed in Karachi on November 12, 1998, when the vehicle they were riding in was attacked by terrorists that seem to have been affiliated with Middle Eastern extremist groups.

The Clash Within A Civilization, the Arab-Israeli Conflict, and the Western Counter-Reaction

It is still unclear how Islamic extremism and the aftermath of "9/11" will play out in the MENA area. What is clear is that Al Qaida launched a new series of bloody attacks of Saudi Arabia that such attacks have taken place in Iraq, that the Algerian civil war continues and extremist Islamic movements exist at some level on every MENA state. Extremism and terrorism remain a major threat to MENA governments, and the end result is more a clash within an Islamic civilization and than not a clash between Islam and the Arab world and the West. The primary goal of most Islamic extremist movements is not to attack the West but to create Islamic regimes, based on ill-defined concepts of religious Puritanism, radical socialism or economic change, and conservative social customs. Such an extremism is an attack on secularism per se, and explains why such movements oppose MENA secular governments and social and economic modernization without clearly articulating the kind of government, society, and economy that should replace them. Islamic extremists know what they are against. They have only vague and impractical ideas of what they are for.

There are, however, other forms of terrorism and extremist violence. The fact that the Arab-Israel peace process has given way to an Israeli-Palestinian war has led to a new wave of violence on both sides. The Israeli side has used conventional forces to occupy and attack the Palestinians. The Palestinians have used asymmetric and guerrilla warfare, and terrorism – most notably in the form of suicide bombings. The Palestinian terrorist attacks have been overwhelmingly by Islamist groups like Hamas and the Palestinian Islamic Jihad, but have increasingly involved support from the hard-line elements of secular Palestinian groups as well.

The lines between Islamic extremism and the Arab-Israeli conflict have been further blurred by the role Shi'ite groups like the Hezbollah played in driving Israel out of Lebanon, and the role Iran and Syria have played in supporting the Hezbollah. Syria at least tolerates terrorist groups on its soil that oppose Israel. Iran has increasingly funded non-Shi'ite groups like Hamas

and the PIJ, and money has flowed to such groups from the Gulf and other Arab states – partly to support their charities and partly to support the groups in attacking Israel.

Unlike most forms of Islamic extremism and terrorism, the Israeli-Palestinian conflict also polarizes the Arab world at a popular level. If the Israeli image is one of Palestinian terrorism, the Arab image is one of excessive Israeli use of force, continued occupation, and continued settlements. It allows extremist and terrorist groups to exploit the conflict to win popular support, and exploit the image of the US as Israel's ally and supporter. More generally, it allows them to exploit the image of the West as exploiting the Arab world.

The West, and particularly the US, have often reacted by confusing Islamist extremism and terrorism with Islam, the Arab world, and Iran. US officials have tried to avoid such stereotypes and dangerous generalizations, but many American Western media and analysts have not. One of the ironies of "9/11" is that Osama bin Laden and Al Qaida have succeeded in part in producing a Western counterreaction that does to some extent reflect a "clash between civilizations." The US and British invasion and occupation of Iraq has increased such tensions as have the failures to bring effective security and development to Afghanistan, and US talk of broad regime change along lines where its concept of future "democracies" is as vaguely defined as of the future desired by most Islamist extremists.

State Support of Terrorism and the Use of Terrorist Proxies

The regional security problems created by independent terrorist movements are further compounded by the state support of terrorism or state use of terrorist proxies. Several states have actively sponsored external terrorist movements, or have conducted acts of terrorism outside their own territory. These states have included Iran, Iraq, Libya, and Syria.

Such states may help extremist movements acquire weapons of mass destruction in the future, and the most serious challenge proliferation poses to MENA energy facilities may well prove to be the risk that proliferation interacts with terrorism. At present, this is only a possibility, but terrorist attacks using weapons of mass destruction would present a fundamentally different kind of threat. They would be a far more lethal kind of terrorist threat than the region and the West have yet faced.

Under many conditions, a single act of terrorism can kill thousands of people and/or induce levels of panic and political reaction that governments cannot easily deal with. Under some conditions, the use of weapons of mass destruction can pose an existential threat to the existing social and political structure of a small country -- particularly one where much of the population and governing elite is concentrated in a single urban area.

Terrorism and Middle East Energy

Both MENA energy exporters and global energy consumers need a smooth flow or energy exports that must be delivered reliably on a day-by-day basis and be expanded over time to meet global demand. Chapter I has shown that the world needs the Middle East and North Africa to both make massive increases in its energy exports, and to sustain these at moderate market prices provide reliable daily deliveries, and avoid any interruptions in supply. The next chapter shows that MENA states face immense demographic and economic challenges that require them to earn as much from energy exports as possible, although the era of "oil wealth" has ended and stability can only come from both energy export and a much more diversified pattern of overall economic development.

So far, terrorism and extremism have rarely made direct attacks on energy facilities, This may be because most Islamic extremist movements act largely as national groups or subgroups and see energy export earnings as serving national needs and not just these of the regime or Western interests. There has, however, been a history of minor sabotage in Bahrain and Saudi Arabia, and Al Qaida has attacked foreign compounds in Saudi Arabia in ways that could have a future impact on the foreign expertise Saudi Arabia still needs for some aspects of its energy production. There have been occasions in the Algerian civil war when terrorists attacked energy targets and workers in energy facilities. Pipelines and energy facilities were sabotaged during the Iran-Iraq War, although conventional attacks dominated the damage to energy facilities. There has also been a consistent pattern of systematic terrorist attack and sabotage of Iraq's nation's energy facilities since the US and British occupation of Iraq.

It is difficult to generalize from such a unique case, and particularly one that is still in progress, but the Iraq War has at least shown that such attacks can have a powerful political and economic success, that pipelines and export facilities are vulnerable. The attacks to date have also shown that much of the reaction is a matter of how the target is then perceived as a reliable

supplier and country for investment, rather than determined by the success of the attack or its impact on exports.

Middle Eastern states are also becoming steadily more vulnerable to sabotage and terrorist attacks. Economies of scale lead to the procurement of highly specialized facilities whose equipment involves long lead times for manufacture and repair. Increases in pipeline capacity increase vulnerability, and petrochemical plants often make lucrative targets as do refineries. Attacks on desalination facilities offer extremely lucrative targets that affect the workers in energy facilities. The creation of large, heavily automated gas trains is creating a new target mix in many countries, and electric power is necessary for oil and gas field operations, export facilities, petrochemical production, and civil life. Even comparatively low value targets like individual oil and gas wells can be attacked in ways that can lead to importer panic or overreaction and force states to deploy large forces to protect entire fields.

There is no present way to know how these various forces will play out, or how much they will affect energy development and supply from the MENA region. It is clear, however, that they already have significantly increased the risk premium many Western companies see as necessary to invest and do business in the MENA area. They have increased the reluctance to provide foreign investment to an area whose nations have long created legal and economic barriers to such investment, and they have led a number of Western businessmen and technical personnel to leave key MENA energy exporting nations like Saudi Arabia. The Arab world, in turn, is increasingly more reluctant to deal with the US and there have been minor boycotts of US companies over US support of Israel. There has been much less reluctance to deal with Europe, but Islamic extremists continue to attack outside investment and secular influences in broad terms, and not just US influence.

There does, therefore, seem to be a growing risk that the forces of extremism and terrorism will present a growing direct threat to energy exports and facilities. The target is extremely tempting. It is one of the few areas where attacker s can easily threaten the fiscal stability of the MENA regimes they are seeking to overthrow, and have significant leverage against the West. At the same time, Saudi Arabia has already been the scene of broader attacks

on Western businessmen, and the guerrilla war in Iraq is demonstrating how attacks on Western workers can affect nation building as well as energy supply.

Regional Self-Defense and The Role of the West and Western Power Projection

The overall military stability of the MENA region is heavily dependent on Western power projection capabilities, and particularly the US. The US has shown in the Iraq War just how well it can project conventional military power, although it has also shown just how many difficulties it can encounter in dealing with asymmetric warfare. While the fall of Saddam has removed a key threat to the region's military stability, threats like Iran remain. The US may be Israel's ally but it is also seen as a major restraining influence and an ally of moderate regimes – most of which have shown they can do a far better job of buying arms than create effective self-defense capabilities.

As a result, the present security structure of the MENA region is still dependent on de facto alliance between the moderate states in the Middle East and the West, and their access to help from Western power projection capabilities. The U.S. is the key to such power projection, but this makes it the target of many opposition movements and Islamic extremists as well. The high profile of U.S. forces in the Gulf has also interacted with the tensions caused by the Second Intifada to cause sufficient political backlash so that the U.S. is now a major target for terrorists and presents growing political problems for U.S. allies, like Egypt, Jordan, and Saudi Arabia.

European power projection forces cannot substitute for those of the U.S. The European members of NATO have never developed to the capability for large-scale power projection in the MENA region and is unlikely to do so. Iraq has deeply divided the US and Europe. Europe itself is deeply divided over the attention and role it should play in dealing with the problems in Algeria and North Africa, and the European Union's efforts to create power projection forces have so far been more political than real. Britain and France are the only NATO powers capable of meaningful power projection to the Gulf, but they have minimal strategic lift, and only about half the potential pool of forces they had in 1990.

The end result is that the US continues to play the critical role in defending the major energy exporters in the Gulf, and this is compounded by the fact that the US is the only power

that now can play a major role in securing the global lines of communication to the MENA region and the flow of tankers and other oil exports.

At the same time, major changes are taking place in the regional role of the US and other western states in projection power in the Middle East. US and other Western power projection will be made steadily more complicated by proliferation and the development of more dangerous forms of asymmetric warfare.

The Israeli-Palestinian War the Iraq War, and problems the US has had in dealing with allies like Saudi Arabia since "9/11," have made it progressively harder for the US to maintain a presence and operate in the MENA region. The US still maintains major forces in the region and many countries depend upon the US, but US and regional military relations are troubled and uneasy. Europe talks about power projection capability, but it is not buying it or the systems to ensure broad interoperability with the US.

The wars in Afghanistan and Iraq have also reinforced the lessons of Lebanon and Somalia that the US is far from ready to fight asymmetric warfare and highly political conflicts in ways that effectively terminate wars and deal with the issues of peacemaking and nation building. The US has not shown it can properly characterize and target forces with weapons of mass destruction. Perhaps most important, the US has never planned to help regional states deal with internal security or save a regime from its own people. US and Western capabilities cannot play a military role in dealing with what may be the most serious threat to MENA stability and energy exports.

The U.S., its Western allies, and its allies in the region do not yet have a clear counterproliferation option or surplus funds to pay for such an option. They have no common strategy for dealing with terrorism and asymmetric warfare. Moreover, none of the moderate Arab states have power projection forces that can substitute for Western ones. Even Egypt and Syria have only tenuous power projection capabilities and little current willingness to use them.

Energy Vulnerability and Maritime Chokepoints

Oil moves in many different ways. Oil and gas pipelines connect North Africa to Europe, and may eventually connect Middle Eastern states to South Asia. During 2002, the EIA

estimates that some 1.9-2.2 MMBD (12%-14%) of the oil export from the Persian Gulf shipped via various pipelines, rather than by tanker through the Strait of Hormuz. Most of MENA oil, and gas however, directly or eventually moved by sea. For example, oil was exported out of maritime ports in the Gulf and Indian Ocean and Indian Ocean and through the Saudi East-West pipeline to the port of Yanbu on the Red Sea (about 1 MMBD); via pipeline from Iraq's Kirkuk oil region to the Turkish port of Ceyhan (about 0.5-0.8 MMBD); and by pipeline via Syria (around 0.2 MMD). Only comparatively small amounts to their ultimate destination moved by land, largely by truck to destinations like the Kurdish areas of northern Iraq, Turkey, Jordan, and Iran.[65]

It is easy to focus on the security of oil and gas fields, energy facilities, and pipelines in the MENA area and to forget that most energy exports ultimately move by sea. Moreover, Chapter I has indicated that Gulf exports alone will require something like 2.5 times the tanker traffic by 2025 that exists today, as well as vastly expanded ports and loading facilities. Much of this increase in tanker traffic will go to Asia and through the Indian Ocean and Pacific, but a substantial portion will go to Europe and the US.

The flow of oil exports can be attacked at any point during a tanker voyage. However, there are several key maritime chokepoints could have a critical impact on the flow of oil in the Middle East. [66]

- **The Strait of Hormuz** is the only shipping channel in and out of the Persian Gulf. Over 14 million barrels per day (b/d) of oil flow through this Strait to Japan, United States, Western Europe, and other countries. It is the world's most important oil chokepoint. At its narrowest, it consists of 2-mile wide channels for inbound and outbound tanker within the Omani side of the Strait, and a 2-mile wide buffer zone. The exits on both sides of the Strait are close to Iranian waters and air space. Iran and the UAE have also long quarreled over sovereignty over three islands on the Western side of the Strait that are near the main tanker channels. These islands include Abu Musa, Greater Tunb Island, and Lesser Tunb Island, all strategically located in the Strait of Hormuz. Iranian troops occupied the islands in 1992, and the Iranian Foreign Ministry claimed that the islands were "an inseparable part of Iran" in 1995. The UAE has sought mediation and Iran rejected proposal by the Gulf Cooperation Council (GCC) for the dispute to be resolved by the International Court of Justice in 1996. Iran also took action to demonstrate its control over the islands. It started up a power plant on Greater Tunb, opening an airport on Abu Musa, and announced plans for construction of a new port on Abu Musa. Iran did state its willingness to hold talks with the UAE on the dispute in September 2000 and reports that Iran had fortified the islands seem to be untrue. However, no talks have taken place, and the GCC issued a statement reiterating its support for the UAE's sovereignty over Abu Musa and the Tunbs on December 31, 2001. It declared Iran's claims on the islands as "null and void," and backed "all measures...by the UAE to regain sovereignty on its three islands peacefully."[67]

  The 13.6 million bbl/d or so of oil that transit the Strait of Hormuz goes all over the world, eastwards to Asia (especially Japan, China, and India) and westwards (via the Suez Canal, the Sumed pipeline, or

around the Cape of Good Hope in South Africa) to Western Europe and the United States. The EIA reference case indicates that exports through the Strait must nearly double by 2020, reaching around 42 MMBD. This implies that up to three times more tankers will transit the Strait in 2020 than at present. Alternative routes cannot move anything close to current export levels, much less the much higher production levels forecast by DOE.

- **The Red Sea** is another potential set of chokepoints. Tankers moving west from Gulf towards the Suez Canal or Sumed pipeline must pass through the Bab al-Mandab. This strait is located between Djibouti and Eritrea in Africa, and Yemen on the Arabian Peninsula. It connects the Red Sea with the Gulf of Aden and the Arabian Sea. Any closure of the Bab al-Mandab would keep tankers from reaching the Suez Canal/Sumed Pipeline complex, diverting them around the southern tip of Africa. This would add greatly to transit time and cost, and effectively tie up spare tanker capacity. [68]

  There has not been any major fighting in this area, but Yemen fought a brief battle with Eritrea over Greater Hanish Island, located just north of the Bab al-Mandab, in December 1995. The Bab al-Mandab can be bypassed by utilizing the East-West oil pipeline. However, southbound oil traffic, Closure addition, closure of the Bab al-Mandab would effectively block non-oil shipping from using the Suez Canal, except for limited trade within the Red Sea region.

- **The Suez/Sumed complex** is a chokepoint at the western end of the Red Sea. Oil passing through the Bab al-Mandab or shipping towards the West from Yemen or the Red Sea cost of Saudi Arabia must move be tanker through the Suez Canal or be shipped through the Sumed Pipeline complex in Egypt. Both of these routes connect the Red Sea and Gulf of Suez with the Mediterranean Sea. The EIA reports that over 3 MMBD of Gulf oil exports currently transit the Suez Canal/Sumed complex. Any closure of the Suez Canal and/or Sumed Pipeline would divert tankers around the southern tip of Africa (the Cape of Good Hope), sharply increasing transit time and the required tanker capacity. [69]

Chokepoints, like the Strait of Hormuz, remain critical areas of risk where American power projection and alliances with friendly nations are critical to energy security. At the same time, the proliferation of long-range naval strike aircraft, anti-ship missiles, smart mines, submarines, and guided missile ships is extending the range at which threats can strike at the movement of energy exports.

These changes in military technology and in the flow of Gulf exports are changing the definition of "chokepoint." One key example is the acquisition of long-range missiles and weapons of mass destruction by nations like Egypt, India, Iran, Iraq, Israel, Libya, and Syria. Another is Iran's development of bases on islands near the Strait of Hormuz and the shipping channels in the Gulf, and its acquisition of advanced anti-ship missiles, submarines, long-range strike aircraft, and missile patrol boats. The same weapons and technologies allow any nation along the shipping lanes to Asia to create new "chokepoints" at ranges up to several hundred kilometers.

Oil Interruption and Embargos

These threats show that that the risk of a serious interruption in Middle Eastern oil exports, and particularly Gulf Exports, cannot be ignored. As Table II.4 shows, there has been a long history of oil interruptions since 1951. Virtually all of these interruptions have taken place in the MENA region, and some have been serious.

The oil embargo of 1973-1974, for example, triggered a massive rise in oil prices that reshaped the energy costs of the global economy, and made dependence on energy imports a major strategic issue for the first time. The fall of the Shah in 1979, and the Iran-Iraq War that followed, created a global panic in the oil market and again dramatized strategic dependence on the Gulf. The period of 1979-1980 also marked the height of MENA energy export revenues in constant dollars. Iraq's invasion of Kuwait and the Gulf War of 1990-1991 marked another major rise in oil prices, although its affects were much less serious than the interruptions of 1973-1974 and 1979-1980.

Table II. 4

Global Oil Supply Disruptions Since 1951

Date of Net Oil Supply Disruption	Duration (Months of Net Supply Disruption)	Average Gross Supply Shortfall (MMBD)	Reason for Oil Supply Disruption
3/51-10/54	44	0.7	Iranian oilfields nationalized May 1, following months of unrest and strikes in Abadan area.
11/56-3/57	4	2.0	Suez War
12/66-3/67	3	0.7	Syrian Transit Fee Dispute
6/67-8/67	2	2.0	Six Day War
5/70-1/71	9	1.3	Libyan price controversy; damage to Tapline
4/71-8/71	5	0.6	Algerian-French nationalization struggle
3/73-5/73	2	0.5	Unrest in Lebanon; damage to transit facilities
10/73-3/74	6	2.6	October Arab-Israeli War; Arab oil embargo
4/76-5/76	2	0.3	Civil war in Lebanon; disruption to Iraqi exports
5/77	1	0.7	Damage to Saudi oil field
11/78-4/79	6	3.5	Iranian revolution
10/80-12/80	3	3.3	Outbreak of Iran-Iraq War
8/90-10/90	3	4.6	Iraqi invasion of Kuwait/Desert Storm
4/99-3/00	12	3.3	OPEC (ex. Iraq) cuts production in effort to increase prices.

Source: adapted from work by the EIA.

The Importance of MENA Energy Exports

Conflicts and instability affecting other major energy exporters could also cause a serious interruption in the flow of global energy exports. These countries include Russia, Nigeria and Angola, and Venezuela. The MENA region, however, is the most critical region because it is both unstable and will remain the center of world oil beyond 2030. The region's importance as an energy exporter has been discussed in detail in Chapter I, and the threat posed by a new interruption in MENA energy exports can be summarized as follows:

- World crude oil flows averaged around 35 MMBD in the early 2000s.
- The Gulf has roughly 65% of all world oil reserves. The flow of exports from the Gulf averages over 15 MMBD versus 1.8 MMBD from North Africa, 2.7 MMBD from Latin America and 1.6 MMBD from Mexico.
- In 2002, Gulf countries had estimated net oil exports of 15.5 million bbl/d of oil.. Saudi Arabia exported the most oil of any Persian Gulf country in 2002, with an estimated 7.0 million bbl/d (45% of the total). Also in 2002, Iran had estimated net exports of around 2.3 million bbl/d (15%), followed by the United Arab Emirates (2.1 million bbl/d -- 13%), Kuwait (1.7 million bbl/d -- 11%), Iraq (1.6 million bbl/d -- 10%), Qatar (0.8 million bbl/d -- 5%), and Bahrain (0.01 million bbl/d -- 0.1%).[70]
- The peak for Persian Gulf oil exports as a percentage of world oil exports was in 1974, when they accounted for more than two-thirds of the oil traded in world markets. The Persian Gulf share of world oil exports has risen since the oil price collapse of the mid-1980s, but it is not expected to surpass the 1974 level until after 2020.
- US imports from the Gulf slowly rose from an annual average of 1.5 MMBD in 1988 to 2.1 MMBD in 1998, and ranged from 2,2-2.8 MMBD in 2001-2003. They rose from 8.7% of US demand in 1997 to 13.9% in 2002, and from 70% to 75% of US imports. [71]
- West European imports from the Gulf ranged from 15% to 29% of total demand during 1990-2002, and from 29% to 45% of total imports.
- Japanese imports from the Gulf ranged from 64% to 76% of total demand during 1990-2002, and from 65% to 76% of total imports.
- DOE projects the MENA region will provide well over 50% of world oil exports by 2020. The Energy Information Administration's International Energy Outlook 2002, projects that Gulf oil production is expected to rise from 22.4 MMBD in 2001 to 28.7 MMBD in 2010, 38.9 MMBD in 2020, and 45.2 MMBD in 2025. This would increase Persian Gulf oil production capacity to 36.2% of the world total by 2025, up from 28% in 2000.[72]
- Gulf exports are critical in terms of preserving a margin of surplus or swing production. The EIA estimates that they normally maintain around 90% of the world's excess oil production capacity.
- Total MENA production capacity was 23.9 MMBD of production capacity in 2000 (29.7%). The EIA estimates that it will be 34.9 MMBD in 2010, 46.4 MMBD in 2020 and 53.6 MMBD in 2020 (43.1%).[73]
- The Southern Gulf states (GCC) alone provided 17.1 MMBD worth of world production capacity in 2000 (21.3% of world capacity); and is estimated at 35.1 MMBD by 2025 (28.25%).[74]

- The IEA projects that Middle Eastern OPEC oil production will increase from 21.0 MMBD in 2000 to 26.5 MMBD in 2010, 37.8 MMBD in 2020, and 54.4 MMBD in 2030. Total Middle Eastern Oil production will increase from 24.1 MMBD in 2000 to 28.3 MMBD in 2010, 39.3 MMBD in 2020, and 52.3 MMBD in 2030 [75] It projects that Middle East oil exports will reach 46 MMBD by 2030.

- The EIA estimates that Gulf oil exports will rise from 14.8 MMBD in 2000 to 35.9 MMBD in 2025 – a rise of 143. They will rise from 35% of world exports to 38%.[76]

- The IEA projects that Middle Eastern refined oil product exports will increase to 7 MMBD by 2030.[77]

- The Gulf is a major gas exporter with 32.8% of world reserves.

- The IEA projects that Middle Eastern gas exports will increase from 23.1 BCM< in 2000 to 364 BCM in 230. Flows to North America will increase from 17 BCM to 104, flows to Europe will rise from 0.4 BCM to 160, flows to South Asia will increase from nearly zero to 27 BCM, and flows to East Asia will increase from 21 BCM to 73 BCM.[78]

The Problem of Guessing at Future Scenarios

There is no consensus as to what kind of interruptions might take place in the flow of MENA oil exports, in part because there is no current set of contingencies or threats that appears probably enough to merit detailed planning. The preceding analysis has shown that such interruptions could have a wide range of causes and take a wide range of forms. Future interruptions, however, could include a new oil embargo, civil war in a key MENA country, the impact of a local war, the result of a series of terrorist attacks, closing a major export route like the Strait of Hormuz.

A major new embargo now seems less likely. The MENA oil-exporting states have a steadily growing need for cash flow, and most have shown little solidarity with the Palestinians since Arafat supported Iraq in 1990. The world has also learned to adapt better to oil interruptions when they occur. The embargo of 1973-1974 led the world market to increase oil production in other areas, but world markets were not capable of tracking what was happening or effectively identifying and distributing the oil available. As a result, the seriousness of the crisis was caused as much by the world's inability to track supply in real time as by any shortfall in supply. These problems continued through the late 1970s, but tracking and reporting improved after the crisis following the fall of the Shah of Iran. Neither the "tanker war" between Iran and Britain and the U.S. in 1987-1998, or the Gulf War in 1990-1991, led to the same level of panic, price rises, and hoarding.

The most likely interruptions seem to be ones that are short or limited in scope, and many could be dealt with by production increases by other countries. The impact of the loss of

Iraq and Kuwait oil production during the Gulf War in 1990-1991, for example, was limited by increases in Saudi and other production. Increases in production by other exporters largely compensated for a political crisis that led to Venezuelan production cuts in 2002, and the same was true when Iraq ceased to export during the Iraq War of 2003. While each interruption did produce price rises, and had some impact on global economic growth, the impact was too limited to have a major impact on the global economy.

The steady increases in world demand for MENA energy exports projected through 2030 do mean, however, that the global economy will become steadily more vulnerable to major interruptions. The Gulf alone is projected to more than double its flow of exports during 2000-2025. Five Gulf countries – Saudi Arabia, the UAE, Iraq, Iran, and Kuwait – will become steadily more important producers and exporters. At the same time, the gap between the normal production of oil and total production capacity is expected to shrink steadily, leaving less and less surplus production capacity that MENA and other nations can bring on line in the event of a major interruption in exports from one or more Gulf states.

The cases that seem to merit most consideration--more because of the seriousness of their impact than their probability--are some form of war involving Iran that could at least temporarily close the Strait of Hormuz, a major attack on Saudi Arabia or a civil conflict that disrupted production, or some new war involving Iraq or a civil conflict.

- Chart II.14 shows that is possible to make rough estimates of how the impact of interruption scenarios might change over time, based on the changes in estimated production capacity, although major differences exist in such estimates between sources and according to the economic conditions assumed.

- Chart II.15 provides similar data in a form where it is possible to see how a major embargo, the closing of Strain of Hormuz, loss of production from Saudi Arabia or another key Gulf country, or loss of Algerian or Libyan production might impact on world supply. The problem is that not only are such estimates uncertain, but there is no way to know market conditions and the level of surplus production capacity relative to demand, how much of a region or nation's output would actually be lost, or how long the interruption would take place.

- Chart II.16 shows the importance of the Gulf, North Africa, and entire MENA region in terms of current and projected world oil exports. While the particular numbers involved are as uncertain as the estimates of production capacity, it is obvious that a true MENA embargo or loss of most Gulf oil exports would have a massive impact on the world economy today and that this impact will grow steadily with time.

- These charts do not include gas exports, which will have growing importance over time.

- The risk of any interruption would be compounded by any problems that reduced the supply of nuclear power or use of coal for environmental reasons.

Charts II.14 to II.16 show how dangerous a major and lasting Arab embargo could be if Arab states would actually be willing to give up their oil export revenues. It is clear how critical the Gulf is to world production capacity, and it is clear just how much the world will come to depend on a steady and stable increase in Saudi production and exports. In fact, Russia is the only major exporter outside the MENA area where a major interruption could have a critical impact on the global economy, particularly because it is both a major oil and gas exporter.

At the same time, the next chapter shows that MENA states already desperately need the cash flow from their energy exports and this need will grow over time. The demographic and economic pressures on the region are so severe that no regime in an exporting country can ignore the consequences of an embargo and the factions in any civil fighting must consider the popular reaction to an attack on such facilities. Wars tend to do limited damage of limited duration, not produce catastrophic interruptions, and any belligerents in the region must consider the fact that US and outside intervention would almost certainly occur in the event of a major interruption, just as it did during the Iraq-Iraq War when the US "reflagged" tankers and defended Gulf shipping against Iran.

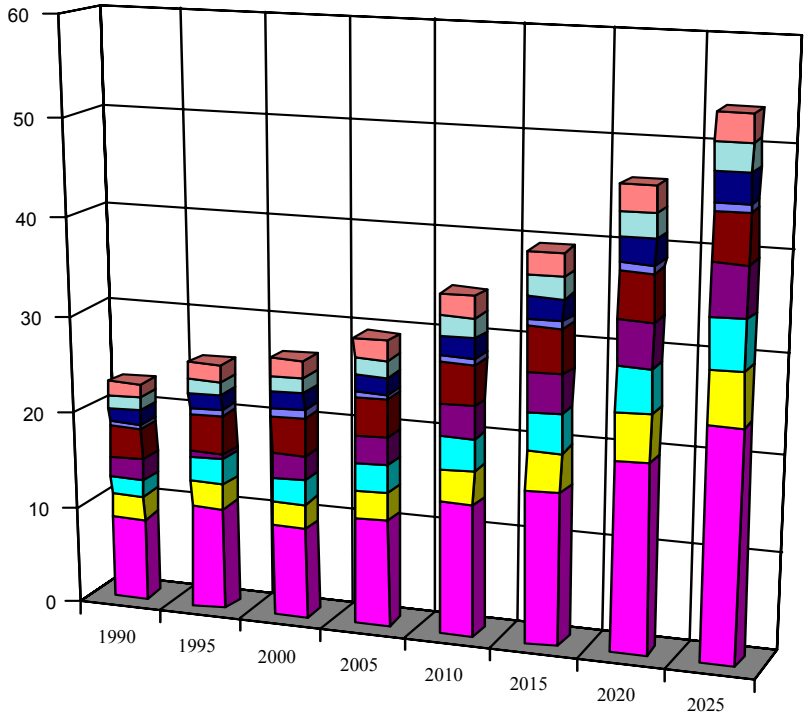
In short, there are so many different real-world ways in which an interruption could develop and play out in terms of its politics, the use of military force, the actual level of cuts in exports, in the duration of such cuts, in the way other exporters can compensate , and in terms of the global economic climate and level of demand that such scenario analysis can be little more than a matter of informed guesswork.

- Chart II.14 shows the relative size of each MENA countries oil export capacity during 2000-2025, and illustrates the maximum impact any combination of MENA states could have in an oil interruption scenario.
- Chart II.15 shows similar data, but organized to show the impact of an oil interruption in a single state.
- Chart II.16 shows how the flow of Gulf, North African, and total MENA exports relates to total world exports in 2001 and 2025, and provides a rough picture of the impact of "worst cases" like a total closing of the Gulf or comprehensive regional oil embargo.

Chart II.14

Trends in Middle Eastern Petroleum Production Capacity That Could Be Affected by a Future Oil Interruption Scenario By Country Relative to World Capacity: 1990-2025

(EIA Reference Case in MMBD)



	1990	1995	2000	2005	2010	2015	2020	2025
Other	1.4	1.7	1.8	2	2.2	2.4	2.5	2.7
Algeria	1.3	1.4	1.6	1.7	2	2.1	2.4	2.8
Libya	1.5	1.6	1.7	1.7	2	2.2	2.6	2.9
Qatar	0.5	0.6	0.9	0.6	0.6	0.7	0.8	0.8
Iran	3.2	3.9	3.8	3.9	4.2	4.5	4.7	4.9
Iraq	2.2	0.6	2.6	2.8	3.3	3.9	4.5	5.1
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
Saudi	8.6	10.6	9.4	11.1	13.6	15.7	19.5	23.8

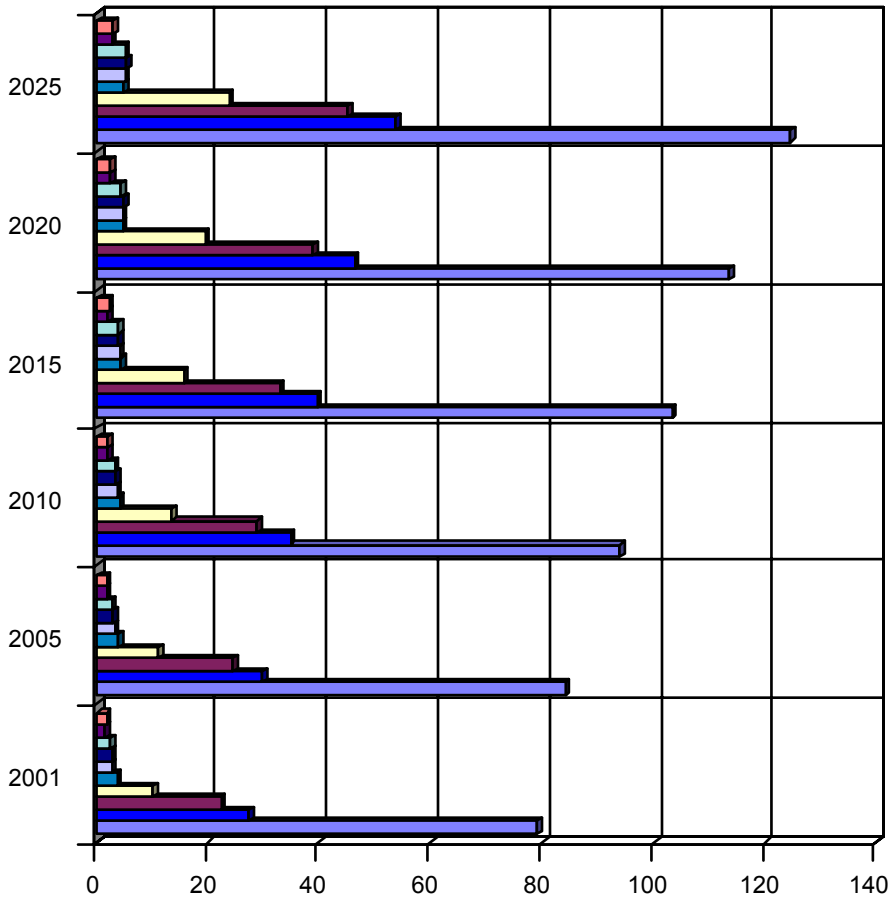
Total Gulf	18.7	-	22.4	24.5	28.7	33.0	38.9	45.2
Total ME	22.9	-	27.5	29.9	34.9	39.7	46.4	53.6
Total World	69.4	-	79.2	84.2	93.9	103.3	113.5	124.5
Total World	69.4	-	79.2	84.2	93.9	103.3	113.5	124.5
Gulf % of World	27.0	-	28.3	29.1	30.6	32.0	34.3	36.3
ME % of World	33.0		34.7	35.5	37.1	38.4	40.9	43.1

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.

Chart II.15

Range of MENA Contribution to World Oil Production Capacity: 2001-2025

(EIA Reference Case in MMBD)



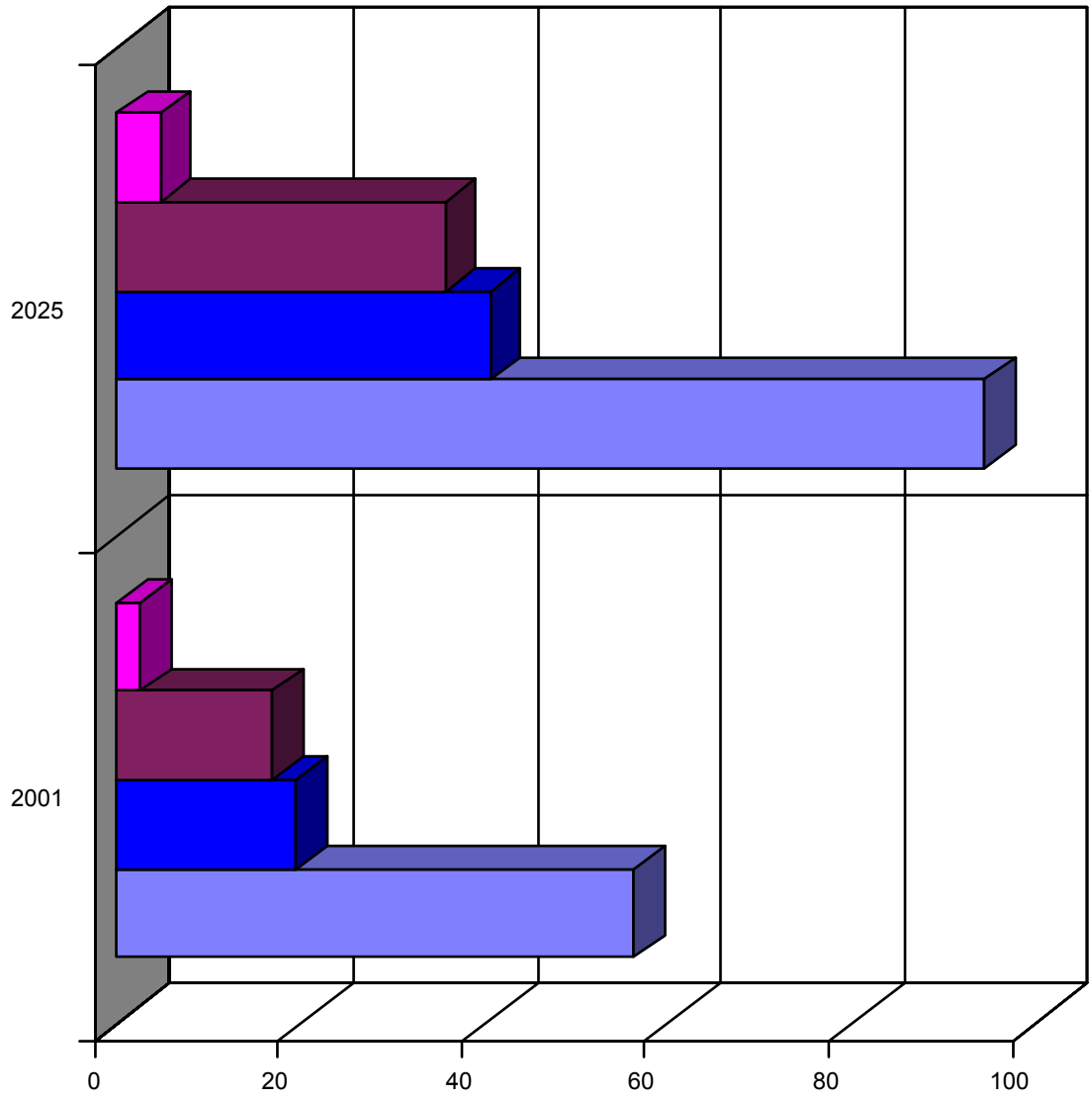
	2001	2005	2010	2015	2020	2025
Libya	1.7	1.7	2	2.2	2.6	2.9
Algeria	1.6	1.7	2	2.1	2.4	2.8
Kuwait	2.4	2.8	3.3	3.9	4.5	5.1
UAE	2.7	2.9	3.4	4	4.8	5.4
Iraq	2.8	3.2	3.6	4.2	4.6	5.2
Iran	3.7	3.9	4.2	4.5	4.7	4.9
Saudi	10.2	11.1	13.6	15.7	19.5	23.8
Gulf	22.4	24.5	28.7	33	38.9	45.2
MENA	27.5	29.7	34.9	39.7	46.4	53.6
World	79.2	84.2	93.9	103.3	113.5	124.5

Source: Adapted by Anthony H. Cordesman from EIA, International Energy Outlook, 2003, DOE/EIA-0484 (03), June 2003, pp. 235

Chart II.16.

Range of MENA Contribution to World Oil Exports: 2001-2025

(EIA Reference Case in MMBD)



	2001	2025
North Africa	2.6	4.8
Gulf	16.9	35.8
MENA	19.5	40.6
World	56.3	94.6

Source: Adapted by Anthony H. Cordesman from EIA, International Energy Outlook, 2003, DOE/EIA-0484 (03), June 2003, Table 14, p. 42

The Economic Impact of Energy Interruptions

There is no reliable way to measure the economic impact any given interruption in MENA energy exports would have, and such an impact would vary sharply according to scenario and duration. Under many conditions, an interruption might be limited enough -- and of be such short duration -- that it would actually have less impact than the normal fluctuations in oil prices than grow out of market conditions.

For example, the EIA reports that the world oil price in nominal dollars per barrel fell from $21.02 in the first quarter of 1997 to a low of $10.86 in the first quarter of 1999. Then, in the second quarter of 1999, the world oil price began to rise dramatically, ultimately almost tripling to a high of $29.11 in the third quarter of 2000.

The EIA's AEO2004 forecast indicates that the average crude oil price in the lower 48 will be $23.61 per barrel in 2010 and $26.72 per barrel in 2025 in the reference case. In the high world oil price case, the price increases to $32.80 in 2010 and $34.90 per barrel in 2025. In the low oil price case, this number declines to $16.36 per barrel in 2010 then rises to $16.49 per barrel in 2025.[79]

The path for the wellhead natural gas price was less volatile than for oil between 1997:1 and 2000:1, fluctuating between a high of $2.63 per thousand cubic feet to a low of 1.76. At the start of the second quarter of 2000, however, the wellhead price of natural gas increased dramatically. From the first quarter to the second quarter of 2000, the price rose from $2.26 to $3.06 and by the fourth quarter to $5.19 per thousand cubic feet.[80]

The EIA has made a rough estimate of the impact of the alternative price and supply levels. During the two-year period from 1997:1 to 1999:1, falling energy prices boosted the US economy. If energy prices had remained at their 1997 levels instead, the growth rate of GDP might well have been reduced by 0.3 percentage points. The opposite case occurred in the years that followed: During the next two-year period from 1999:1 to 2001:1, energy prices first rose dramatically, then began to decline. If this rapid rise in energy prices had not occurred, there may have been as much as 0.7 percentage points of additional GDP growth. Over the entire four-year period, a steady energy price path could have potentially boosted GDP growth by 0.2 percentage points.

This price volatility may at first seem so massive that it must have dramatic effects, but its not atypical of the impact of "normal" market conditions in energy exports. In fact, any analysis of the past ups and downs in oil prices caused by market forces show that it would take a very serious interruption to have more serious effects. It is important to note, however, that the shifts in prices during 1997-2001 occurred over an extended period of time and avoided panic buying. It is almost impossible, however, to estimate the psychological impact of sudden interruptions on the market, and it is clear that major market-driven changes in energy prices – which would be similar to the impact of a major oil interruption – had a real but moderate impact on the US economy.

The economic impact of an interruption could also be reduced if the US made timely and effective use of its Strategic Petroleum Reserves (SPR) and the interruption was not serious enough to trigger the sharing of available oil imports called for under the security agreements the US and its allies signed in creating the International Energy Agency. The SPR currently has a storage capability of 700 million barrels, and, President George W. Bush ordered the SPR to be filled to its maximum capacity on November 13, 2001.

This fill is being carried out by continuing to use the Royalty-in-Kind program carried out jointly between the Department of Energy and the Department of the Interior. The royalty-in-kind program applies to oil owed to the U.S. government by producers who operate leases on the federally-owned Outer Continental Shelf. These producers are required to provide from 12.5 percent to 16.7 percent of the oil they produce to the U.S. government. The government can either acquire the oil itself or receive the equivalent dollar value. The SPR reached 600 million barrels in May 2003, about 53 days of inventory at current US consumption rates.[81]

The EIA "Rules of Thumb" for Calculating the Impact of Energy Interruptions

The EIA has established some rough "rules of thumb" for estimating the impact of major interruptions. The EIA rules estimate that oil prices increase by $3-5 per barrel for every one million barrel per day of oil disrupted, and that the growth rate of the U.S. Gross Domestic Product will be reduced by between 0.3-0.5 percentage points. In other words, if U.S. GDP is expected to increase and a 3.0 percent and a one million barrel per day oil supply disruption occurred, the U.S. GDP would be expected to grow by only 2.5-2.7 percent (a reduction of 0.3-0.5 percentage points).[82]

As the EIA notes, these rules of thumb are subject to important qualifications:[83]

- These estimates represent price pressure on the economy, but the actual pass through will be determined by a number of other factors, such as the financial and operating position of firms and industries comprising the economy.

- If the price of oil were $30 per barrel, the price and GDP rules-of-thumb could be combined in the following way to estimate the impacts of a disruption. For every 1 million barrels per day of oil disrupted, the price rule-of-thumb suggests that oil prices could increase by $3-$5 per barrel, or by 10%-17%. The GDP rule-of-thumb suggests that if these price increases were sustained, the U.S. GDP growth rate could be reduced by 0.05-0.0.08 percentage points (likely first year impacts), with the U.S. GDP growth rate reduction ranging as high as 0.10-0.17 percentage points (likely second year impacts).

- The effects of an oil supply disruption are directly related to the size of the disruption. …First, estimate how much oil was being produced in the disrupted countries that is no longer available. EIA defines this as the Gross Disruption Size. However, to better estimate price and economic impacts, an adjustment to the Gross Disruption Size is necessary. To better estimate the impacts of an oil supply disruption, subtract from the Gross Disruption size how much more oil unaffected countries are likely to produce to help offset the loss of oil to the market. As the initial supply disruption occurs, prices are likely to increase immediately. However, this higher price increases the incentive for other producing countries, where possible, to increase their oil production. . Once you have subtracted an assumed amount of excess production that will be utilized from the gross Disruption Size, your result is what EIA labels the Net Disruption Size. Using the Net Disruption Size in the rule-of-thumbs listed above should better estimate the impacts of the disruption. Other factors, such as the availability of oil inventories and the use of strategic oil inventories such as the Strategic Petroleum Reserve, can also affect the impacts of an oil supply disruption.

- The basic economic data used in formulating these EIA rules are now badly out of date, and have not been updated since at least 1997. As a result, they understate the real-world economic impact of any interruption even if the basic rules are valid. It should also be understood that these additional rules do not consider the psychological impact of a given crisis on world markets or the impact of any conflict that may cause them. At the same time, they are no weaker than far more sophisticated models because so many complex factors are involved, and so many uncertainties, that no method of modeling or estimation can have more than low credibility as a predictive tool.

The grim truth is that the nature and economic impact of any given energy interruption is likely to be known only as it develops, It is always possible to speculate using both the scenarios discussed earlier and the EIA rules of thumb, but the chances of their coinciding with reality are negligible, This does not, however, make the risks less real. The fact that no one can predict the impact of regional conflict and instability 30 years into the future, or even the nature and outcome of the most likely cases, has never prevented them from occurring.

[1] Energy Information Agency, International Energy Outlook, 2003, Washington, DOE/EIA-0484(2003), May 2003, pp. 18-27.
[2] BP Amoco Statistical Review of World Energy, 1999, London, BP Amoco, June 1999, p. 4; BP Statistical Review of World Energy, 2003, London, BP, June 2003, p. 4.
[3] Energy Information Agency, International Energy Outlook, 2003, Washington, DOE/EIA-0484(2003), May 2003, pp. 185.
[4] Energy Information Agency, *Annual Energy Outlook, 2004*, Washington, DOE/EIA-0383(2004), January 2004, p.68.
[5] Matthew R. Simmons, "The Saudi Arabian Oil Miracle," Washington, CSIS, February 24, 2004.
[6] BP/Amoco, BP Statistical Review of World Energy, London, BP, 2003, p. 3.
[7] Matthew R. Simmons, "The Saudi Arabian Oil Miracle," Washington, CSIS, February 24, 2004.
[8] Energy Information Agency, International Energy Outlook, 2003, Washington, DOE/EIA-0484(2003), May 2003, p. 40.
[9] US Geological Survey, World Petroleum Assessment, 2000, http://usgs.gov/energy/WorldEnergy /DDS-60.
[10] International Energy Agency, World Energy Outlook, 2002 Insights, Paris, IEA, 2002, p. 97.
[11] 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 MMBD in 2001 to 25.8 MMBD in 2005, 31.8 MMBD in 2010, 38.4 MMBD in 2015, 46.6 MMBD in 2020, and 54.4 MMBD in 2025. Put differently, Gulf OPEC oil production capacity will increase from 26.9% of total world capacity in 1990, and 28.3% of world capacity in 2001, to 36.0% of world capacity in 2015 and 41.6% of world capacity in 2025. These figures would be even higher in 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 MMBD in 2001 to 3.5 MMBD in 2005, 4.2 MMBD in 2010, 4.7 MMBD in 2015, 5.3 MMBD in 2020, and 6.1 MMBD in 2025. [11] If the entire MENA region is considered, oil production capacity will increase from 22.9 MMBD in 1990 and 27.5 MMBD in 2001 to 31.2 MMBD in 2005, 38.1 MMBD in 2010, 44.9 MMBD in 2015, 54.2 MMBD in 2020, and 63.1 MMBD in 2025. This would mean that total MENA oil production capacity would increase from 33.0% of total world capacity in 1990, and 34.7% of world capacity in 2001, to 36.9% of world capacity in 2005, 39.8% in 2010, 42.0% in 2015, 45.8% and 48.2% of world capacity in 2025
[12] Energy Information Agency, International Energy Outlook, 2003, Washington, DOE/EIA-0484(2003), May 2003, p. 237.
[13] Energy Information Agency, International Energy Outlook, 2003, Washington, DOE/EIA-0484(2003), May 2003, p. 237.
[14] Energy Information Agency, International Energy Outlook, 2003, Washington, DOE/EIA-0484(2003), May 2003, p. 237.
[15] International Energy Agency, World Energy Outlook, 2002 Insights, Paris, IEA, 2002, pp. 91-93; Energy Information Agency, International Energy Outlook, 2003, Washington, DOE/EIA-0484(2003), May 2003, p. 185.
[16] International Energy Agency, World Energy Outlook, 2002 Insights, Paris, IEA, 2002, pp. 91-93. for a detailed comparison of different estimates, see Energy Information Agency, International Energy Outlook, 2003, Washington, DOE/EIA-0484(2003), May 2003, p. 45.
[17] Energy Information Agency, International Energy Outlook, 2003, Washington, DOE/EIA-0484(2003), May 2003, p. 235-240.
[18] BP/Amoco, BP Statistical Review of World Energy, London, BP, 2003, p. 6.
[19] BP/Amoco, BP Statistical Review of World Energy, London, BP, 2003, p. 18.
[20] BP/Amoco, BP Statistical Review of World Energy, London, BP, 2003, p. 6.
[21] Energy Information Agency, International Energy Outlook, 2003, Washington, DOE/EIA-0484(2003), May 2003, p. 42
[22] Energy Information Agency, International Energy Outlook, 2003, Washington, DOE/EIA-0484(2003), May 2003, p. 237.

[23] BP/Amoco, BP Statistical Review of World Energy, London, BP, 2003, p. 17.
[24] BP/Amoco, BP Statistical Review of World Energy, London, BP, 2003, p. 17.
[25] Energy Information Agency, International Energy Outlook, 2003, Washington, DOE/EIA-0484(2003), May 2003, p. 42.
[26] Energy Information Agency, *Annual Energy Outlook, 2004*, p. 68.
[27] International Energy Agency, World Energy Outlook, 2002 Insights, Paris, IEA, 2002, p. 106.
[28] International Energy Agency, World Energy Outlook, 2002 Insights, Paris, IEA, 2002, p. 107.
[29] International Energy Agency, World Energy Outlook, 2002 Insights, Paris, IEA, 2002, p. 103.
[30] International Energy Agency, World Energy Outlook, 2002 Insights, Paris, IEA, 2002, p. 109.
[31] http://www.eia.doe.gov/fueloverview.html#I, accessed August 8, 2003.
[32] Table 1.7, Overview of US Petroleum Trade, EIA Monthly Energy Review, July 2003, p. 15.
[33] Table 1.7, Overview of US Petroleum Trade, EIA Monthly Energy Review, July 2003, p. 15.
[34] EIA, EIA Short Term Energy Outlook, August 2003, Table HL-1.
[35] EIA, Annual Energy Outlook, 2003, pp. 80-84.
[36] Energy Information Agency, *Annual Energy Outlook 2004,* p. 95.
[37] EIA, Annual Energy Outlook, 2003, pp. 80-84.
[38] EIA, Annual Energy Outlook, 2003, pp. 80-84.
[39] EIA, Annual Energy Outlook, 2003, pp. 80-84.
[40] Energy Information Agency, International Energy Outlook, 2003, Washington, DOE/EIA-0484(2003), May 2003, p. 47
[41] BP/Amoco, BP Statistical Review of World Energy, London, BP, 2003, p. 20.
[42] BP/Amoco, BP Statistical Review of World Energy, London, BP, 2003, p. 20; Energy Information Agency, International Energy Outlook, 2003, Washington, DOE/EIA-0484(2003), May 2003, p. 49.
[43] BP/Amoco, BP Statistical Review of World Energy, London, BP, 2003, p. 20; Energy Information Agency, International Energy Outlook, 2003, Washington, DOE/EIA-0484(2003), May 2003, p. 49.
[44] Energy Information Agency, International Energy Outlook, 2003, Washington, DOE/EIA-0484(2003), May 2003, p. 50.
[45] International Energy Agency, World Energy Outlook, 2001 Insights, Paris, IEA, 2001, p. 141.
[46] International Energy Agency, World Energy Outlook, 2001 Insights, Paris, IEA, 2001, p. 141.
[47] Energy Information Agency, International Energy Outlook, 2003, Washington, DOE/EIA-0484(2003), May 2003, p. 55.
[48] BP/Amoco, BP Statistical Review of World Energy, London, BP, 2003, p.9.
[49] BP/Amoco, BP Statistical Review of World Energy, London, BP, 2003, p.25.
[50] Energy Information Agency, International Energy Outlook, 2003, Washington, DOE/EIA-0484(2003), May 2003, p. 186.
[51] Energy Information Agency, International Energy Outlook, 2003, Washington, DOE/EIA-0484(2003), May 2003, p. 185.
[52] Energy Information Agency, International Energy Outlook, 2003, Washington, DOE/EIA-0484(2003), May 2003, p. 186.
[53] Energy Information Agency, International Energy Outlook, 2003, Washington, DOE/EIA-0484(2003), May 2003, p. 186.
[54] International Energy Agency, World Energy Outlook, 2002 Insights, Paris, IEA, 2002, p. 141.
[55] See Energy Information Agency, International Energy Outlook, 2003, Washington, DOE/EIA-0484(2003), May 2003, pp. 57-.68.
[56] See Energy Information Agency, International Energy Outlook, 2003, Washington, DOE/EIA-0484(2003), May 2003, pp. 68-70.
[57] International Energy Agency, World Energy Outlook, 2002 Insights, Paris, IEA, 2002, p. 117.
[58] International Energy Agency, World Energy Outlook, 2002 Insights, Paris, IEA, 2002, p. 117.
[59] CIA, World Factbook, 2001,
[60] US State Department,, Bureau of Verification and Compliance, World Military Expenditures and Arms Transfers, 1989-1999. Middle East does not include North African states other than Egypt.
[61] Richard F. Grimmett, Conventional Arms Transfers to Developing Nations, 1993-2000, Congressional Research Service, RL31529, August 2001.

[62] The New York Times, December 18, 2003.
[63] There have also been cases of state-sponsored attacks. These include the Libyan bombings of Pan Am flight 103 over Scotland in 1988 and the bombing of UTA flight 772 over Chad in 1989. The bombing of Pan Am flight 103 killed 259 people on board and 11 people on the ground, and the bombing of UTA flight 772 killed 171 people on board.
[64] For historical background on Bin Laden, see Kenneth Katz man, "Persian Gulf: Radical Islamic Movements," Washington, Congressional Research Service, 96-731-F, August 30, 1996.
[65] EIA, "Persian Gulf Fact Sheet," April 2003, http://www.eia.doe.gov/emeu/cabs/pgulf.html.
[66] EIA, "Persian Gulf Fact Sheet," April 2003, http://www.eia.doe.gov/emeu/cabs/pgulf.html.
[67] This text is adapted from EIA reporting in "Persian Gulf Fact Sheet," April 2003, http://www.eia.doe.gov/emeu/cabs/pgulf.html.
[68] This text is adapted from EIA reporting in "Persian Gulf Fact Sheet," April 2003, http://www.eia.doe.gov/emeu/cabs/pgulf.html.
[69] This text is adapted from EIA reporting in "Persian Gulf Fact Sheet," April 2003, http://www.eia.doe.gov/emeu/cabs/pgulf.html.
[70] EIA, "Persian Gulf Fact Sheet," April 2003, http://www.eia.doe.gov/emeu/cabs/pgulf.html.
[71] EIA, "Persian Gulf Fact Sheet," April 2003, http://www.eia.doe.gov/emeu/cabs/pgulf.html.
[72] EIA, International Energy Outlook, 2003, p. 235.
[73] EIA, International Energy Outlook, 2003, p. 235.
[74] EIA, International Energy Outlook, 2003, p. 235.
[75] IEA, World Energy Outlook, 2002, p. 96.
[76] EIA, International Energy Outlook, 2003, p. 42.
[77] IEA, World Energy Outlook, 2002, pp. 108-109.
[78] IEA, World Energy Outlook, 2002, pp. 118-119.
[79]EIA, *Annual Energy Outlook 2004,* p. 93.
[80]This analysis is taken from EIA, "Energy Price Impact on the Economy," April 2001, http://www.eia.doe.gov/oiaf/economy/energy_price.html.
[81] DOE, "Strategic Petroleum Reserve Profiler, August, 2003, http://www.fe.doe.gov/programs/reserves/spr/
[82] EIA,, "Rules of Thumb for Energy Interruptions," December 11, 1997 is virtually identical to "Rules of Thumb for Energy Interruptions," October 18, 2002, in spite of changes in oil flows, inflation, and world economic conditions. See http://www.eia.doe.gov/emeu/security/rule.html,.
[83] EIA,, "Rules of Thumb for Energy Interruptions," October 18, 2002, in spite of changes in oil flows, inflation, and world economic conditions. See http://www.eia.doe.gov/emeu/security/rule.html,.