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Current MENA Energy Developments: The Trends By Sub-Region and Country

DRAFT FOR COMMENT AND REVIEW

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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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As has been discussed earlier, the efforts to model future energy developments in the MENA region described in the previous chapters are based on projections of market forces and not on an analysis of country energy development plans and national ability to implement them. There is no way to avoid this. Only a handful of MENA countries announced plans for modernizing and expanding their energy production and exports, and these only for limited periods in the future. Similarly, a risk assessment of the countries involved would require a net assessment of all of the strategic, military, political, economic, demographic, and social issues that affect each country. This is a level of analysis that is scarcely practical in a regional overview and where the risk assessment would usually still have to be based largely on speculation.

It is possible, however, to provide an overview of what MENA states have said about the energy developments in their country, and a brief summary of the key factors shaping a given country's stability and ability to develop its energy resources. Like all summary risk analysis, such judgments are inevitably filled with broad generalizations and uncertainties, and grow progressively more uncertain as they move into the future. They do, however, illustrate the key issues involved, and provide a rough indication of whether major exporter s will be ready and willing to respond to market forces.

The Importance of The Gulf Region

While the preceding analysis has dealt with the Middle East and North Africa as a region, most of MENA energy reserves and production are concentrated in the Gulf. The MENA region as a whole may have more than 65% of the world's proven oil reserves and 35% of its gas reserves, but over 94% of these oil reserves are in the Gulf. Similarly, the U.S. Department of Energy (DOE) estimates that the Gulf averaged 20.8 MMBD worth of exports in 2000. This equaled 28% of all world exports versus 30% for the entire Middle East. DOE estimates that the Gulf will average 35.8 MMBD in exports by 2025, which will equal 38% of all world exports compared to 44% for the entire MENA area.[1]

Many Gulf oil-exporting nations are expected to reach future production levels equal to entire regions. The EIA, for example, estimates that Saudi oil production capacity will rise from a little over 10.2 MMBD in 2001 to 23.8 MMBD in 2025. This is a larger output than is projected for all of the OPEC nations outside the Gulf combined, whose total production capacity is estimated at 16.6 MMBD. To put this increase in Saudi production in a broader perspective, the entire former Soviet Union – Russia, Central Asia, and the Caspian – is estimated to have a capacity of 19.7 MMBD. Latin America will have a capacity of 12.3 MMBD, Asia will have 4.1 MMBD, and Africa will have 10.5 MMBD. The US is estimated to have a capacity of 9.4 MMBD, Mexico 48 MMBD. Canada will have 4.1 MMBD, even with tar sands included.[2] Moreover, production costs in the Gulf will average 15-30% of those of virtually all other producers.

Gulf Oil Exports

As has been discussed in previous chapters, there are important uncertainties in these estimates, Gulf OPEC nation production capacity increased from 18.7 million barrels per day in 1990 to 20.6 million barrels per day in 2001. If one compares the estimates in the EIA reference case estimate with the high-low range in other scenarios, Gulf production capacity will rise to 21.7 MMBD in 2005 (19.98-23.5) , 28.7 MMBD in 2010 (20.8-28.4), 33.0 (23.1-34.5) MMBD in 2015, 38.9 (27.4-43.21) MMBD in 2020, and 45.2 (32.1-52.1) MMBD in 2025 . This is a potential increase from 28% of all world production capacity in 2000 to 36% in 2025.[3]

The EIA estimates that the Gulf contains around 674 billion barrels of proven oil reserves, and 1,923 Tcf of natural gas reserves (35% of the world total). At the end of 2002, Gulf countries maintained about 22.3 MMBD of oil production capacity, or 32% of the world total. In addition, Gulf countries also normally maintain nearly a 90% share of the world's surplus oil production capacity, although the Iraq war has reduced excess world oil production capacity to only around 0.7-1.2 MMBD, all in the Gulf region.[4]

In 2002, eight Gulf countries (Bahrain, Iran, Iraq, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates) produced about 25% of the world's oil, and Gulf countries had estimated net oil exports of 15.5 MMBD. Saudi Arabia exported the most, with an estimated 7.0 MMBD (45% of the total). Iran had estimated net exports of around 2.3 MMBD (15%), followed by the United Arab Emirates (2.1 MMBD -- 13%), Kuwait (1MMBD bbl/d -- 5%), and Bahrain

(0.01 MMBD -- 0.1%). OECD gross oil imports from Persian Gulf countries averaged about 10.6 MMBD or some 27% of the OECD's total gross oil imports

The EIA estimates that industrialized countries imported 9.7 million barrels per day from the Gulf region in 2001,and these imports represented some 58 percent of all Gulf exports. . The EIA also estimates that OPEC exports to industrialized countries will be about 11 million barrels per day higher in 2025 than in 2001 , and that more than half of this increase is expected to come from the Gulf region.[5]

The EIA estimates that North America's petroleum imports from the Gulf will almost double during 2001-2025. This increase is estimated to occur in spite of the fact that more than one-half of North America's imports in 2025 are expected to come from other regions and particularly from Atlantic Basin producers and refiners. The EIA projects that the US will make significant increases expected in crude oil imports from Latin America, including Venezuela, Brazil, Colombia, and Mexico, and from West African producers like Nigeria and Angola. In the case of Europe, moderate decline in North Sea production is expected to increase, Western European imports from Persian Gulf producers and from OPEC member nations in northern and western Africa. Substantial increases in imports from the Caspian Basin are also expected. Finally, industrialized Asian nations are expected to increase their already heavy dependence on Gulf oil and depend almost exclusively on Gulf exports.

In spite of such increases in the amount of Gulf oil going to industrialized states, the EIA estimates that the share of total Gulf exports going to the industrialized nations will fall to about 12 percent, from 57% in 2001 to 45% in 2025 This shift will occur because of the high rate of economic growth the EIA projects for developing nations, especially in Asia. Total OPEC petroleum exports to developing countries are expected to increase by more than 16.8 million barrels per day during 2001 and 2025, with three-fourths of the increase going to the developing countries of Asia. The developing countries of the Pacific Rim are expected to almost double their total petroleum imports between 2001 and 2025. The EIA estimates that China alone, is likely to import about 5.9 million barrels per day from OPEC by 2025, virtually all of which is expected to come from Gulf producers. [6]

The IEA does not project a trend for the Gulf per se, but its definition of the "Middle East" excludes Egypt and North Africa, and Syria – a minor producer and exporter – is the only non-Gulf nation included in the IEA totals. The IEA projects Middle Eastern oil supply as increasing from 21 MMBD in 2000, in its reference case, to 26 MMBD in 2010, 38 MMBD in 2020, and 51 MMBD in 2030.[7] These estimates track, in broad terms, with those of the EIA.

As has been discussed earlier, the EIA and IEA estimates are shaped by demand driven models, and do not reflect many of the real-world constraints affecting major energy suppliers and exporters. Many experts in the oil industry feel the levels of future production and exports estimated by the EIA, and other governmental groups like the IEA are too high. Few, however, dispute the broad accuracy of such trends. Virtually all feel that the Gulf will become steadily more important with time, not only as a percentage of total production and exports, but also as a "swing" producer whose ability to increase production and exports will stabilize world prices.

It is also clear that the Gulf states will be absolutely critical to both compensating for the depletion of oil in reserves outside the Gulf and in expanding production. As Chapter V describes in more detail, this is a matter of investment and production costs, and the price of oil in future world markets, and not simply the size of Gulf reserves.

Gulf Gas Exports

As has been discussed in Chapter I, the Gulf also has major gas reserves, and is becoming a major exporter of liquid natural gas. While the Russian Federation dominates the world's reserves with 1695 trillion cubic feet, or 31% of the world total, EIA analysis of the energy resources of the Persian Gulf indicates that it contains huge reserves (1,923 Tcf) of natural gas, with Iran and Qatar holding the world's second and third-largest reserves (behind Russia), respectively. Iran alone has 17% of the word's gas reserves and Qatar and the UAE have another 11.8%. In total, the Gulf has over 35.3% of the world's reserves. The rest of the Middle East adds less than another 1.26%.[8] As has been discussed in Chapter I, these reserves will become increasingly important over time to serve domestic gas consumption and gas exports.[9]The EIA projects major new gas developments in the Gulf region. Saudi Arabia resolved a long-standing offshore Persian Gulf border dispute with Kuwait in 2000, making possible the development of the 13-Tc) Dorra gas field in the waters between Iran, Saudi Arabia and Kuwait. Qatar's gas is located in the North Dome Field, which contains 380 Tcf of in-place and 239 Tcf of recoverable

reserves, which EIA estimates is the largest known non-associated gas field in the world. Qatar has two LNG exporters: Qatar LNG Company (Qatargas); and Ras Laffan LNG Company (Rasgas). Its $10 billion Dolphin Project is expected to supply gas from the North Dome to the United Arab Emirates, and Oman , beginning in 2005.[10]

Iran's huge South Pars field contains 280 Tcf of gas (some estimates run as high as 500 Tcf), and over 17 billion barrels of liquids. Development of this field is Iran's largest energy project, and has some $20 billion in investment. The EIA reports that natural gas from South Pars is slated to be shipped north via the planned 56-inch, $500 million, IGAT-3 pipeline as well as a possible IGAT-4 line, and then reinjected to boost oil output at the mature Aghajari field), and possibly the Ahwaz and Mansouri fields (which make up part of the huge Bangestan reservoir in the southwest Khuzestan region). South Pars natural gas also could be exported, both by pipeline and possibly by liquefied natural gas (LNG) tanker.

Phases 2 and 3 of South Pars development began to come on-stream in September 2002, and are producing around 2 Bcf per day of natural gas, and 85,000 bbl/d of condensates. On September 29, 1997, Total (now TotalFinaElf) had signed a $2 billion deal (along with Russia's Gazprom and Malaysia's Petronas) to explore South Pars and to help develop the field during Phase 2 and 3 of its development. In July 2000, Italian firm ENI had signed a $3.8 billion deal with Iran to develop the South Pars region for gas. The deal reportedly was the largest between Iran and a foreign company since the 1979 Islamic Revolution.

Iran is also seeking to develop the 6.4-Tcf, non-associated Khuff (Dalan) reservoir of the Salman oil field, which is located across Iran's maritime border with Abu Dhabi, where it is known as the Abu Koosh field. The NIOC is seeking to develop the reservoir to the production of up to 500 Mmcf/d of non-associated gas, along with the 120,000 bbl/d of crude oil now being produced from a shallower reservoir.

In addition, Iran plans to develop the 47-Tcf North Pars field development to provide up 3.6 Bcf/d of gas production, of which 1.2 Bcf/d would be re-injected into the onshore Gachsaran, Bibi Hakimeh, and Binak oil fields. The other 2.4 Bcf/d would be sent to the more mature Agha Jari oil field.

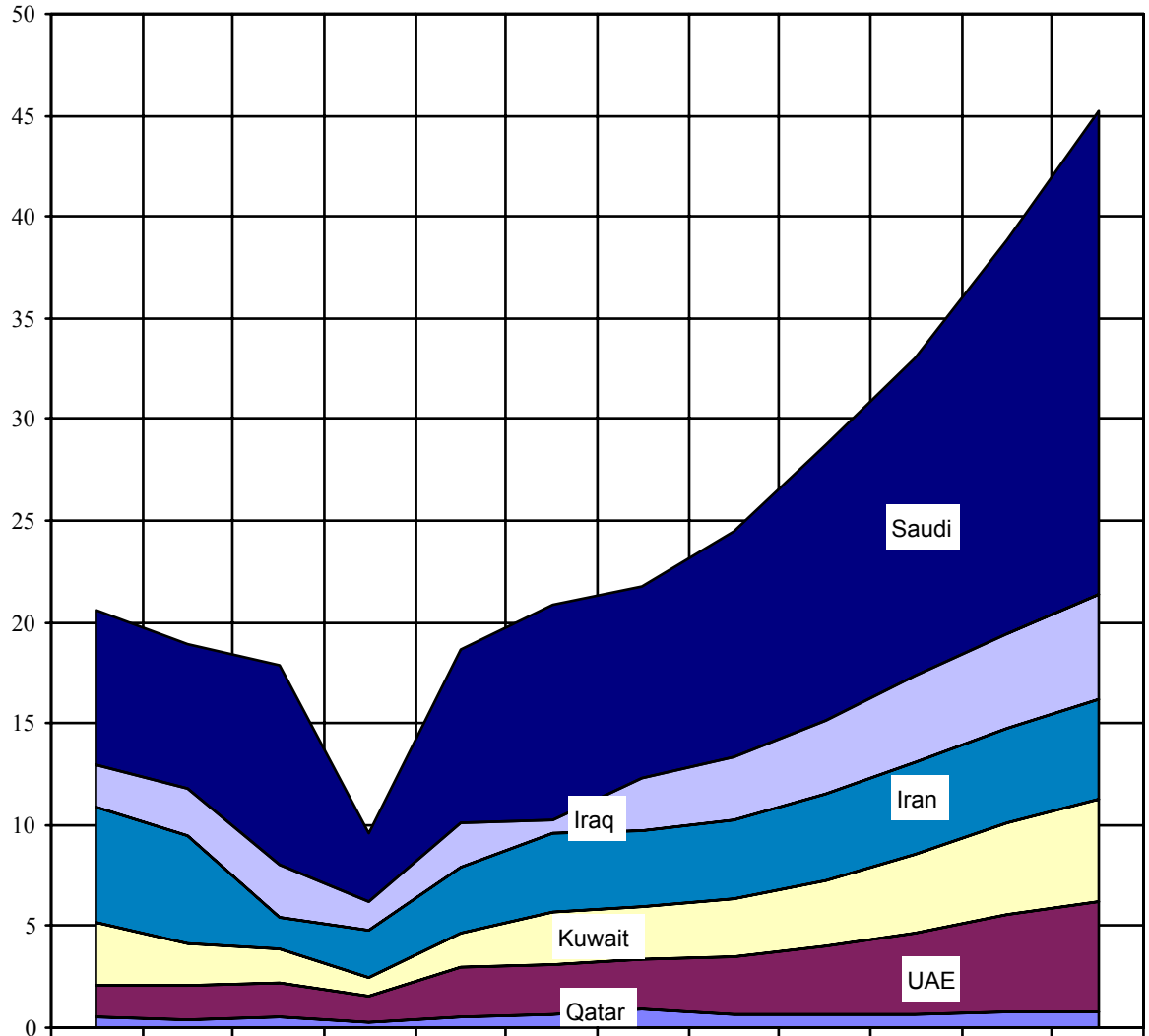
- Chart IV.1 shows the EIA reference cases estimate of the future increase in Gulf oil production capacity through 2002. The pivotal role of Saudi Arabia is clearly apparent. So, however, is the importance of the rest of the "Big Five," Kuwait, Iraq, Iran and the UAE.

- Chart IV.2 shows the EIA's estimate of the increase in Gulf petroleum exports between 2001 and 2025 by total and area of destination. The massive overall increase in exports is clearly apparent. So is the shift towards exports to the developing world and particularly towards Asia, China, and the Pacific Rim.

Chart IV.1

The EIA Reference Case Estimate of Gulf Production and Future Production Capacity

(EIA Reference Case in MMBD)



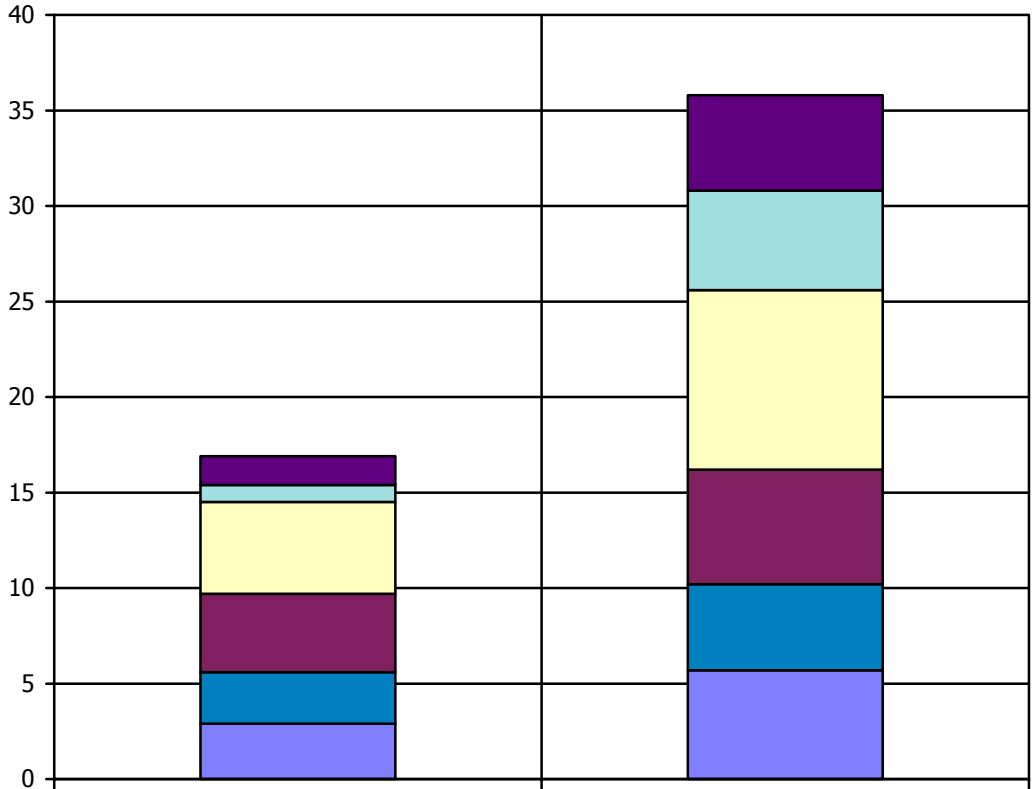
	1973	1975	1980	1985	1990	1996	2000	2005	2010	2015	2020	2025
Saudi	7.596	7.075	9.9	3.388	8.6	10.6	9.4	11.1	13.6	15.7	19.5	23.8
Iraq	2.018	2.262	2.514	1.433	2.2	0.6	2.6	3.2	3.6	4.2	4.6	5.2
Iran	5.8	5.35	1.662	2.25	3.2	3.9	3.8	3.9	4.2	4.5	4.7	4.9
Kuwait	3.02	2.084	1.656	1.023	1.7	2.6	2.5	2.8	3.3	3.9	4.5	5.1
UAE	1.533	1.644	1.709	1.193	2.5	2.5	2.5	2.9	3.4	4	4.8	5.4
Qatar	0.57	0.438	0.472	0.301	0.5	0.6	0.9	0.6	0.6	0.7	0.8	0.8

Source: Adapted by Anthony H. Cordesman from EIA, International Energy Outlook, 2002, DOE/EIA-0484 (02), June 2002, pp. 239, EIA, International Energy Outlook, 2003, DOE/EIA-0484 (03), June 2003, pp. 239and EIA, Monthly Energy Review, April, 1997, pp. 130-131.

Chart IV.2

Estimated Gulf Oil Exports: 2001-2025

(In MMBD)



	2000	2025 Reference
Total	*16.9	*35.8
Rest of World	1.5	5
China	0.9	5.2
Pacific Rim	4.8	9.4
Industrial Asia	4.1	6
Western Europe	2.7	4.5
North America	2.9	5.7

Source: Adapted by Anthony H. Cordesman from EIA, International Energy Outlook, 1998, DOE/EIA-0484 (97), April 1998, pp. 175-177, International Energy Outlook 2002, June 2002, DOE/EIA-0484 (02), p. 38; and International Energy Outlook 2003, June 2003, DOE/EIA-0484 (03), p. 42

Country Trends and Risks

Any effort to summarize country plans, trends, and risks presents the problem that most countries do not have public long-term energy plans, that the plans they do announce are regularly resolved, and major individual projects emerge and then go into a constant state of flux that often are not part of any overall plans. MENA nations respond to market forces, external and internal risk, and new discoveries of energy resources in ways that cannot be anticipated in detail. There are, however, a number of trends that do seem likely to shape the actions of given countries during the period from 2004-2030.

Similarly, any summary risk assessment both necessarily oversimplifies the complex factors at work in each MENA country, and ultimately depends on the ability to predict the political, economic, and security dynamics of nations up to 30 years in the future. The recent history of the MENA region makes it all too clear that it is not possible to go beyond short and mid-term judgments and that even these judgments can be nothing more than broad guesses.

Saudi Arabia

Saudi Arabia is one of the largest and most powerful states in the Gulf. According to estimates by the EIA, Saudi Arabia contains 264.2 billion barrels of proven oil reserves, or more than one-quarter of the world's total. The Saudi Arabian Oil Company (ARAMCO) claimed in 2004 that Saudi Arabia had a nominal total of 260 billion barrels of proven reserves, or 25% of all world reserves.[11] Roughly 131 billion barrels of these proved reserves were stated to be "developed," and in fields that already were in production. It also claimed that it had a total of 700 billion barrels of "discovered reserves" and 200 billion barrels of "undiscovered reserves," and projected that its discovered volume of oil initially in place would reach 700 billion barrels by 2025. It also claimed that it replaced 3 billion barrels of oil production with new reserves in 2004, and added 5 trillion cubic feet of gas to its reserves.[12]

Saudi Arabia is the pivotal oil exporter in the Gulf, the Middle East, and the world. During 2002, Saudi Arabia produced around 8.5 million barrels a day of oil. (It has produced more than 8 million barrels per day since 1991 – roughly 30% of total OPEC crude production.) According to the EIA, Saudi Arabia had a production capacity of around 10.0-10.5 million barrels a day in 2004. The Saudi Arabian Oil Company (ARAMCO) estimates a production

capacity of 10 MMBD of oil and 9.6 billion cubic feet (BCF) of gas. [13] Saudi Arabia is also a driving force behind OPEC and in determining whether it can create favorable oil prices. As a result, Saudi production can vary sharply according to global demand for oil and Saudi calculations about which level of production both maintains high oil export revenues in the short run and continued demand for Saudi oil over time.

Saudi Arabia has steadily improved its production capacity and down stream capabilities in response to market forces in the past, and it has sought to retain and expand its oil revenues by keeping prices moderate and preserving both its market share and long term demand for imports. It has also sought to maintain 2 MMBD of surplus production capacity to maintain its role in shaping the oil market by being its key swing producer. [14] While Russia is emerging as a rival, it has generally been the world's largest producer, and its surplus production capacity has allowed it to act as a "swing" producer that can rapidly increase the supply of exports by 1-2 MMBD, and play a critical role in ensuring and stable supply and more moderate oil prices. [15]

Saudi Oil Production Plans

Saudi Arabia's short-term oil production policy is clear and has not changed since the late 1990s. In October 1999, Oil Minister Naimi stated that Saudi oil policy was based on four facts: 1) the largest oil reserves and among the lowest production costs -- around $1.00-$2.00 per barrel -- in the world (the country also has extremely low finding costs, estimated at around 10 cents per barrel); 2) maintenance of significant spare oil production capacity; 3) a national economy closely linked to the oil industry; and 4) a stable political and economic system. Naimi also stressed the importance of "a stable international oil market" where "wide and rapid swings in prices are undesirable." It is also clear that one of Saudi Arabia's long-term goals is to develop its lighter crude reserves, including the Shaybah field located in the remote Empty Quarter area bordering the United Arab Emirates.[16]

Saudi Arabia currently has three projects underway that should increase production capacity by some 1.1 MMBD at a cost of $4-5 billion, and is attempting to change its role as an energy exporter by heavily investing in refinery upgrades and expansions. Currently, it has eight refineries with crude throughput capacity of 1.75 million barrels per day.[17] A $1.2 billion upgrade of the Ras Tanura refinery is nearing completion and its capacity may be further expanded to as much as 1 million barrels per day under longer-term investment plans (through

2007). Saudi Basic Industries Corporation (SABIC) accounts for 10% of world petrochemical production. Reduced tariff barriers for petrochemical exports by SABIC are a major motivation behind Saudi Arabia's pursuit of membership in the World Trade Organization.

Saudi Arabia has also taken aggressive measures to secure market share for its crude oil through refining ventures in the United States, Europe, and Asia. The Kingdom took the first step in this direction in 1988, when it acquired a 50% stake in Texaco's Star Enterprise joint venture. The newly combined company will have $13 billion in assets, 13 refineries, and 22,000 retail outlets. Despite the recent economic problems in East Asia, Saudi Arabia has continued to look to that region for expansion of its downstream oil investments. Saudi Aramco's ambitious, $3 billion, expansion plan in the Philippines, for instance, still seems to be moving forward.

EIA versus Saudi Projections

Saudi Arabia's mid and long-term energy strategy, and future production capacity, are much less clear. Both the Department of Energy and the International Energy Agency estimate that the growth in Saudi oil production will outstrip the growth in all of the nations in the Former Soviet Union, in spite of major increases in production by the former Soviet republics in the Caspian and Central Asia. The Gulf states, especially Saudi Arabia, not only have vast reserves, but the lowest costs in the world in terms of incremental production. This explains why the demand-driven models of the EIA and IEA models call for Saudi production capacity to increase by so much between 2001 and 2025.

The EIA estimates that Saudi Arabia will increase its production capacity from 8.6 million barrels per day in 1990, and 10.2 million barrels per day in 2001 to 19.5 million barrels per day in 2020, and 23.8 million barrels per day in 2025. [18] The projected increase in Saudi production of 14.4 MMBD from 2001 to 2030 (from 9.4 MMBD to 23.8 MMBD) is equal to 63% of a total projected increase of 22.8 MMBD in Gulf production capacity, 55% of the total projected increase of 26.1 MMBD in Middle Eastern production capacity, and 32% of the 45.3 MMBD increase in world production capacity.[19]

To put this projected growth in Saudi production capacity in broader perspective, Saudi Arabian production is already equal to all other states in the Gulf combined, and will remain so through 2020 in spite of major increases by Iran and Iraq. The Department of Energy estimates

that Saudi Arabia's production will shift from 12.8% of world production capacity in 2001 to 13.2% in 2005, 14.5% in 2010, and then rise to 19.1% in 2025. [20]

Yet, the fact these estimates are made on the basis of demand-driven models, and not on the basis of Saudi plans, means actual future Saudi production may well be much lower. Like other MENA states, the Saudi Arabia has only provided limited detail on its long-term energy strategy regarding future production and export levels, down stream production capabilities, and development of new distribution facilities and ports. It has never had a public debate over the kind of increases in production capacity called for in EIA, IEA, and OPEC estimates.[21]

Saudi Aramco did announce in February 2004, however, that it had plans to maintain production capacity at levels of 10-12 MMBD for the next fifty years (through 2054), and had examined the possibility of producing at levels up to 15 MMBD. Saudi Aramco summarized these fifty-year production scenarios as follows:[22]

> "Contingent on global market conditions, the Company can readily achieve and sustain a 10 million barrels per day production level through 2054, by relying only on 15 billion barrels of its possible/probable reserves. Future exploration, delineation, and development efforts will certainly push the production plateau well beyond 2054 by expanding the Company's proved reserve portfolio. (Note: the Company's Business Plan calls for a reserves replacement of 15 billion barrels during 2005-2009).
>
> …The Company can achieve and sustain 12 million barrels per day production level through 2054 by relying on 35 billion barrels of its probable/possible reserves through exploration and development efforts. (The supporting graph shows this increase will occur during 2010-2015)
>
> A 15 million barrels per day production level can be accomplished and maintained through 2054, by utilizing 68% of the Company's probable/possible reserves. Prudent reservoir management practices, oil-focused exploration efforts and continual emphasis on cutting-edge technologies (including current and future EOR), can certainly extend the plateau period well beyond 2054.

These Saudi statements are a warning that can apply to virtually every other exporting country in the Middle East. Exporting nations may ultimately react to economic forces, and their need to increase oil export earnings, by developing production capabilities far higher than they now plan. At the same time, they may not. As a result, the modeling efforts of the EIA and IEA are most important in indicating that the Saudi share of new and sustained production will be so large that it will be the most critical single factor in limiting the projected price of oil in future world markets.

Even this conclusion, however, has been challenged. There have long been experts who raised serious questions about how long EOR can contribute to the growth of proven reserves, and about the quality of the estimates used to estimate reserves. Other experts have questioned how well given states manage their exploration, production, and development, and make effective use of the best available technology and practices. A number of states in the MENA area have had significant problems at various times. These include such major producers as Abu Dhabi, Iran, Iraq, Kuwait, and Oman.

Key Uncertainties in Estimates of Saudi and Other MENA Increases in Production: The Simmons Challenge

Matthew R. Simmons has conducted a lengthy investigation of Saudi oil reserves and oilfield management practices, as well as of the broader availability of future oil supplies. He feels that most forecasts of production are based on uncertain estimates of reserves, and notes that oil and gas production has peaked in other areas with only limited warning. He also notes that some 20% of the world's oil supply comes from only 14 fields that average 60 years since their discovery.[23] Simmons also claims that major problems exist in the IEA and EIA estimates of OPEC output that can prevent the tracking of production problems.

Simmons focuses on Saudi Arabia as the symbol of what he feels are estimates that are both uncertain and rely far too heavily on continued increases in production from a limited number of major fields. While Simmons is not a petroleum geologist or reservoir engineer, he analyzed a wide range of papers on Saudi fields from the Society of Petroleum Engineers (SPE) that describe problems in producing Saudi fields over the period from 1961 to 2003. Simmons feels these papers reflect steadily growing problems. These include:[24]

- Saudi over-reliance on production from a small number of large, but aging oilfields. Saudi Arabia has over 3200 recognized reservoirs, but 90% of its production comes from a small number of fields. The three main fields include Abqaiq (1940), Ghawar (1948-1949), and Safaniya (1951). The more recent major producing fields are smaller and still date back to 1945-1967 (Berri, Zuluf, Marjan, Abu Sa'fah, and Qatif). "Most other formations seem to lack permeability, porosity, aquifer, or all three." Abqaiq peaked in 1973 at 1.095 MMBD, and Berri in 1977 at 787,888 bpd.

- All five major producing Saudi fields use waterdrive to create high levels of oil flow and avoid the normal rate of depletion. Water injection, however, permanently bypasses large pockets of oil.

- Ghawar alone has accounted for 55%-60% of all Saudi oil produced to date, and still produces 5 MMBD or almost 2 billion barrels a year. Saudi Arabia estimates it still has 125 billion barrels of production capacity left using advanced production techniques. However, some 400 wells have already been drilled in this filed. If advanced EOR techniques do not produce vast amounts of oil from Ghawar, the much more conservative

methods of estimating oil reserves developed up to 1975 would indicate that the field only had 60 billion barrels of recoverable reserves and is now 90% depleted. There are also problems with tar mats on its eastern flank, some areas require heavy water injection, and others have yet to show any proof they can be produced.

- Saudi Arabia is experiencing production problems with Safaniya, the world's largest offshore field, with watercuts, sand control issues, and problems in producing the Southern end. Zuluf is its other major offshore field and faces serious production issues. The Marjan complex has H_2S problems.

- Shaybah is the last giant field to be discovered and was discovered in 1967, but its gas cap and contact between oil and water make vertical wells impractical.

- The fields at Qatif, Abu Sa'fah, and Khurais all have their own problems.

- The last major commercial success occurred in 1989. It was the Hawtah field in central Arabia and it produces 200,000 bpd. It has problems with corrosive aquifer water and bacteria contamination.

- The inability to get economic production from vertical wells than are relatively simple and cheap to drill, and reliance on complex, more costly horizontal wells that require much more careful management and which may present risks in terms of their ultimate recovery of oil. These "bottle brush" wells create complex paths through bottom-side water and top-side gas formations to extract the "last thinning columns of easy oil" and may never recover much of the oil in the formation. Over-reliance on this technology led to the collapse of production from Oman's Yibal field.

- While technologies like 3-D seismic, horizontal drilling, multilateral well completions, subsea oil production techniques and other new methods are touted as technical revolutions, "the technology revolution created monstrous decline rates. Proven reserve write-off is likely worldwide." These technologies accelerate extraction, rather than produce the projected increases in recoverable reserves. Prudhoe Bay is a typical example, as are the North Sea giant fields. Once giant fields peak, they usually produce a steady decline, as was the case in East Texas.

- A massive drilling effort now requires some 46 drilling rigs, drilling 333 new wells a year. By 20010, Aramco will need 90 rigs and have to drill 600 new wells. These well will all be horizontal and average production per well will drop from 2,010 bpd in 2004 to 1,170 bpd in 2010.

- The methods the USGS uses to estimate proven oil and gas reserves are extremely uncertain, and lead to order of magnitude ranges of uncertainty in undeveloped fields. Saudi projections of reserves and future production rely heavily on the content and output of some 85 untested oil and gas fields. Saudi Arabia no longer is subject of the strict review of its reserve estimates that took place when outside oil companies ran Aramco, and exaggerated its gas reserves in recent efforts to negotiate major gas development contracts with outside companies. If one applies the older method for estimating Saudi reserves, it would have had only 163.4 million barrels in 1982, rather than the 259.2 billion barrels it now claims.

- Saudi Aramco field production and reservoir models began to fail to predict fluid behavior as early as 1990. New models developed in 2002 remain unproven.

- Saudi Arabia may be forced to shift from producing from high field, giant fields, to scattered small fields with much less output at much higher costs.

- Saudi oil production could peak as early as 2006-2007 if the "worst case" proves to be true.

It is important to note that Simmons raises many points more as questions than as firm conclusions, and that he uses Saudi Arabia as an example of problems that will affect almost all major oil production efforts throughout the world. Simmons arguments do not, therefore, affect the strategic importance of Saudi Arabia and the MENA areas as much as raise serious questions about all energy forecasts of oil and gas production. Moreover, Simmons is careful to call for further study and for global transparency in producing the best oil reserve and production forecasts, not leap to sudden conclusions.

These are important points and they deserve careful attention at the policy level. It is true that their have been Cassandra-like predictions about oil before, in the Middle East, Former Soviet Union, and the world, As the previous chapters have shown, none has proved accurate enough to merit serious retrospective analysis. At the same time, many current production and export forecasts are driven by models and assumptions that do not explicit analyze technical or geological risk, and assume a predictable level of technological progress. Such assumptions are inherently and inevitably wrong. No matter how long a trend lasts, it will eventually end and usually in ways that produce sharp changes in either a positive or negative trend. The current estimating models of the IEA and EIA do not explore enough variables and lack adaptation to modern complexity theory. They also tend to be recalibrated regressively, rather than consider future risk. Given the immense increases in mid-term energy out put that they project during 2020-2030, this is not an adequate approach to modeling and analysis.

The Saudi Aramco Response

At the same time, it is clear that Saudi Aramco has a very different view of the future, as do virtually all oil companies and government and international agencies. The fact that the *possibility* of drastic error exists in world, MENA, and Saudi energy forecasts, does not mean that they are in error, and experts have raised similar arguments in the past. Saudi Aramco argues that:[25]

- Aramco operates on the basis of five basic principles: (1) Sustainable performance, (2) maximum hydrocarbon recovery, (3) emphasis on optimal life-cycle economics, (4) prudent reserves management, and (5) excellence in safety and environmental practices.

- Saudi Aramco practices are equal to, or better than, best practices in the industry. Its estimates of 260 billion barrels of proved oil reserves are conservative and do not include any portion relying on advanced EOR other than pressure maintenance. The standard estimates of reserves set by leading industry exports in the SPE, WPC, and AAPG do include reserves based on such methods

- Some 131 billion barrels, or 50% of Saudi Arabia's 260 billion barrels of proved reserves are developed, and largely on production. Extensive field performance data, and the relatively high level of development (50%), confirm the accuracy of Aramco estimates of proved reserves, and are further confirmed by comprehensive characterization of local, regional, and basin proved reserves.

- Aramco uses SPE, WPC, and AAPG standards for calculating recoverable proved reserves for oil prices, operating methods, hydrocarbon water content, and deepest know n hydrocarbon depth, and the same probability criteria (90%).

- Reservoir management is based on a sophisticated learning model that is continually improved, and based on maximum hydrocarbon recovery, reservoir monitoring, low depletion rates, advanced diagnostics, and cutting edge technologies.

- The extent of depletion in existing Saudi fields ranges from 5% in newly developed fields like Shaybah to 73% in mature fields like Abqaiq. The total depletion is 28% as of year-end 2003. (Abqaiq=73%, Ain Der/Shedgum=60%, Ghawar=48%, Berri=28%, Safaniya=26%, Abu Sa'fah=21%, Zuluf=16%, Marjan=13%, Haradh=10%, and Shaybah=5%.)

- Saudi depletion rates average 1-4.1% annually versus 4.2-9.6% for most international fields.

- As a case example, Shaybah is currently being depleted at a rate of 1% a year, with a production plateau of more than 50 years. It has continued to produce 500,000 bpd since July 1988, and actual production has conformed to Aramco predictions. It will be expanded to 1 MMBD or higher when needed. Horizontal drilling and the shift from simple horizontal wells to maximum reservoir contact wells increased production from 3,000 bpd in 1996, drawing on a distance of 1 kilometer, to 10,000 bpd in 2002, drawing on a distance of 12 kilometers. At the same time, unit development costs dropped by more than 66% during 1996-2002.

- Ghawar's development was enhanced by peripheral water injection as early as 1965, and has maintained a comprehensive pressure maintenance program ever since. Rather than decline, technology and prudent reservoir management techniques allowed it to produce 55 billion barrels by the end of 2003. Water cut did increase slowly from under 30% in 1993 to 36.5% in 1999, but improved practices cut it back to 33% in 2003. It has never risen above moderate levels.

- The Ain Dar/Shedgum area of Ghawar has produced 26.9 billion barrels, and currently produces 2 MMBD at a steady water cut of 36%. Reservoir pressure has been stable for more than two decades. It still has 13.9 billion barrels of proved reserves, 3.4 billion barrels of probable reserves, 6.8 billion barrels of possible reserves, and 17.1 billion barrels of contingent resources. EOR should allow recovery of 75% of the oil initially in place or 51 billion barrels.

- Two giant shut-in fields, Manifa and Khurais, which contain proved reserves of 40.8 billion barrels, have depletion states of 1.2% and 1.8% respectively. Both fields have been developed and placed on – stream as predicated b y Aramco's production and maximum sustainable production capacity (MSC) imperatives.

- Valid exploration, delineation, and development efforts increased Saudi Aramco's estimates of oil initially in place by 17% during 1984-2003.[26]

- Exploratory wells have been drilled to confirm the producability of the other fields and expanded use of existing fields, including areas in northwest Saudi Arabia, northern basins along the borders with Iraq, central Saudi Arabia, the Rub' al Khali, and offshore Red Sea basin.

- Saudi reserve estimates are confirmed by a USGS survey in 2000 of the top eight regions of undiscovered, recoverable oil resources. The mean estimate of such oil resources was 87 billion barrels for Saudi Arabia, 77 billion for Russia, 53 billion for Iran, 47 billion for Greenland, 47 billion for Greenland, 45 billion for Iraq, 38 billion for Nigeria, and 21 billion for Kazakhstan.

- Saudi Arabia now projects its estimate of undiscovered oil initially in place to increase from 7000 billion barrels in 2004 to 900 billion in 2025.

- The use of "smart wells," and quad-lateral smart well completion technologies, has already been proven in the Haradh Increment III project and is currently producing 300,000 bpd. Production is projected for 50 years, and water cut levels will only rise to a moderate 22% in 2036.

- Simmons relies on reports designed to identify problems that Aramco has largely solved. He is projecting generally from the wrong type of highly specific source.

It is worth noting that Aramco's exploration, reservoir management, and other practices win almost universal praise from US, British, and Dutch oil companies – praise they do not give to Kuwait, Iran, Iraq, Oman, and the UAE. US government experts share this opinion. As a result, it seems likely that Saudi Arabia can meet its goals in the near and mid-term (through 2025) unless Simmons's calculations are proven correct for reasons that would require significant new discoveries about petroleum geology and oil field management. As has been noted earlier, however, this is *possible* although not *probable*. Moreover, Simmons is certainly correct in warning that IEA and EIA forecasts of Saudi production are unrealistic to the degree that Saudi Arabia has never announced plans to produce at anything like the levels projected by the IEA and EIA.

Saudi Ability to Ship and Transport Oil

Saudi ability to safely ship its oil is also an important strategic issue. Saudi Arabia has attempted to secure its position as an exporter and boost its export capabilities by acquiring new tankers and increasing its overseas crude oil storage capacities. The Saudi fleet currently comprises 23 crude tankers and four product vessels. Saudi Arabia also owns and leases storage facilities.

Most of Saudi Arabia's crude oil is exported via the Persian Gulf through the Abqaiq processing facility. In the Persian Gulf, the Kingdom's primary oil export terminals are located at Ras Tanura (6 million barrels per day capacity- the world's largest offshore oil loading facility) and Juaymah (3 million barrels per day). In addition, the Yanbu terminal (as high as 5 million bbl/d) serves as the main oil port in the Red Sea, though it is far less profitable than Ras Tanura.

Saudi Arabia operates two major oil pipelines that give it a capability to bypass shipments through the Gulf and the Strait of Hormuz. The 4.8 million barrels per day East-West Crude Oil Pipeline (Petroline) is used mainly to transport Arabian Light and Super Light to refineries in the Western Province and to Red Sea terminals for direct export to European markets. Running parallel to the Petroline is the 290,000 barrels per day Abqaiq-Yanbu natural gas liquids pipeline, which serves Yanbu's petrochemical facilities. The EIA reports that Saudis expanded the Petroline to maintain Yanbu as a strategic option to Gulf port facilities in the event that exports were blocked at that end, and that the Petroline's capacity could be expanded significantly by using so-called "drag reduction agents" (DRAs).

This could enhance the line's strategic value, but the EIA also reports that Yanbu is a far less economic option for exports than Ras Tanura. Shipments from Yanbu add about 5 days roundtrip travel time for tankers through the Bab al-Mandab strait to Asia compared to Ras Tanura through the Strait of Hormuz. In addition, the Petroline is normally utilized at half capacity. Saudi Aramco has begun converting the AY-1 (48-inch) line to natural gas pumping capability. The natural gas will supply Yanbu's petrochemical and power facilities.[27]

The Trans-Arabian Pipeline (Tapline) was mothballed following the Persian Gulf War (after providing only limited service to a refiner in Jordan since the 1970s), and the 1.65 million barrels per day Iraqi-Saudi Pipeline (IPSA-2) was closed indefinitely after the start of the Gulf War.

Saudi Natural Gas Resources

Saudi Arabia's natural gas reserves are estimated at 224.7 trillion cubic feet (Tcf). Most of these reserves consist of associated gas, which comes primarily from the Ghawar field and the offshore Safaniya and Zuluf fields. The Ghawar oil field alone accounts for one-third of the country's total gas reserves. Most new associated gas reserves discovered in the 1990s have been in fields that contain light crude oil, especially in the Najd region south of Riyadh. Most of Saudi Arabia's non-associated gas reserves are located in the deep Khuff reservoir, which underlies the Ghawar oil field, and which has been expanded steadily over the past decade. In 2002, construction was completed on a $4 billion, 1.4 Bcf per day, non-associated gas processing plant at Hawiyah, near the Ghawar oil field. Hawiyah represents the largest Saudi natural gas project in more than 10 years.[28]

Aramco discovered four new gas fields in 2003. Moreover, the ongoing projects of Hawiyah and Hanadh will enable the respective oil company to increase its natural gas production from 3 to 5 tcf annually. This increase requires an expanded gas pipeline network, and Aramco plans to construct some additional 3,000 kilometers of pipeline by 2006.[29] Nevertheless, many oil company experts believe that Saudi Arabia is still not ready to offer attractive terms for the level of foreign investment it needs in its gas facilities, and is not prepared to address the need for foreign financing of its oil production in the future.

Natural gas development is both a short and long-term energy issue because of its value as feedstock and because it is critical to reducing the domestic demand for oil. With domestic gas demand expected to grow as much as 8% per year through 2007, increasing gas production, particularly non-associated production is a priority for the Saudi government. The gas will be used as feedstock for the growing petrochemical industry as well as for electricity generation. In addition, using gas domestically instead of oil could help free up 200,000-300,000 barrels per day of additional crude oil for export within the next two years.

Saudi Need tot Increase Domestic Use of Natural Gas

There are no current Saudi plans to export natural gas, but Saudi Aramco projects that domestic gas consumption could exceed 6 Bcf per day by 2005, and the EIA reported in June 2003 that Saudi Arabia aims to triple natural gas output (to 15 Bcf/d) by 2009. Most of this demand will come from industrial consumers, power plants, and petrochemical plants located in the Eastern Province. (at Yanbu and Jubail,), as well as desalination plants and a replacement for burning oil.

To date, Saudi Arabia has not expressed great interest in exporting liquefied natural gas mainly due to doubts regarding economic viability. The Saudi oil minister, Ali Naimi, has said that the Kingdom will only investment in major export facilities like gas trains if it finds gas reserves similar to Qatar's North Field. Saudi officials have also indicated that building a large natural gas-to-liquids plant is not part of Saudi energy strategy through 2020-2025.[30]

Using natural gas instead of oil domestically frees up additional crude oil for export (OPEC quotas are on production, not exports). Investment in natural gas also provides a substitute for crude burning by electric utilities. In the summer of 1996, high demand by

domestic power plants contributed to Aramco's decision to reduce its crude oil deliveries under some term contracts by 5%. Domestic demand for gas is rising at a rate of 7% per year, and is driving investment in Saudi Arabia's Master Gas System (MGS), which started up in 1982 (prior to that time, all of the country's natural gas was flared). In 1999, Saudi Arabia began an ambitious $4.5 billion expansion of the MSG that continues today.[31]

The need to make massive further increases in gas exploration and development, production, distribution, and use presents investment problems for Saudi Arabia at a time it must fund oil development, restructure the rest of its economy and meet rapidly growing civil demands from its rising population. The Kingdom also needs technology transfer in the gas sector because Aramco has less experience with gas development than with oil.

Gas development is now slated to consume a large share of Saudi Arabia's energy budget. In late 1999, Aramco decided to invest $45 billion over 25 years on upstream gas development and processing facilities), and Aramco is aiming to add 3-5 Tcf of new non-associated natural gas reserves per year to meet rapid (5% annual) gas demand growth. Non-associated gas development is desirable because it guarantees a steady flow of gas regardless of oil output, which tends to fluctuate. Currently, non-associated gas accounts for 40% of Saudi Arabia's total gas reserves.

As a result, Saudi Arabia has had a steadily growing interest in foreign investment in its gas industry. Crown Prince Abdullah has led a major effort, beginning in March 2000, to obtain foreign investment to help support the expansion of Saudi Arabia's gas industry, but this effort has encountered major problems. Saudi Oil Minister Naimi officially announced termination of negotiations with foreign energy companies on the $15-$20 billion "Saudi Gas Initiative" (SGI) in June 2003. The SGI was supposed to the first major reopening of Saudi Arabia's upstream hydrocarbons sector to foreign investment since nationalization in the 1970s. The SGI had aimed to increase foreign investment and natural gas development in the country, while integrating upstream gas development with downstream petrochemicals, power generation, and water desalination. SGI had been seen as the key to Saudi Arabia's entire foreign investment strategy.[32]

The EIA reports negotiations broke down over two major stumbling blocks: the extent of gas reserves to be opened to upstream development, and whether or not this should include gas from the Saudi Aramco Reserve Area (SARA); and the rates of return to participating companies (the companies wanted a significantly higher rate than the Saudis were offering).

- Core Venture 1, in South Ghawar, would have been one of the world's largest ($15 billion) integrated natural gas projects, including exploration, pipelines, two gas-fired power plants, two petrochemical plants, two desalination units, and more.
- Core Venture 2 was to involve exploration in the Red Sea, development of the Barqan and Midyan fields on the Red Sea coast in northwestern Saudi Arabia, as well as construction of a petrochemical plant, a power station, desalination capacity, etc., at a cost of $4 billion.
- Core Venture 3 would have involved exploration near Shaybah in the Rub al-Khali ("Empty Quarter") of southeastern Saudi Arabia, development of the Kidan gas field, laying of pipelines from Shaybah to the Haradh and Hawiyah natural gas treatment plants east of Riyadh, and construction of a petrochemical plant in Jubail, at a cost of $4 billion.

In mid-June 2003, the Dubai-based Gulf News reported that Saudi Arabia was considering inviting international oil companies to bid again on the SGI. Companies which had been selected (in 2001) for the three "core ventures" under the SGI were: 1) South Ghawar: Exxon Mobil (35%), Shell (25%), BP (25%), Phillips (15%); 2) Red Sea: Exxon Mobil (60%), plus Marathon (20%) and Occidental (20%); 3) Shaybah: Shell (40%), Total (30%), and Conoco (30%).

This was followed in July by a breakthrough agreement with Shell and Total on joint gas exploration with Aramco, the first time Saudi Arabia had accepted foreign investment since the 1970s. This represented a scaled-down version of Core Venture 3, and covered 209,160 square kilometers of the Empty Quarter. Shell took a 40% share and Total and Aramco 30% each. Both at the time and later, the major US and British oil companies stated privately that they were not willing to take the risk of bidding on areas where non-associated gas reserves were so uncertain and the terms were not competitive with other countries in risk-benefit.

While Core Ventures 1 and 2 were abandoned, Saudi Arabia also sent out bid packages for three smaller upstream packages and held discussions with some 40 companies. The Contract A area A is 29,900 square kilometers, the Contract C area is 38,800 square kilometers, and the Contract C area is 51,400 square kilometers. [33]

In March 2004, the Kingdom made gas deals in each area that involved a strikingly new set of partners. Saudi Arabia opened the door on Sunday to fresh natural gas exploration, securing $800 million worth of Russian, Chinese and European investment that it said would forge new political and economic alliances. Saudi oil minister Ali al-Naimi announced that new deals had been signed with Russia's LUKOIL, China's Sinopec, and a consortium of Italy's Eni and Spain's Repsol YPF. The deals in Contract Areas A, B, and C covered a total 120,000 square kilometers in the southeastern edge of Saudi Arabia's Empty Quarter near its border with the UAE. Saudi Aramco took a 20 percent stake in all three ventures.

Saudi oil minister Naimi announced at the signing ceremony that, "We already have strong relations with Russia and excellent cooperation in managing market stability…And there is no question in my mind that strengthening economic relations will strengthen other areas of cooperation." The LUKOIL deal was signed less than a year after Saudi Crown Prince Abdullah visited Moscow both to improve Saudi relations with a major competing oil and gas producer and in reaction to US treatment of Saudi Arabia after September 11, 2001. It committed LUKOIL to investing $200 million to explore Contract Area A in southeastern Saudi Arabia. The head of LUKOIL announced that the company expected a minimum rate of return on investment of 12.5 to 15 percent, and that LUKOIL could invest up to $3 billion in the Saudi gas sector if were to find gas.

The Chinese firm Sinopec signed its deal with Saudi Arabia in response to growing Chinese concerns over dependence on oil and gas imports. Saudi Arabia already ranked as China's top supplier of crude oil, and exported some 13.5 million tons of crude in 2003. The deal gave Aramco a 25 percent stake in a planned $3 billion refinery and petrochemical venture in China, while Sinopec pledged to invest an initial $300 million in drilling wells and shooting seismic surveys in a 38,800 square kilometer block in the Empty Quarter. [34]

The European firms of Eni and Repsol took the biggest block, which had an area of 51,400 square kilometers. Even so, the deals were striking in that they excluded the US U.S. oil majors which had been involved in the "Natural Gas Initiative," and only one U.S. company -- Chevron Texaco -- even bid in the current round. The Chevron-Texaco bids did not come close in Contract Area A, where Aramco gave LUKOIL a bid score of 218.50 to Chevron Texaco's

108.77, or in Area B, where Sinopec got a score of 189.50 to Chevron Texaco's 93.77. The only area where it was roughly competitive was in Area C, where it had a bid score of 93.77 compared to 103.50 for Eni and Repsol.

Saudi officials claimed the reasons were economic and not political. There is certainly some truth to this. US and British firms like BP, British Gas, and Exxon Mobil did not find that the Kingdom provided the necessary disclosure of its data on reserves and costs, believed that it might be greatly exaggerating its estimates of probable non-associated gas reserves, and felt its cost-benefit calculations were not competitive. They also saw little incentive to "buy in" to contracts when they felt that Saudi Arabia's oil minister had little intention of offering truly attractive deals in the future. At the same time, it is clear that the Kingdom did have strong geopolitical reasons to turn away from its past dependence on US oil companies; to work out lasting energy relationships with Russia and China, and to send the Bush Administration at least an indirect message that the Kingdom resented the treatment it had been given since "9/11."[35]

Saudi Arabia and Energy Risk

Saudi Arabia is the most important single case in the world in terms of assessing energy "risk," This is partly because of regional military threats, and internal stresses. Saudi Arabia remains the most lucrative single target in the Gulf to any nation seeking to use its military or political leverage to influence the world economy. It faces major economic and demographic challenges for at least the next two decades, and it must its economy and ability to attract private and foreign investment to deal with these issues.[36]

In spite of its conservative religious character, Saudi Arabia also faces a serious terrorist challenge from religious extremists, most notably Al Qaida and affiliated neo-Salafi and neo-Wahhabi groups. It must deal with elements of extremism in its own religious and educational system, and it must reform its political and legal structure to provide a more pluralist and modern political system.

As is discussed in Chapter V, these strategic, political, and economic risks are compounded by financial risks. It simply is not clear that the Kingdom can – or should -- continue to finance upstream oil and gas production, and the growth and diversification of its downstream sector, with anything like the level of direct and indirect public funding it has relied

upon in the past. The Kingdom simply has too many other budgetary and investment priorities. It has long suffered from budget deficit problems, except in years of exceptionally high oil revenues. It has never had a public discussion or debate over the costs and financing involved, or the possible need for outside private or foreign investment in its upstream oil sector. There are many forces in the Kingdom pressing for a more open, consultative, and representative government, and sooner or later such a debate is inevitable.

These pressures on Saudi Arabia do not seem urgent today, although the threat posed by terrorist groups cannot be ignore. The need for political, economic, and social reform will grow steadily, however, as Saudi Arabia's "youth explosion" reaches maturity. This explains why Saudi Arabia has begun reforms to deal with its economic problems. For example, the Saudi government has declared its aim to accede to the World Trade Organization. The Kingdom has announced its intend to join the organization in early 2004. In addition, the Saudi government approved a new income bill in order to attract foreign investors to the Kingdom. The new bill cuts the tax rate on foreign investors from 45 to 20 percent. [37] However, Saudi ability to deal with these issues -- and to smoothly respond to market forces, in the manner the EIA, IEA, and OPEC currently project --remains uncertain.

There are many area where reform is still more surface reform than substantive change, and where Saudi Arabia has made a gesture or a beginning that it has yet to demonstrate that it will fully implement. In the past, Saudi Arabia has issued a whole series of five year plans that have called for reforms in critical areas like "Saudization," only to fail to implement them at anything like the rate required. Its measures to encourage both the repatriation of Saudi private capital and large scale foreign direct investment have not yet removed many practical barriers that slow the pace of economic liberalization far below the rate that its desirable.

More needs to be done to address problems in the education of young Saudis, both in terms of tolerance and in moving decisively away from the emphasis on rote learning that its one of the greatest single self-inflicted wounds of the Arab world, and one that now makes the idea of a knowledge-based economy little more than a hollow dream. The Kingdom has done nothing to address population growth and its demographic problems, and it is unclear that anything else it does can be adequate until it does. It also is just beginning to confront the fact that young Saudi

woman now are significantly better and more practically educated than young Saudi men, and represent a half of the labor force that must become at least as productive as men.

The very real progress that Saudi Arabia has made in improving the rule of law and expanding the size and powers of the Majlis is important in a nation with no political parties, but the Kingdom has not yet provided the degree of transparency in its budgets, and Majlis control over the budget process, that is critical to developing a truly effective popular consensus for reform and to laying the ground work for the creation of political parties and an elected Majlis. Human rights reforms are just beginning, and the press needs to have substantially more freedom.

At the same time, Saudi Arabia is a nation whose more progressive rulers, technocrats, educators, businessmen, and clergy must deal with an extremely conservative population and cannot move quickly, or on Western terms, without creating new problems for internal stability. King Fahd's six-point reform program already challenges Saudi conservatives, and Crown Prince Abdullah's continuing support for the actual implementation of reform has clearly moved more quickly than many conservatives desire. The Kingdom can and should move faster, but it must maintain a difficult balance between the demands of its reformers and its conservatives, the US and the West must recognize that it is the conservatives and not the reformers that almost certainly have the largest share of public opinion.

If Saudi Arabia does sustains the momentum behind reform that it has built up since 2000, it may well be able to achieve mid and long-term stability. There are, however, several "worst cases" and problems that must be considered in such a judgment as it applies to Saudi stability in the mid and long-term:

- The pace of reform must be sustained, and should be accelerated. Saudi Arabia has no slack for a ruler who neglects or slows reform, or a pause in political, social, and economic change – any more than it can afford to slow its improvements in counter terrorism.

- As Crown Prince Abdullah has publicly recognized, Saudi Arabia already has its own poor, slums, and underclass, and many of its schools and public facilities do not meet the needs of its growing poor. Oil wealth no longer provides the money for broad subsidies and the Kingdom's infrastructure and services need to be put on a basis which funds services for its growing poor while charging full market value for those Saudis that can afford it. The Kingdom must pay growing attention to income distribution and must convert its budget from a patriarchical approach to the entire population to providing welfare for those who are legitimately in need.

- At the same time, reform must phase out patriarchical subsidies, which are not only unaffordable, but discourage a work ethic and Saudi employment. Taxation, market value for utilities and services, and a concentration of entitlements for those in true need must replace the patriarchical system over time.

- Saudi Arabia must redefine the role of its royal family as elections and the expanded role of the Majlis change its political structure. In the process, it must find ways to limit grants and subsidies, ensure that corruption does not take place, and provide the kind of transparency on royal family expenditures that will build public confidence and trust.

- Saudi Arabia must develop ways of repatriating Saudi private capital and getting foreign direct investment that do in fact rapidly expand and diversify its private sector.

- It needs US and Western encouragement for its reforms that focus on practical schedules of action and which reinforce internal Saudi efforts; not efforts to dictate or impose Western approaches.

- Saudi Arabia must transfer part of the funds now used for the military to civil programs, and concentrate more on internal security than foreign threats.

- It is more important for Saudi Arabia to invest in economic diversification and the growth of the private sector than to insist on total state control of the upstream sector.

- Saudi Arabia must prepare for the return of unforeseen and uncontrollable cycles in oil revenues and "bad years." It cannot afford to plan for continued high oil revenues.

- Saudi Arabia must convincingly demonstrate that it is properly managing its oil fields and reservoirs and can, in fact, make and sustain major increases in its oil production capacity and oil exports. The charges now being made that Saudi fields would soon be in decline must be convincingly refuted, and enough technical detail and evidence must be provided regarding oil field development to reassure investors about the Kingdom's future.

- Saudi Arabia will face a major mid and long-term challenge if Iraq does rapidly come on line with production capacities of 6 to 9 to 12 MMBD at any point before 2020. This could be compounded by any broader production capacity race in OPEC, and by Iranian efforts to make major production increases. If rises in Gulf production combine with high levels of Russian production, rises in Caspian and other production outside the MENA area, Saudi Arabia cannot count on dominating the market share of oil export revenues to the extent it does today, and this could produce a crisis in financing the state and per capita income.

- Educational reform must do more than change the curriculum. No reform that does not eliminate dependence on rote learning can be effective.

- Saudi Arabia must find ways to give its Shi'ites full equality in de facto terms in regard to civil rights, opportunity, and legal procedures, and reduce social tensions between Shi'ite and Sunni.

- No amount of educational reform can substitute for job creation and job pull. One great danger in Arab thinking about economic reform is that better education creates jobs. It does not. It may raise the value of jobs, but only economic growth and particularly private sector growth outside the petroleum sector creates jobs.

- As King Fahd's six-point reform program recognizes, Saudi Arabia must find its own answer to using women as productively as it does men.

- Saudi Arabia must honestly examine its own demographic crisis and begin to deal with it.

- None of these potential "worst cases" and problems is a "show stopper" in political terms or a reason why the US private sector should not invest in Saudi Arabia. No nation has a secure future, and Saudi Arabia still has ample opportunity to deal with its problems. In fact, its challenges are significantly lower than those of most other oil exporting nations in terms of mid and long-term risk management.

No country can afford to prepare for every risk, anymore than it can eliminate risk. There is, however, one set of mid to long-term problems that Saudi Arabia must address – difficult as it is for Saudis to do so at the political and cultural level. The UN estimate of Saudi population growth projects massive increases that are still gathering momentum and which will continue to accelerate through at least 2010. The growth in the age group from 15 to 19 years of age during 1990 through 2030 should be a red flag to every Saudi that a massive social and economic crisis will occur unless reform is sustained, and serious efforts are made to reduce the rate of population growth. This age group grew by 35% during 1990-2000 (1.5 million to 2.1 million), and will grow by 84% during 2000-2030 (2.1 million to 3.8 million).

As both King Fahd and Crown Prince Abdullah seem to have recognized, the importance of integrating women into a fully productive role in the Saudi economy will ultimately be as important as finding employment for young men. Its importance is indicated both by a current fertility rate of 4.53% and the projected decline to 2.28% in 2020. If this decline does not take place because women have no other role, Saudi population problems will go from the extreme difficult to impossible problem level. Moreover, women in the working age population already total over 4.6 million. They will nearly double to 11.7 million by 2030. No Saudi economy can hope to be diversified and globally competitive that does not give Saudi women a role whose productivity is equivalent to that of men.

At the same time, these demographics reinforce the need to convert from a patriarchical nation budget that subsidizes everyone to a welfare budget that aids those truly in need. These same charts show there has already been a growth in the post-labor force population of is over 65 years of age from 374,000 in 1990 to in 561,000 in 2000. This population is projected to grow nearly five times to 2.6 million in 2030. This is an incredible increase in dependency on pensions and invested capital and social services.

As a result, Saudi Arabia represents a moderate short to mid-term energy risk.

Iraq

Iraq is another Gulf state projected to make major increases in production between 2001 and 2025 – in this case the EIA projects that Iraqi production capacity will increase from 2.6 MMBD in 2001 to 5.1 MMBD in 2025 – an increase of 2.5 MMBD. Since the fall of Saddam Hussein, various other sources have talked about a much more rapid expansion to levels of 6 MMBD, 9 MMBD, and even 12 MMBD.

If one accepts current methods of estimating proven and potential reserves, Iraq has the oil to reach such production levels – although it would be at least as subject to a reduction in its total reserves as Saudi Arabia if analysts like Simmons are correct. In practice, however, the Iraq War of 2003 has been followed by low intensity warfare and the sabotage of Iraq's oil facilities and pipelines. These kept Iraq's production levels at 2.4 to 2.6 MMBD through March 2004. It has also opened up internal political and economic issues that could disrupt Iraq's energy development and/or lead to internal violence long into the future.

Iraqi Energy Resources

The EIA summarizes Iraq's role in world energy supplies as follows:[38]

> Iraq contains 112 billion barrels of proven oil reserves, the third largest in the world (behind Saudi Arabia and Canada). Estimates of Iraq's oil reserves and resources vary widely, however, given that only 10% or so of the country has been explored. Some analysts (the Baker Institute, Center for Global Energy Studies, the Federation of American Scientists, etc.) believe, for instance, that deep oil-bearing formations located mainly in the vast Western Desert region, for instance, could yield large additional oil resources (possibly another 100 billion barrels or more), but have not been explored. Other analysts, such as the US Geological Survey, are not as optimistic, with median estimates for additional oil reserves closer to 45 billion barrels.
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> …Iraq's oil development and production costs are amongst the lowest in the world (perhaps $3-$5 billion for each million barrels per day), making it a highly attractive oil prospect. However, only 17 of 80 discovered fields have been developed, while few deep wells have been drilled compared to Iraq's neighbors. Overall, only about 2,300 wells reportedly have been drilled in Iraq (of which about 1,600 are actually producing oil), compared to around 1 million wells in Texas for instance. In addition, Iraq generally has not had access to the latest, state-of-the-art oil industry technology (i.e., 3D seismic, directional or deep drilling, gas injection), sufficient spare parts, and investment in general throughout most of the 1990s. Instead, Iraq reportedly utilized sub-standard engineering techniques (i.e., overpumping, water injection/"flooding"), obsolete technology, and systems in various states of decay (i.e., corroded well casings) in order to sustain production. In the long run, reversal of all these practices and utilization of the most modern techniques, combined with development of both discovered fields as well as new ones, could result in Iraq's oil output increasing by several million barrels per day.
>
> …In December 2002, the Council on Foreign Relations and the Baker Institute released a report on Iraq's oil sector. Among other things, the report concluded that: 1) Iraq's oil sector infrastructure is in bad shape at the moment, being held together by "band-aids," and with a production decline rate of 100,000 bbl/d per year; 2) increasing Iraqi oil production will require "massive repairs and reconstruction...costing several billions of dollars and taking months if not years;" 3) costs of repairing existing oil export installations

alone would be around $5 billion, while restoring Iraqi oil production to pre-1990 levels would cost an additional $5 billion, plus $3 billion per year in annual operating costs; 4) outside funds and large-scale investment by international oil companies will be needed; 5) existing oil contracts will need to be clarified and resolved in order to rebuild Iraq's oil industry, with any "prolonged legal conflicts over contracts" possibly "delay[ing] the development of important fields in Iraq;" and 6) any "sudden or prolonged shut-down" of Iraq's oil industry could result in long-term reservoir damage; 7) Iraq's oil facilities could easily be damaged during any domestic unrest or military operations (in early February 2003, the Patriotic Union of Kurdistan claimed that Iraqi soldiers were mining oil wells in the north of the country in anticipation of war); and 8) given all this, a "bonanza" of oil is not expected in the near future.

…According to the Middle East Economic Survey (MEES), problems at Iraqi oil fields include: years of poor oil reservoir management; corrosion problems at various oil facilities; deterioration of water injection facilities; lack of spare parts, materials, equipment, etc.; damage to oil storage and pumping facilities; and more. MEES estimates that Iraq could reach production capacity of 4.2 million bbl/d within three years at a cost of $3.5 billion, and 4.5-6.0 million bbl/d within seven years.

Iraqi Oil Production

As of November 2003, Iraq's oil ministry called for production levels to rise to 3 MMBD in 2004, but the oil minister also talked of costs of $50 billion to reach production levels of 5 MMBD and compensate for years of underinvestment and cannibalization. It would also require a peaceful environment, and several years of intensive work and investment.[39] Any such estimates, however, are purely speculative. For example, Edward C. Chow, a former Chevron executive and visiting scholar with the Carnegie Endowment for International Peace, estimated on November 2003 that it would cost $20 billion to restore Iraqi production to prewar levels.[40] The US and Interim Governing Council have since found that the cumulative impact of past mismanagement, the Iran-Iraq War, the Gulf War, sanctions, and fighting and looting in 2003 will require billions of dollars in immediate US aid, although no reliable estimates yet exist of the ultimate cost of fully modernizing Iraq's oil facilities, fixing past neglect, and dealing with reservoir problems.

A great deal has been said about rapid Iraqi energy development over the years without adequate surveys of the state of the industry and the cost of renovation and expansion, without regard to military and political risk, and on the basis of extremely uncertain estimates of reserves and incremental production costs. Yet, a number of outside assessments raise serious issues about the present state of Iraq's oil fields and production efforts.[41] They have criticized the Bush administration for spending hundreds of millions of dollars to repair the pipes and pumps that carry Iraq's oil, but for not addressing what they fell are serious problems with Iraq's underground oil reservoirs, which might severely limit the amount of oil these fields can produce.

According to such critics, Iraq's large northern Kirkuk field suffers from water seeping into its oil deposits, and similar problems are evident in the major oil fields like Rumaila in southern Iraq. This is not said to be a product of the Iraq War, but rather years of poor management. At the same time, such critics charged that US-led efforts to rapidly return the fields to prewar capacity could cut long-term productivity.

There is some evidence to support this criticism. The UN found before the war that Saddam Hussein demanded high production at a time that UN economic sanctions precluded Iraq from acquiring the sophisticated computer-modeling equipment and technology required to manage older reservoirs properly. Oil experts working for the UN estimated that some reservoirs in southern Iraq "may only have ultimate recoveries of between 15 percent and 25 percent of the total oil" in the field, as compared with an industry norm of 35 to 60 percent.

- Maury Vasilev, senior vice president of PetroAlliance Services, a Russian oil-field company that held discussions with Iraq's Oil Ministry in 2000, concluded that. "Kirkuk was of particular concern and particular urgency because of the water content in the wells…there was a question of how much oil they could recover."

- Fadhil Chalabi, a former top Iraqi oil claimed in the summer of 2003 that Kirkuk's expected recovery rate had dropped to 15 percent from 30 percent. The Times also quote an unnamed American oil executive as saying in November 2003 that Iraqi engineers r told him that they were now expecting recovery rates of 9 percent in Kirkuk and 12 percent in Rumaila without more advanced technology.

- Issam al-Chalabi, Iraq's former oil minister, stated in November 2003 that, "We are losing a lot of oil"..(It) "is the consensus of all the petroleum engineers involved in the Iraqi industry that maximizing oil production may be detrimental to the reservoirs." An earlier United Nations report on the Kirkuk field issued in 2000, warned of "the possibility of irreversible damage to the reservoir of this supergiant field is now imminent."

The US ignored these issues in its initial approach to nation building, and failed to come to grips with them in the period after the war ended in May 2003. *The New York Times* reported in November 2003 that the Energy Infrastructure Planning Group, that senior Bush administration officials established in September 2002 to plan for the oil industry in the event of war, learned that Iraq was still reinjecting crude oil to maintain pressure in the Kirkuk field. It did so even though "Iraqis acknowledged it was a poor practice," and "were unequivocal that that practice had to stop and right away." In October 2003, however, Iraq was still reinjecting 150,000 to 250,000 barrels a day, down from as much as 400,000 barrels a day, but still far higher than oil industry practice.

According to the *New York Times*, the energy planning task force avoided the issue of reservoir development for political reasons. These were partially to avoid charges the US planned to steal Iraq's oil, and also because the group had secretly decided that the contract for fixing Iraq's oil infrastructure would go to Kellogg, Brown & Root, a unit of Halliburton which had an existing Pentagon contract related to war planning and was previously run by Vice President Dick Cheney. It did so , without soliciting bids, making any reserve or reservoir development more controversial.

The *Times* also reported that Wayne Kelley, a Texas oil engineer, and other experts had asked Iraq's oil reservoirs during a conference for contractors in July 2003, Army Corps of Engineers officials stated that their mission was to restoring war-damaged facilities, not "redeveloping the oil fields," according to a transcript of the meeting. However, Rob McKee, who became senior oil adviser for the Coalition Provisional Authority in Baghdad in September 2003, said that the reservoirs would receive attention. "It's bad, but it will not be catastrophic and especially overnight." [42]

The *Times* quoted Wendy Hall, a spokeswoman for Halliburton, the Houston oil services and engineering company managing the Iraqi oil-repair job, as stating Iraq's present production levels and the administration's future oil goals "cannot be sustained without reservoir maintenance." Thamir Ghadhban, a senior adviser to the current Iraqi oil minister, Ibrahim Bahr al-Uloum, was quoted as predicting that production would return to prewar capacity of 3.0 MMBD by the end of 2004; although he also said, "we should do much more than we have in the past" to maintain the reservoirs…We definitely have to put more money into it and bring in consultants." [43]

As of December 2003, the US Army Corps of Engineers had allocated $1.7 billion for maintaining Iraq's oil supply, with funds going to payments for imported fuel and repair of pipes, pumps and transfer stations, About $2 billion had been approved for oil infrastructure repairs in 2003, including about $40 million to begin the study of the reservoirs. Any actual improvement in managing the reservoirs could, however, take years and be a highly expensive process involving complicated computer simulation and changes in extraction techniques. K.B.R., as well as others, had made the case that reservoir management was necessary..

According to some KBR sources however, these efforts were "pulled and are not being funded." The CPA stated that the financing was not canceled, but "pushed back for a short while."

A rough estimate of Iraqi energy investment costs is provided by the International Energy Agency in a study called "Restoration of Iraqi Oil Infrastructure, Final Work Plan, (July 2003).[44] This study estimates that raising Iraqi production cost to around 3.7 MMB by 2010 would require a cumulative investment of close to $5 billion, but that government production revenues in a peaceful and stable environment would then be much higher over the 2003-2010 period – at over $20 billion. In contrast, extending production to levels over 4 MMBD would call for major investments in exploration, new production capacity, and new export facilities.

The IEA examined a number of other production scenarios – all assuming peace and stability. A rapid growth case, calling for levels of 9 MMBD in 2030, required investment levels of $54 billion. This was about $12 billion higher that the slower growth rate to 8 MMBD called for in the IEA's reference case projections. Both growth rates are far higher, more rapid, and more expensive that the growth to 5.1 MMBD in 2025 called for in EIA estimates.

Iraqi Energy Export Capabilities

These risks affect Iraq's export capabilities as well as its production capabilities. The EIA reports that many of these capabilities suffered severely during the war. While the CPA is attempting to rapidly repair these facilities, they have been subject constant attack and sabotage from former regime loyalists and other hostiles since the fall of Saddam Hussein. The EIA summarized the situation in late 2003 as follows:[45]

> Under optimal conditions, and including routes through both Syria and Saudi Arabia that are now closed, Iraq's oil export infrastructure could handle throughput of more than 6 million bbl/d (2.8 via the Gulf, 1.65 via Saudi Arabia, 1.6 via Turkey, and perhaps 300,000 bbl/d or so via Jordan and Syria). However, Iraq's export facilities (pipelines, ports, pumping stations, etc.) were seriously disrupted by the Iran-Iraq War (1980-1988), the 1990/1991 Gulf War, the most recent war in March/April 2003, and periodic looting and sabotage since then.
>
> The 600-mile, Kirkuk-Ceyhan (Turkey) dual pipeline is Iraq's largest crude oil export line. One, 40-inch line has a fully-operational capacity of 1.1 million bbl/d, but reportedly could handle only around 900,000 bbl/d pre-war. The second, parallel, 46-inch line has an optimal capacity of 500,000 bbl/d and was designed to carry Basra Regular exports, but at last report was inoperable. Combined, the two parallel lines have an optimal capacity of 1.5-1.6 million bbl/d. On August 13, 2003, officials at the Turkish port of Ceyhan said today that Iraq had begun pumping fresh crude oil through the Kirkuk-Ceyhan pipeline for the first time since war broke out in late March 2003. However, the pipeline was operating far below capacity, at perhaps 300,000-400,000 bbl/d, with significant repairs still required. Also, the line was damaged by a bridge ("Al Fatah") that collapsed on it after being bombed by U.S. planes during the war. This will require major

repairs, including the drilling of a new tunnel under the Tigris River and the laying of a new pipeline. In addition, the IT-1 pumping station on the Kirkuk-Ceyhan line was damaged by looters, but reportedly is operable manually. The IT-2 pumping station on the same line reportedly was looted and destroyed.

On August 16, 2003, two blasts on the Kirkuk-Ceyhan line once again shut down Iraqi oil flows to Turkey. Officials estimated that it would take 10 days to two weeks in order to repair the line, and also that the shutdown was costing Iraq $7 million per day in lost oil export revenues.

At least since 2001 until March 2003, Iraq and Syria were utilizing the 50-year-old Banias oil pipeline in violation of U.N. sanctions. The pipeline, from Iraq's northern Kirkuk oil fields to Syria's Mediterranean port of Banias (and Tripoli, Lebanon), reportedly was being used to transport as much as 200,000 bbl/d of Iraqi oil, mainly from southern Iraq, to Syrian refineries at Homs and Banias. The oil was sold at a significant price discount and freed up additional Syrian oil for export. Iraq and Syria also had talked of building a new, parallel pipeline as a replacement for the Banias line. In March 2003, flows on the pipeline were halted, although the US Defense Department denied that its forces had targeted the line.

During the Iran-Iraq War, Iraq also built a pipeline through Saudi Arabia (called IPSA) to the Red Sea port of Mu'ajiz, just north of Yanbu. IPSA has a design capacity of 1.65 million bbl/d, but was closed after Iraq invaded Kuwait in August 1990. In June 2001, Saudi Arabia expropriated the IPSA line, despite Iraqi protests. In June 2003, Thamir Ghadban said that he hoped Iraq would be able to use the IPSA line again.

Iraqi Gas Development

Iraq's status as a gas producer is equally uncertain. The EIA estimates that Iraq contains 110 trillion cubic feet (Tcf) of proven natural gas reserves, along with roughly 150 Tcf in probable reserves. About 70% of Iraq's natural gas reserves are associated (i.e., natural gas produced in conjunction with oil), with the rest made up of non-associated gas (20%) and dome gas (10%). In 2001, Iraq produced 97 billion cubic feet (Bcf) of natural gas, down drastically from peak output levels of 700 Bcf in 1979.[46]

Before the Iraq War, Iraq announced plans to increase its natural gas output in order to reduce dependence on oil consumption and possibly for export. Iraq was also developing plans to build a liquefied natural gas terminal. These plans called for Iraq to produce 550 Bcf within two years after the lifting of UN sanctions, and about 4.2 Tcf of natural gas annually within a decade.

Iraq's Future Energy Development Plans

All such plans must wait on the restoration of internal stability in Iraq, and the development of gas is closely linked to oil because most of Iraq's natural gas is associated with oil. The main sources of associated natural gas are the Kirkuk, Ain Zalah, Butma, and Bai Hassan oil fields in northern Iraq, as well as the North and South Rumaila and Zubair fields in the south. The Southern Area Gas Project was completed in 1985, and brought online in February 1990, with a processing capacity of 1.5 billion cubic feet per day. Natural gas gathered from the North and South Rumaila and Zubair fields is carried via pipeline to a 575-Mmcf/d

natural gas liquids (NGL) fractionation plant in Zubair and a 100-Mmcf/d processing plant in Basra. Natural gas also used to be pumped from Rumaila into northern Kuwait via a 40-inch, 105-mile pipeline. The gas was used to supply Kuwaiti power stations and LPG plants, but was halted following Iraq's invasion of Kuwait in August 1990.

Iraq's only non-associated natural gas production is from the al-Anfal field (200 Mmcf/d of output) in northern Iraq. Al-Anfal production, which began in May 1990, is piped to the Jambur gas processing station near the Kirkuk field, located 20 miles away. Al-Anfal's gas resources are estimated at 4.5 Tcf, of which 1.8 Tcf is proven. In November 2001, a large non-associated natural gas field reportedly was discovered in the Akas region of western Iraq, near the border with Syria, and containing an estimated 2.1 Tcf of natural gas reserves. It is not clear whether the field is associated or non-associated. Iraq has four other large non-associated natural gas fields (Chemchamal, Jaria Pika, Khashm al Ahmar, Mansuriya) located in Kirkuk and Diyala provinces, with total recoverable reserves that may exceed 10 Tcf.

The EIA reports that Iraq has a major natural gas pipeline with the capacity to supply around 240 MMcf/d to Baghdad from the West Qurna field. The 48-inch line was commissioned in November 1988, with phases II and III of the project never completed due to war and sanctions. The last two phases of the pipeline project were meant to supply Turkey. Iraq's Northern Gas System, which came online in 1983, was damaged during the Gulf War as well as by the Kurdish rebellion of March 1991. The system supplied LPG to Baghdad and other Iraqi cities, as well as dry gas and sulphur to power stations and industrial plants. Iraq also has a Southern Gas System, which came online in 1985.

Iraqi Energy Risks

The previous analysis of energy risks in Saudi Arabia has shown that even a country that has vast oil resources can present a significant degree of risk. These risks are far higher in Iraq, a nation that is still at war and which faces years of difficult political compromises if it is to avoid civil conflict or a return to some form of authoritarian rule. Iraq may well succeed in evolving a more stable mix of politics, economics, and energy production over the next five to ten years, but it faces daunting challenges:

- **Iraq faces a long-term population explosion.** In spite of sanctions, war, and mass graves, the US Census Bureau estimates that Iraq's population has leaped from 5.1 million people in 1950, and 13.2 million in

1980 – at the beginning of the Iran-Iraq War – to some 25 million in 2004. The fertility rate is 4.9 and the birth rate is 2.9%. Conservative Census Bureau estimates indicate the population will rise to 30 million in 2010, 37 million in 2020, and 44 million in 2030.

- **Jobs are a critical problem, and the problem will grow with time.** Some 530,000 young men and women now enter the work force each year at a time when unemployment is 50-60%. The figure will rise to over 800,000 per year by 2025. Approximately 40% of the population has been affected by the educational problems that began during the Iran-Iraq War, and which became steadily graver after 1990 as a result of the Gulf War and sanctions.

- **The current Iraqi leadership has been denied the experience it needs during Saddam's tyranny**. Iraq's political problems have been made worse by nearly three decades of dictatorship, nearly continuous war and sanctions, failed command economy, and ruthless political purges. Roughly 70% of the population has never known any political leader other than Saddam and the Ba'ath Party. No rival political leaders or parties could develop in Iraq, and its leaders that have returned from exile have not been able to win the trust of the people.

- **The Iraqi people have a national consciousness, but are deeply divided**. The Iraqi people have no real political experience and there are deep ethnic divisions. While there has never been an accurate recent census, Iraqis seem to be divided into 60% Shiite, 20% Sunni, 15% Kurd, and 5% Turcoman and other. Further divisions exist between Sunni and Shi'ite, by tribe, and between the rural and urbanized populations, and in terms of how religious or secular particular Iraqis are.

- **Guilt by association is a major problem affecting the ability to draw on Iraqi talents and skills**. The most experienced technocrats, managers, police, and military are all tarred by their association with the former regime.

- **There is no history of an adequate structure of law for dealing with security, civil law, crimes or human rights.**

- **The economy has long been a state controlled kleptocracy** favoring the minority in power and giving guns priority over butter. Few economies in the region have less real world experience with global competition and the free market.

- **The oil sector has been crippled** by years of underfunding, lack of technology, state mismanagement, and overproduction of key reservoirs. Many pipelines and large centralized facilities are highly vulnerable to sabotage or terrorism.

- **Oil income is Iraq's only significant export income, and funds virtually all of the state budget, but is grossly inadequate to meet current and future needs.** The US Department of Energy estimates that oil sector earnings in real dollars have gone from real earnings ($US2000) of $58 billion in 1980 to a maximum of $12.3 billion in 2002. They will probably be around $9-$12 billion in 2003, and a little over $15 billion in 2004 and $19 billion in 2005. Even with an expansion to 6 MBD, it is unlikely that real per capita oil income can be more than half what it was in 1980.

- **The agricultural sector has been driven by inefficient state planning and subsidies** which never resulted in more than half the productivity Iraq should have had and which produced crops with large portions of inedible output. Some 60% of food has been imported, and farmers have no experience with financing their crops or marketing them on a competitive basis.

- **Foreign investment has been illegal and there has been no real banking system in the Western sense**. Industrial employment has been dominated by some 200-250 state industries, of which roughly 48 have been critical employers. None are remotely competitive in global terms, and most cannot survive competition from imports. Massive military industries effectively no longer exist.

- **Utilities and infrastructure have been crippled** by underfunding that began in 1982-1984, cannibalization, and fragmented organization. Most systems favor urban and Sunni areas and services like water and sewers are grossly inadequate in slums and in many Shi'ite areas.

- **Information has been government dominated at every level.** There is no past basis of trust in the media or authority, and Iraqis have had to turn to sources outside their country for anything approaching the truth.

It is hardly surprising under these circumstances that postwar nation building in Iraq has proved to pose major challenges at the political, economic, demographic, social, ethnic, and religious levels. This challenge has been compounded by the fact that virtually every aspect of nation building had to be improvised after the fall of Saddam Hussein's regime in an environment of increasing low intensity combat, and by US officials and contractors with virtually no experience working in Iraq or in transforming a command economy.

If anything, the CBO report of January 2004 on Paying for Iraq's Reconstruction estimates some $50-$100 billion will be needed for nation building during 2004-2007. This total does not begin to cover the full cost of creating a new economy and meeting a backlog of human needs. It may still sharply underestimate the scale of the funding required, even if war and sabotage do not add further major burdens. Total reconstruction expenses and government budgets could range from $94 to $160 billion during this period, and oil revenues are estimated to range from $44 to $89 billion, and seem likely to total well under $70 billion.

Iraq's economic and social problems will continue well beyond 2010, even under the best of circumstances. Iraq can also only approach the progress it needs to make if it is not crippled by loan repayments well in excess of $100 billion, and reparations claims that are even larger. One key future issue will be whether a new Iraqi government can find ways to develop Iraq's petroleum production and export facilities in ways that meet both the expectations of its Shi'ite majority (60%-plus), and of key minorities like its Sunnis (less than 20%), and Kurds (Around 15%.) Petroleum exports provided something like 80% of all government revenues for Iraq's command economy in the past, and were its only meaningful export.

The way in which revenues are divided in the future will be critical to power sharing and internal political stability. This could affect the priority given to the development of largely unexploited reserves in the West (largely in Sunni areas,) the major reserves north of Basra (Shi'ite areas), and pipelines (the Kurds want major amounts of exports to go North and have

claimed the right to oilfields around Kirkuk. The Kurdish Regional government of Northern Iraq is preparing to offer a proposal to reorganize the Iraqi economy on a federal basis. In this proposal the key is the city of Kirkuk, which holds 40% of Iraq's oil reserves. The Iraqi Kurds believe that Kirkuk is an indisputable part of Iraqi Kurdistan." Yet the Arab settlers and indigenous Turkmen of Northern Iraq make it clear that they will never give up their rights on Kirkuk. The confessional and ethnic politics are likely to play a major role in shaping the real-world nature of Iraq's petroleum development indefinitely into the future, and will inevitably increase the risk in such development.

As a result, Iraq will be a moderate to high-risk producer for at least the coming decade, and any accurate assessment of its future role in the world energy market must await a period of far greater political, economic, and military stability.

Iran

Iran is a major energy exporter whose production and export capabilities have been sharply affected by the Iranian revolution, the hostage crisis with the US that followed, the Iran-Iraq War of 1980-1988, and US sanctions which seek to block US and foreign investment in Iran's energy sector. Iran also remains deeply divided politically between "moderate" and "hardliner" and over how to restructure and finance its economy and energy sector. There is a significant risk its internal power struggles could turn violent and its inability to agree on realistic incentives to attract foreign energy investment, combined with US sanctions have limited the modernization and growth of its petroleum sector. Like Iraq, it will be a moderate to high-risk producer for at least the coming decade.[47]

Iranian Energy Resources

The EIA summarizes the current state of Iran's petroleum industry as follows:[48]

> Iran's domestic oil consumption, 1.3 million bbl/d in 2003, is increasing rapidly (about 7% per year) as the economy and population grow. Iran subsidizes the price of oil products heavily, to the tune of $3 billion or so per year, resulting in a large amount of waste and inefficiency in oil consumption. Iran also is forced to spend around $1 billion per year to import oil products (mainly gasoline) that it cannot produce locally. In early April 2003, as part of an effort to curtail the rise in gasoline subsidy expenditures, gasoline consumption and imports (both of which are growing rapidly), Iran raised gasoline prices by 30%-35%, to around 31-44 cents per gallon. In November 2003, Iran announced that it might even be forced to start rationing gasoline.
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> It is possible that, with sufficient investment, Iran could increase its oil production capacity significantly. Iran produced 6 million bbl/d in 1974, but has not surpassed 3.8 million bbl/d on an annual basis since the

1978/79 Iranian revolution. During the 1980s, it is believed that Iran may have maintained production levels at some older fields only by using methods that have permanently damaged the fields. Also, Iran's oilfields are -- according to Oil Minister Zanganeh -- experiencing a depletion rate of 200,000-300,000 bbl/d per year, and are in need of upgrading and modernization. Despite these problems, Iran has ambitious plans to double national oil production -- to more than 7 million bbl/d by 2015 or so. The country is counting on foreign investment to accomplish this, possibly as high as $5 billion per year.

NIOC's onshore field development work is concentrated mainly on sustaining output levels from large, aging fields. Consequently, enhanced oil recovery (EOR) programs, including natural gas injection, are underway at a number of fields, including Marun, Karanj, and the presently inactive Parsi fields. EOR programs will require sizeable amounts of natural gas, infrastructure development, and financing. Overall, Iran's oil sector is considered old and inefficient, needing thorough revamping, advanced technology, and foreign investment.

Iranian Efforts to Expand Oil Production and Exports

Iran has made progress in dealing with its own internal debates over how to modernize its energy sector, but US sanctions and internal political problems remain. The EIA summarize the current situation as follows: [49]

Iran is attempting to diversify by investing some of its oil revenues in other areas, including petrochemicals. Iran also is hoping to attract billions of dollars worth of foreign investment to the country by creating a more favorable investment climate (i.e., reduced restrictions and duties on imports, creation of free-trade zones). In May 2002, the country's Expediency Council approved the "Law on the Attraction and Protection of Foreign Investment," which aims at encouraging foreign investment by streamlining procedures, guaranteeing profit repatriation, and more.

This Law, which was sent to the government for implementation in January 2003, represents the first foreign investment act passed by Iran's legislature since the 1978/79 revolution. The legislation was delayed for several years due to disagreements between reformers and conservatives. In June 2001, the Council of Guardians had rejected the bill as passed by the Majlis the previous month. In November 2001, the Majlis had passed a second, heavily amended, version of the bill. Although this version was far weaker than the first bill, the Council of Guardians again rejected it (in December 2001).

…President Bush extended the sanctions originally imposed in 1995 by President Clinton for another year in March 2003, citing Iran's "support for international terrorism, efforts to undermine the Middle East peace process, and acquisition of weapons of mass destruction." The 1995 executive orders prohibit U.S. companies and their foreign subsidiaries from conducting business with Iran, while banning any "contract for the financing of the development of petroleum resources located in Iran." In addition, the U.S. Iran-Libya Sanctions Act (ILSA) of 1996 (renewed for 5 more years in July 2001) imposes mandatory and discretionary sanctions on non-U.S. companies investing more than $20 million annually in the Iranian oil and natural gas sectors. In May 2002, the United States announced that it would review an $80 million contract by Canada's Sheer Energy (see below) to develop an Iranian oilfield to determine whether or not it violates ILSA.

Although Iran is the second largest oil producer after Saudi Arabia, and holds the world's fourth-largest pool of proven oil reserves, its production has dropped by more than a third from a peak of over 6 million barrels per day in 1974 to about 3.4 barrels per day in 2002. Years of political isolation, recurring war and US sanctions have deprived the oil sector of needed investment. Iran's share of total world oil trade peaked at 17.2% in 1972, then declined

to 2.6% in 1980, but has since recouped to roughly 5%. In 2002, earnings from oil and gas made up more than 70% of total government revenues, while taxes made up about 20%.

After the 1980-1988 Iran-Iraq War, NIOC launched a reconstruction program to restore damaged fields. Since 1994, production has averaged 3.6 million barrels per day, although this is still roughly half of Iran's 1974 levels. The government hopes that foreign finance and technology will help raise Iran's output to 5.6 million barrels per day by 2010 and 7.3 million barrels per day by 2020.

Iranian Oil Production Goals and Investment Requirements

Iranian officials estimate that the country will need to invest as much as $90 billion in its oil industry over the next decade if it is to avert a dramatic drop in oil production, though many estimates go as low as $40 billion. It is estimated that development of new offshore Persian Gulf and Caspian Sea oil fields will require investment of $8-$10 billion. In December 1997, Oil Minister Zanganeh stated that the country aimed to boost oil production capacity 200,000-250,000 barrels per day each year. He set a goal of reach 5 MMBD in the next five years, possibly surpassing 6 MMBD by 2010, and reaching 7 MMBD at some point between 2010 and 2020. These goals would more than restore the country's production capacity to the level of over 6 MMBD it achieved in the mid-1970s.[50]

Iran estimated that meeting these goals would require anywhere from $8 billion to $30 billion worth of investment. [51] U.S. government experts, however, are less optimistic. Some experts question whether even six million barrels per day is possible, and the majority of industry opinion seems to be that four to five million barrels a day may represent the limit of sustained conventional oil production.

Iran has sought to finance these expenditures with "buy back deals" to get around the fact that the Iranian constitution prohibits granting petroleum rights to any private company on a concessionary basis or direct equity stake. The 1987 Petroleum Law does, however, permits the establishment of contracts between the Ministry of Petroleum, state companies and "local and foreign national persons and legal entities."

As a result, Iran has offered foreign companies "buyback" contracts, where the contractor funds all investments, receives remuneration from NIOC in the form of an allocated production

share, and then transfers operation of the field to NIOC after the contract is completed. This system presents problems for both Iran and any private investor. It offers a fixed rate of return (usually around 15%-17%), but this means the NIOC bears all the risk when oil prices are low, and the NIOC has to sell more oil or natural gas to meet the compensation figure. Private investors and companies have no guarantee that they will be permitted to develop their discoveries, or operate them, and Iran has generally offered contracts with too short a period.

The EIA reported in 2003 that Iranian officials had increasing reservations about the problems in these buyback deals (including charges of corruption, insufficient benefits to Iran, and concerns that the Iranian proposals defining the conditions for buyback deals attract too little investment). Iranian leaders were reported to be considering substantial modifications to its "buy-back" model, possibly extending the length of such contracts from the current 5-7 years.

Iranian production has also been affected by regional politics and its role in OPEC. Since President Khatami's election, Iran has attempted to coordinate oil policy with Saudi Arabia. Even so, there have been a number of disputes between the two nations. Regarding OPEC production quotas. An agreement was finally reached, delimiting the baseline for Iran's share of OPEC cutbacks at 3.9 million barrels per day, rather than 3.6 million barrels per day as argued by other OPEC member states. Although Iran faced the same 7.3% reduction as other member states, in actuality Iran's cuts were smaller due to the amended baseline.[52] As of November 1, 2003, Iran's OPEC production quota was 3.597 MMBD.[53]

Recent Iranian Oil Development Deals

Iran has been able to get some such contracts in spite of these problems and US sanctions. The EIA reported the following developments as of March 2004:[54]

- In October 1998, the first major projects under the buyback scheme became operational. The offshore Sirri A oil field (operated by Total and Malaysia's Petronas) began production at 7,000 bbl/d (Sirri A currently is producing around 20,000 bbl/d). The neighboring Sirri E field began production in February 1999, with production at the two fields expected to reach 120,000 bbl/d.

- In March 1999, France's Elf Aquitaine and Italy's Eni/Agip were awarded a $1 billion contract for a secondary recovery program at the offshore, 1.5-billion-barrel Doroud oil and natural gas field located near Kharg Island. The program is intended to boost production from around 136,000 bbl/d to as high as 205,000 bbl/d by 2004. In April 1999, Iran awarded TotalFinaElf (46.75% share), along with Canada's Bow Valley Energy (15% share), a buyback contract to develop the offshore Balal field. The field, which contains some 80 million barrels of reserves, started producing at a 20,000-bbl/d rate in early 2003, reportedly reached 40,000 bbl/d in October 2003. In February 2001, ENI-Agip acquired a 38.25% share in Balal.

- In October 1999, Iran announced that it made the biggest oil discovery in 30 years, a giant onshore field called Azadegan, a few miles east of the border with Iraq. Reportedly, the Azedegan field contains in place-oil reserves of 26-70 billion barrels, with potential production of 300,000-400,000 bbl/d (and possibly higher) over a 20 year period. In February 2004, Japanese oil officials signed a preliminary commercial agreement for the development of Azadegan field. First production of the oil field is expected in 2006, with an estimated output of 300,000 bbl/d.

- In November 2000, Norway's Statoil signed a series of agreements with NIOC to explore for oil in the Strait of Hormuz area, to cooperate on developing a natural gas-to-liquids processing plant for four southern onshore fields, and possibly develop the Salman offshore field at a cost of $850 million, with eventual production of 130,000 bbl/d. Iran appears to be accelerating its plans to boost production of natural gas liquids (NGL), as well as liquefied petroleum gas (LPG). NGL expansion plans, including a $500 million plan to build two NGL plans on the south coast of Iran, are aimed mainly at making ethane feedstock available for Iran's growing petrochemical industry.

- In May 2002, Iran's Oil Ministry signed a $585 million buyback contract with PetroIran to develop the Foroozan and Esfandiar offshore oilfields, and. increase production at the fields from around 40,000 bbl/d at present to 109,000 bbl/d within 3 years. The two oilfields straddle the border with Saudi Arabia's Lulu and Marjan fields.

- In May 2002, Canada's Sheer Energy reached agreement ($80 million to develop the Masjed-I-Suleyman, or MIS, field), with the goal of raising production from 4,500 bbl/d to 20,000 bbl/d.

- In April 2003, Shell reported that it was frustrated with the slow pace of negotiations on Bangestan, including numerous changes to terms of the project The development of the giant Bangestan field had already been delayed several times after an expected award in 2001. Bangestan includes three oilfields (Anwaz, Mansuri, Ab-Teymour) that currently produce about 250,000 bbl/d of oil.

- In September 2003, Russia's Lukoil was granted approval by NIOC to explore for oil in the Anaran block along the border with Iraq. Norsk Hydro is currently in charge of the project.

- In November 2003, NIOC announced the launch of a new tender for 16 oil blocks. Based on the buyback model, but covering exploration, appraisal, and development for the first time.

- The Cheshmeh-Khosh field, which had been awarded to Spain's Cepsa for $300 million, is likely to be re-awarded to a consortium of Cepsa and OMV. The two companies are to raise crude production at the field from 30,000 bbl/d to 80,000 bbl/d within four years.

- In early 2004, the Japanese firm Inpex, a government-affiliated oil exploration company, concluded a contract with the Iranian government to develop the Azadegan oil field in two stages, with crude oil production estimated to peak at 150,000 and then at 260,000 barrels per day. Inpex announced on March 5, 2004, that the French oil company Total SA, and four other foreign companies, offered to participate in the project, but Inpex did not announce the names of the four other companies, which included a Malaysian state-run company. The Royal Dutch/Shell Group of Companies announced that it would not to participate, despite earlier expectations it would do so, and Inpex had sought partnerships with foreign companies with suitable technology and financing capability. The project had an estimated cost of $2 billion, and the deal required the Inpex-led consortium to invest 75% of the amount. Inpex sought financing for 40% of its 75% portion. The investment is expected to be recovered when production in the first stage reaches six and a half years, enabling project participants to decide whether they should proceed to the second stage.[55]

While many deals have been affected by US sanctions to some extent, Iran has probably created more barriers to its success than the US. Project plans have often been too large, reserve estimates too uncertain and risk-benefit calculations too unrealistic.

There have been arcane internal political debates over foreign ownership and the best way to attract foreign investment, as well as serious internal political instability.

Caspian Energy Issues

Iran is only one element in the complex mix of issues affecting the Caspian Sea and Central Asia, but its role is significant. The Department of Energy indicates that the Caspian Sea's proven and possible oil reserves could reach 191 billion barrels, along with huge natural gas reserves. Since the break-up of the former Soviet Union, territorial issues have arisen regarding rights to the Caspian's resources.

The main dispute among the five littoral countries has been heavily influenced by the uneven distribution of potential oil and gas reserves in the Caspian Sea. This issue was brought to the international arena when the Iranian military units confronted an Azerbaijani research ship in the Caspian Sea in July 2001.[56] Iran's position is that treaties signed in 1921 and 1940 are still valid, implying that all countries bordering the Caspian must approve any offshore oil developments. In late February 1998, Iran's Foreign Minister Kamal Kharrazi reiterated Iran's position that any unilateral exploitation of Caspian Sea resources would be illegal. Oil Minister Zanganeh stated that Iran backs national zones extending several miles from the coast and a "condominium" in the middle of the Sea. Iran also has stated (along with Russia) that it opposes laying an oil pipeline across the Caspian Sea floor.

Iranian Energy Export Capabilities

As is the case with its oil production capabilities, Iran has not been able to modernize its export facilities because of the Iran-Iraq War and cash flow problems growing out of its confrontations with the US, US sanctions, and internal political debates over how to structure and finance its energy sector. All Iranian onshore crude oil production and output from the Forozan field (which is blended with crude streams from the Abuzar and Dorood fields) is exported from the Kharg Island terminal located in the northern Gulf. The terminal's original capacity of 7 MMBD was nearly eliminated by more than 9,000 bombing raids during the Iran-Iraq War. Kharg Island's current export capacity is 5 MMBD, or double Iran's 1996 total crude oil exports of 2.5 MMBD.

Iran installed four single buoy moorings at Ganeveh during the Iran-Iraq War. These provide an additional combined capacity of 1 MMBD. Furthermore, smaller amounts of offshore crude oil production from the southern Persian Gulf are exported from terminals on Lavan Island and Sirri Island. Iran also has unused terminals at Cyrus and Ras Bahregan in the southern Gulf. Iran's role in regional pipelines is a major source of controversy between the U.S. and Iran. Iran feels it is the natural transit route for oil and gas exports from the Central Asian countries to world markets. U.S. policy opposes pipelines through Iran, the shortest (and most likely the least expensive) path to the open sea. The United States has instead favored multiple routes for Caspian oil and gas through the Caucasus region to the Black Sea or to the Turkish port of Ceyhan, as part of its attempt to isolate Iran and to contain its influence in the region.

The NIOC is currently exploring Iran's territorial waters in the Caspian Sea and has sought stakes in several of the various oil field development projects offshore Azerbaijan. Since 1995, Iran has been conducting a five-year exploration program of its sector of the Caspian Sea. However, exploration largely has been limited to shallow waters and primarily has resulted in marginal natural gas finds. In February 1996, Turkmenistan invited Russia and Iran to conduct exploratory drilling in that country's Caspian Sea sector, where oil reserves are estimated at around 100 million barrels. The Azerbaijan International Operating Company (AIOC) is working on another project that will send Caspian oil through Russia for years to come.[57]

Although the five Caspian littoral states could not reach an agreement on division of Caspian Sea's resources; Russia, Azerbaijan, and Kazakhstan have come to a trilateral agreement on sub-surface boundaries and collective administration of the Caspian Sea. This agreement, which was signed in May 2003, divided the 64 % of the northern Caspian into three unequal zones along a median line principle. The agreement gives Kazakhstan 27 %, Russia 19%, and Azerbaijan 18 %. Turkmenistan and Iran were present during the negotiations but refused to sign the agreement.[58] Thus, the future of Caspian oil remains unclear.

Iran hopes to solve some of its problems in increasing its oil exports by swapping crude oil with its neighbors in the Caspian and Central Asia. Swap arrangements make sense for Iranian domestic purposes, as well as creating the equivalent of Caspian oil exports through Iran. Most of Iran's oil is located in the south, far from major population centers and refineries in the

north, meaning that large volumes of oil have to be pumped long distances across Iran. "Swaps" can alleviate this problem, and the U.S. Department of Energy reports that Iran and Kazakhstan agreed to such a swap arrangement for Kazakh crude exports in May 1996. The swap deal was for 10 years and set a goal of about 70,000 barrels per day. Much larger swap arrangements could occur in the future. Iran claims that it could handle 750,000 barrels per day in Caspian crude swaps in a short period of time, and up to 1.5 MMBD over time. According to Iran, this would involve "not much investment" – mainly in modifying existing pipelines linking the Tabriz and Tehran refineries with Caspian coastal cities.

Iranian Gas Development

Iran's natural gas development will be a key factor shaping its future energy policy and exports, and possibly its nuclear policy as well. The EIA estimates that Iran contains 812 trillion cubic feet (Tcf) of natural gas reserves – the world's second largest reserves, surpassed only by those found in Russia. The bulk of Iranian gas reserves are located in non-associated fields. However, Iran's large onshore oil fields contain approximately 120 Tcf of associated gas, which is either dissolved in crude or is in gas caps.

In 1990, Iran undertook an ongoing gas utilization program that is designed to boost production to 10 Tcf per year by 2010, reduce flaring, provide gas for EOR re-injection programs, and allow for increased gas exports abroad. Presently, the majority of Iranian gas is consumed domestically.

Iran's largest non-associated gas is the South Pars field, which is an extension of Qatar's 241-Tcf North Field. South Pars was first identified in 1988 and was originally appraised at 128 Tcf in the early 1990s. NIOC-sponsored studies indicate that South Pars contains an estimated 240 Tcf, of which a large fraction will be recoverable, and at least 3 billion barrels of condensate. Iran's other sizable non-associated gas reserves include the offshore 47-Tcf North Pars gas field (a separate structure from South Pars), the onshore Nar-Kangan fields, the 13-Tcf Aghar and Dalan fields in Fars province, and the Sarkhoun and Mand fields.

South Pars is Iran's largest energy project, and development of "Phase 1," which involves production of 900 million cubic feet per day, is scheduled for completion in mid-2004. Understandably, it has attracted considerable interest from foreign companies. In 1997 a

consortium led by Total won a $2 billion contract to carry out the now ongoing second and third phases of South Pars development. According to *MEED,* a consortium comprising Shell, BG (Amoco), Gaz de France, and Petronas (Malaysia) and Russia's state-owned Gazprom were the main competitors for phases 4 and 5 in the fall of 1999. Elf Aquitaine and Petronas were among the many companies said to be bidding on the later phases of development.[59] More interest from foreign investors might be forthcoming if a clear export route through Turkey or Pakistan were in place.

According to Iran's Oil Ministry, sales from South Pars could earn Iran as much as $11 billion per year over the next 30 years. An analysis by the International energy Agency notes that Iran has expanded its development plan to a ten phase plan with the following structure:[60]

Phase	On Stream	Sustainable Peak Production	Gas Production (Bcm/yr)	Foreign Participants
1	July 2003	November 2003	10	-
2&3	March 2003	October 2002	21	Total, Petronas, Gasprom
4&5	August 2005	December 2005	21	ENI
6,7&8	June 2006	Late 2006	31	Statoil
9&10	November 2006	Early 2007	21	LG
Total Awarded			104	

Iranian Gas Pipelines and Transport Issues

Although domestic gas consumption is growing rapidly, Iran continues to promote export markets for its natural gas. Iran also hopes to serve as a major transit center for gas exports from Central Asia. Under current plans, NIOC initially hoped to export 450 Mmcf/d of gas by 2000, rising to 4,000 Mmcf/d by 2005 as its larger, more ambitious projects come online. The NIOC planned to have completed three gas export pipelines to Turkey, Armenia, and Nakhichevan by 2000. Two more lines to Europe and India were planned by 2005, in addition to the possibility of a liquefied natural gas (LNG) facility for LNG exports to Asia. Implementation of these ambitious plans, however, required substantial international financing and support, both of which have been lacking.

In January 2002, Iran and Turkey officially inaugurated the gas pipeline link between the two countries. The pipeline supplied Turkey with four billion cubic meters of natural gas in 2002, and capacity will rise to 10 billion cubic meters a year by 2007. To further relations with Western Europe, Iran and Greece signed a $300-million agreement in March 2002 that entails expending the pipeline from Iran to Turkey into northern Greece.[61] Greece and

Turkey agreed on extending the Iran-Turkey natural gas pipeline into Greece. The extension pipeline will be 175-mile long (125 miles in Turkey, 50 miles in Greece) and could be completed by 2005. The pipeline will carry around 17,7 Bcf of gas per year. Iran gives great importance to this project since it could transport its natural gas to Southeast Europe and enter the European market.[62]

Iran has increasingly targeted emerging Asian markets like Pakistan and India (rather than Japan and South Korea) for LNG exports. A committee was established in April 1999, to examine the possibility of a gas pipeline from Iran to India via Pakistan. Iran offered to pay more than half of the cost of the proposed natural gas pipeline from the Islamic Republic to India via Pakistan. The Indian government, however, fears that Pakistan might use this pipeline as a political weapon. Because of continuing India-Pakistani tensions, the Indian concerns, and recent advances in pipeline technology, however, Iran may opt instead for a deep undersea pipeline that bypasses Pakistan's territory.[63] In May 1999, British BG proposed construction of a one billion LNG facility on Kish Island to supply gas to India. The proposal calls for construction of LNG production, storage, and export facilities on the Island, located in the Central Gulf. The project is in the pre-feasibility stage, and awaits gas supply guarantees by the NIOC and a government assessment of environmental risk factors.

Iran as an Energy Risk

As for risk, Iran has not yet demonstrated that it can consistently create the kind of oil and gas development programs that will attract enough foreign investment and technology to meet its ambitious energy development and exploration goals. Far too often, it proposes over-ambitious and badly formulated projects without adequate analysis of the costs and risks foreign companies must bear and the necessary level of profit it must grant such companies. These problems are compounded by the threat the US will try to enforce sanctions on third country oil companies, although such threats are increasing less effective.

More generally, Iran has failed to stabilize its political process and modernize its economy. The election of President Khatami has not been followed by the social and economic reforms most Iranians sought, and Iran's hardliners have steadily limited the role of Iran's elected officials and freedom of speech. The Ayatollah Khamenei and Council of Guardians block legislation to limit the role of Iran's religious conservatives in 2003, and A new crisis

emerged in early 2004 when the Council prevented many reform candidates from running for the National Assembly and threatened to destroy the democratic elements of Iran's government. Its political system moved sharply away from true democracy in 2004, compounding all of the faults inherent in a system where hard-line clerics must vet all candidates by openly rigging the choice of candidates for the Majlis to benefit the hardliners and the authority of a religious Supreme Leader who has yet to demonstrate practical competence in meeting his nation's needs in a single area.

Iran's problems go far beyond its politics. Although its economic problems have recently been eased by years of high oil export revenues, it has failed to make anything like the progress it needs in reforming and diversifying its economy. Years of attempts at economic reform have produced little more than token results, and it is under severe demographic pressure in spite of a relatively low current birth rate by Gulf standards.

At present, Iran must be regarded as at least a moderate to high risk.

Kuwait

Kuwait in another Gulf state that plays a critical role in any projection of the world's future oil supplies. Kuwait contains an estimated 96.5 billion barrels of proven oil reserves, over 9.2% of the world total. The Neutral Zone area or "Divided Zone", which Kuwait shares with Saudi Arabia, holds 5 billion barrels of reserves, half of which belong to Kuwait. The oil produced in the Kuwait-Saudi Neutral Zone is shared equally between the two countries. The KPC owns a 10% share in the Arabian Oil Company that operates offshore production in the zone, while Saudi Arabia Texaco operates the onshore production.

The EIA reports that Kuwait contains an estimated 96.5 billion barrels of proven oil reserves, more than 9% of the world total. It estimates that the Neutral Zone that Kuwait shares with Saudi Arabia, holds 5 billion barrels of reserves, half of which belong to Kuwait. Kuwait's oil reserves are located largely in the 70-billion barrel Greater Burgan area, which comprises three structures: Burgan, Magwa and Ahmadi. The Greater Burgan area is widely considered the world's second largest oil field, surpassed only by Saudi Arabia's Ghawar field. It has been producing oil since 1938. Kuwait has three other fields with proven reserves: Rawdhatain, Sabriya, and Minagish with 6 billion, 3.8 billion, and 2 billion barrels of oil, respectively. All

three fields have been producing since the 1950s. The South Magwa field, discovered in 1984, is estimated to hold at least 25 billion barrels of light crude oil with a 35o-40o API gravity. In November 2000, Kuwait announced the discovery of significant amounts of light crude oil at Sabiryah.[64]

Kuwait has another major field -- Ratqa – that will present problems for Kuwait's future relations with Kuwait. It was once thought to be an independent reservoir, but the EIA reports that it is now known to be a southern extension of Iraq's super-giant Rumaila field. The UN made decisions in Kuwait's favor after the Gulf War in 1991, and a United Nations survey team made a demarcation of the Iraqi- Kuwaiti border that put all 11 of the existing wells at Ratqa within Kuwaiti territory, and Kuwait produces around 40,000 bbl/d from Ratqa. In September 2000, however, Iraq renewed accusations that Kuwait was "stealing" its oil. Iraq claimed that Kuwait was doing this through horizontal drilling on fields straddling the border between the two countries, and that Iraq was losing $3 billion per year worth of oil. Kuwait denied the charges, but it seems likely that the issue will at some point again become a point of contention between the two countries.

Kuwait has recently produced between 2.2 and 2.5 MMBD, including 250,000 bbl/d of Neutral Zone production. Kuwait is one of the two major oil-exporting powers that can rapidly increase production in an emergency, and its role as a swing producer may increase over time. The development of Kuwait's petroleum industry has an important impact on world oil exports. The U.S. Department of Energy estimates that Kuwait will expand its production from 1.7 million barrels per day in 1990, and 2.4 million barrels per day in 2001, to 2.8 million barrels per day in 2005, 3.3 million barrels per day in 2010, 3.9 million barrels per day in 2015, 4.5 million barrels per day in 2020, and 5.1 million barrels per day in 2025.[65]

Kuwait's Uncertain Oil Development

Kuwait's oil wealth should be enough to support the needs of its population with only limited economic reform and diversification. Kuwait's oil industry is the core of its national wealth and economy and indirectly dominates much of its politics. Oil accounts for more than 90% of the country's export revenues 80%-85% of the government's income, and around 40% of gross domestic product (GDP). Aside from foreign investments and oil-revenue funded trade, Kuwait has no other meaningful industry. It is also the center of much of the nation's politics.

Many of the struggles within Kuwait's ruling elite and within the National Assembly, have been over the distribution of oil revenues, oil export policy, or how to develop and modernize Kuwait's oil resources.

Kuwait's ability to fund and implement these plans, however, has become a key issue. Much depends on the extent to which the government actually presses ahead with its plans, and can reform its laws to allow it to obtain the domestic private and foreign investment it needs. Kuwait can only fully develop its oil resources if it makes significant changes in the structure of its oil industry and finds an effective solution to private and foreign investment in some aspects of its oil production development and downstream industries.

This will not be easy. For the last decade, every decision affecting oil exports, oil production capacity, and oil revenues has been a highly visible and important aspect of Kuwaiti political life. Every major proposal or contract has been the subject of intense examination and discussion by the ruling and business elite, the media, Kuwaiti technocrats and intellectuals, the Kuwaiti public, the National Assembly, and the government. So far, the government and National Assembly have failed to reach any important agreement since the end of the Gulf War, and this has not only blocked critical improvements in the use of enhanced oil recovery technology, but threatens to seriously reduce Kuwait's production capacity in the near term..

Managerial and technical difficulties compound these political problems. Kuwait's organization for the development of its oil resources is outdated, Kuwait has no petroleum law and the Emir of Kuwait, Sheik Jaber al-Ahmed al-Sabah, has ultimate authority over all major decisions relating to oil. The Sheik's principal advisor is the Oil Minister. A Supreme Petroleum Council was established in 1974 to review all major decisions. This Council is chaired by the Foreign Minister. Its membership includes six other ministers, and members of the private sector appointed by the Emir. This structure encourages internal political debate within the Kuwaiti government, and these problems have been compounded by the government's agreement that the National Assembly must debate and approve every contract.

International oil company participation is now restricted to technical service agreements between the Kuwait Oil Company and BP, TotalFinaElf, and ChevronTexaco. Exxon Mobil and Royal Dutch Shell have technical studies agreements for upstream operations.[66] Outside sources

report that Kuwait's native technocrats often do a poor job of seeking outside advice, and tend to resist technical innovation. They feel the system works at the top, but the quality of Kuwaiti management and planning is weak at middle echelons and that younger Kuwaitis sometimes feel they cannot make a real contribution and have little reason to take their work seriously. Kuwait relies on state investment and is not earning enough to rely on its own resources to pay for both its operating and social needs and must obtain extensive foreign investment. Like Saudi Arabia, these pressures are driving Kuwait and the Kuwait Supreme Petroleum Council towards a new oil strategy.

The government has attempted to modernize Kuwait's oil production through Project Kuwait (a $7 billion), which will entail the doubling of the production capacity of the northern fields to 900,000 b/d, to compensate for declines at the mature Burgan field.[67] In mid-1997, the Kuwaiti Supreme Petroleum Council agreed to allow foreign firms to assist in development plans which called for Kuwaiti production to increase from around 2.2 million bbl/d in 2003 to 3.5 million bbl/d in 2005, and 4 million bbl/d by 2020.[68] This involved a number of new projects in western and northern Kuwait, including 300,000 barrels per day from the Neutral Zone. According to the Kuwaiti Oil Ministry, total cost for the related upstream and downstream expansion was expected to total $13 billion between 1995 and 2005.

Upon request from 32 members of the 50-seat parliament, mainly from the Islamic and liberal blocs, Kuwait's National Assembly held a debate on February 8, 2000, on all aspects of Project Kuwait, including the lack of clarity in the relationship between the government and the international oil companies (IOCs). Despite the government's earlier declaration that no new legislation was needed, during the debate, Oil Minister, Shaikh Sa'ud Nasir al-Sabah, announced that a law would be submitted to parliament to regulate Project Kuwait. However, Shaikh Sa'ud refrained from indicating a time frame for the award of contracts.[69] Shaikh Said resigned before any law was passed, and no action had been taken as of March 2003. Kuwait has delayed any effective action for more than a decade. As a result, there is a continuing moderate risk that Kuwait's energy development will be inhibited in both its growth and efficiency, largely because of internal politics.

Kuwait does, however, have a number of options. Its major production expansion plans focus on the northern part of the country, but proposals exist for other areas. Among the northern fields expected to receive priority development efforts are the Zubair reservoir in the Ratqa oil field, the Zubair and Ratawi reservoirs in the Abdali field, and the Mauddud and upper Burgan reservoirs in the Sabriya and Bahra fields. Combined, the northern fields of Raudhatain, Sabriya, Bahrah, Ratqa, and Abdali are being expanded to 1.25 million barrels per day in capacity by 2005, compared to current output of 400,000 barrels per day.

Onshore and offshore survey work is being undertaken to review existing data on undeveloped fields and to explore for new structures. Kuwait is cooperating with Saudi Arabia in expanding production from the "Divided" or "Partitioned Neutral Zone" shared by the two countries. The Neutral Zone encompasses a 6,200 square mile area shared equally between Kuwait and Saudi Arabia under a 1992 agreement. It contains an estimated 5 billion barrels of oil and 1 trillion cubic feet (TCF) of natural gas. Oil production in the Neutral Zone, which is at least 500,000 barrels per day, is exported from area terminals.

Two joint ventures will increase oil output in the area. U.S.-based Texaco and KPC produce from onshore fields at Wafra, South Fawaris, and South Umm Gudair. Texaco plans to boost output in the Neutral Zone's onshore area from around 250,000 barrels per day at present, to 300,000 barrels per day by 2000. Offshore, the Arabian Oil Company (AOC) of Japan produces around 260,000 barrels per day from the Khafji and Hout fields, both of which are connected to Saudi Arabia's Safaniyah, the world's largest offshore oilfield.

Kuwaiti Refining and Petrochemicals

Kuwait's refining capacity was damaged severely during the Gulf War. After losing most of its pre-war, 820,000-barrels per day capacity, Kuwait had only 200,000 barrels per day of refinery output by early 1992. Kuwait's $400-million downstream reconstruction program was completed in mid-1994. By 1997, Kuwait's domestic refineries were operating at around their pre-war capacity of 886,000 barrels per day. The Kuwait National Petroleum Corporation (KNPC) plans to further expand refining capacity to almost 1 million-barrels per day by 2005. This is part of an overall strategy to focus increasingly on relatively high-value product exports. At present, Kuwait domestic refinery capacity is around 773,300 bbl/d, around 100,000 bbl/d less than normal because of damage to Mina al-Abdullah, the country's largest refinery. By mid-

2002, Mina al-Ahmadi was operating at around 300,000 barrels per day, and is expected to return to full capacity in 2004.

Kuwait is expanding its investments in petrochemicals. It has been producing fertilizer since the mid-1960s, and had just started building a major complex at Shuaiba when the war began. In mid-1993, Kuwait's state-owned Petrochemical Industries Company (PIC) and Union Carbide Corporation formed a joint venture to build and operate a world-scale petrochemical complex at Shuaiba. Construction of the $2.3-billion facility began in late 1995, and opened on November 12, 1997. PIC and Union Carbide each have a 45 percent share in the project, with the remainder reserved for public offer. The complex includes a 650,000 metric ton per year (mt/y) ethane cracker, 450,000 mt/y of polyethylene capacity and 350,000 mt/y of ethylene glycol production. The complex will primarily serve Asian products markets.

Kuwaiti Energy Export Facilities

Prior to the Iraqi invasion, Kuwaiti terminals had the capacity to load more than 3 million barrels per day of crude oil and around 800,000 barrels per day of refined products. KNPC has completed major reconstruction efforts on its Mina al-Ahmadi export facility, Kuwait's main crude-oil export port. Kuwait has fully operational terminals at Mina Abdullah (repairs completed in September 1992), Shuaiba (restored by late 1996), and at Mina Saud in the Neutral Zone. Kuwait now has an oil export capacity of over 2 million barrels per day.

Kuwaiti Gas Development

Kuwait is among the top twenty nations in the world in terms of natural gas reserves, but its reserves are not large by Gulf standards. Kuwait estimates that it has 1.5 trillion cubic meters, or 1.1% of the world's reserves. Almost all of Kuwait's gas reserves are associated with oil fields, and the Kuwait Production Company carries out all of its natural gas production. Kuwait has established gas gathering facilities and pipelines, but its efforts to find separate gas fields have failed. As a result, gas production has varied with oil production – a trend reflected in the decline in gas production during 1980-1985 and the massive drop in production resulting from Iraq's invasion. Kuwait has been looking for other sources of gas and recently decided to import natural gas from Qatar. A sales and purchase agreement is to be signed between Kuwait Petroleum Corporation and Qatar Petroleum/ Exxon Mobil.

Kuwait made progress in utilizing its gas for domestic needs and oil production purposes before the Iraqi invasion. The share of Kuwaiti gas that was marketed rose from 42% in 1975 to 74% in 1989, but massive amounts had to be flared during the first phase of the Gulf War. The Kuwaiti gas industry suffered some war damage. Three of Kuwait's five gas booster stations were damaged, and one was destroyed. However, its LPG plant and bottling unit were not damaged. Gas production and domestic use has since recovered, but Kuwait actually needs more gas than it produces. Though it was an importer of Iraqi gas before the war, for obvious reasons Kuwait is now looking for other sources of gas.

Kuwait as an Energy Risk

The fall of Saddam Hussein's regime has removed the primary security threat to Kuwait. Its internal politics have, however, led to serious underinvestment in its oil field development and use of enhanced oil recovery to the point where Kuwait's oil industry risks serious decline and is a self-inflicted wound. The Kuwaiti National Assembly may be one of the leaders in democratic reform in the region but so far has shown little practical ability to come to grips with economic reality or the nation's most urgent needs.

These problems are compounded by the fact that the petroleum sector provides wealth, but not jobs. Upstream and down stream petroleum operations are among the least labor intensive activities in modern economies, and create some of the fewest lasting jobs per unit of investment capital. Some 65%-70% of Kuwait's of the population is under the age of 25,

and around 90% of the employees in its private sector are currently non-Kuwaiti citizens because salaries are relatively low and native Kuwait's have limited job skills and a uncertain work ethic. Roughly 93% of Kuwaiti citizens are employed in state-owned enterprises and the government.[70] Some Kuwaiti ministers privately estimate that 2 out of 3 such jobs are make work positions with no productive output. The minimum estimate is one out of three.

Like most MENA governments, Kuwait is seeking to create jobs for young natives Kuwaitis. It is trying to attract additional foreign investment. It also is developing a program to privatize state-owned businesses (outside the oil sector) to reduce the strain subsidies put on the national budget. Kuwait has discussed privatizing such key sectors as utilities, ports, oil stations, and telephone service. Privatization, however, can only be competitive in free market terms if massive cuts are made in currently employment levels and charges are increased to honestly reflect cost and a reasonable return on investment. There are few indications Kuwait (or other MENA governments) are prepared to come to grips with this reality or to aggressively create the necessary climate for the growth of the private sector.

As a result, Kuwait is at least a moderate near-term energy risk.

The United Arab Emirates

The UAE is a federation of seven emirates - Abu Dhabi, Dubai, Sharjah, Ajman, Fujairah, Ras al-Khaimah, and Umm al-Qaiwain. Political power is concentrated in Abu Dhabi, which controls the vast majority of the UAE's economic and resource wealth. The two largest emirates—Abu Dhabi and Dubai—provide over 80% of the UAE's income. In June 1996, the UAE's Federal National Council approved a permanent constitution for the country. This replaced a provisional document that had been renewed every five years since the country's creation in 1971. The establishment of Abu Dhabi as the UAE's permanent capital was one of the new framework's main provisions.

UAE Oil Development

The UAE is one of the world's largest oil producers. It currently has 97.8 billion barrels of proven reserves, or nearly 10% of the world total.[71] Abu Dhabi holds 94% of this amount or about 92.2 billion barrels, and Dubai contains another 4.0 billion barrels. The U.S. Department of Energy estimates that the UAE will increase its production capacity from 2.5 million barrels per day in 2000, to 3.0 (2.6-3.2) million barrels per day in 2005, 3.7 (2.8-4.0) million barrels per day in 2010, 4.4 (3.1-4.8) million barrels per day in 2015, and 5.1 (3.5-5.6) million barrels per day in 2020. [72]

Energy development in the UAE has generally been efficient and market-driven, although Abu Dhabi has failed to make the necessary investment in enhanced oil recovery technology and properly manage its oil reservoirs.. The UAE is also in the process of expanding production from Abu Dhabi's giant Upper Zakim offshore field, which has reserves of 98 billion barrels. There have been no additions to the production capacity of this field, which has most of the UAE's proven reserves since 1995. Work is underway, however, to increase capacity from around 2.4 MMBD in 2003 to 3 MMBD by 2005 and 4 MMBD by 2010. [73] In 2003, Abu Dhabi signed contracts worth over $ 1,000 million with international companies to expand its onshore oil capacity.[74]

The UAE does, however, have some political problems and tensions in dealing with the management of its oil resources . Under the UAE's constitution, each emirate controls its own oil production and resource development. Although Abu Dhabi joined OPEC in 1967 (four years before the UAE was formed), Dubai does not consider itself part of OPEC or bound by its quotas. Consequently, if Dubai were to produce at its full capacity, Abu Dhabi might have to adjust its output in order to keep the UAE within its OPEC production quota.

The UAE still treats oil and gas as state industries. On October 12, 1998, however, the Abu Dhabi National Oil Company (ADNOC) announced a major plan to restructure its management. The plan consolidates ADNOC's operations under five new directorates: Exploration and Production, Gas Processing, Chemicals, Marketing and Refining and Shared Services (Administration). According to *Petroleum Intelligence Weekly*, the plan is the first step in the direction of eventual privatization of major oil assets, beginning with downstream

operations. Such privatization might help what has become an increasingly serious problem, at least in Abu Dhabi. ADNOC's reservoir management badly needs modernization, and Abu Dhabi needs to make more effective use of advanced enhanced oil recovery techniques.

UAE Refineries and Petrochemicals

The UAE has two refineries operated by ADNOC. The Ruwais refinery underwent a $100 million upgrade in 1995 and is now operating at 145,000 bbl/d, producing light products mainly for export to Japan and India. After upgrades, Ruwais' total capacity will be around 500,000 bbl/d by 2005. UAE's smaller refinery at Umm al-Nar is now running at 88,500 bbl/d.[75]. The UAE has several major petrochemical projects in the development and early stage and will become a major producer in the future.

UAE Natural Gas Development

The U.S. Department of Energy estimates that the UAE's natural gas reserves total roughly 212 trillion cubic feet (Tcf), and are the world's fifth largest – 4.0% of the world's total – after Russia, Iran, Qatar, and Saudi Arabia. About 196.1 Tcf of these reserves are located in Abu Dhabi. Sharjah, Dubai, and Ras al-Khaimah contain smaller reserves of 10.7 Tcf, and 1.1 Tcf, respectively. The UAE's current gas reserves are projected to last for at least 150 years. [76]

Restrictive OPEC oil production quotas and increased domestic consumption of electricity have provided a growing incentive for the UAE to develop its vast gas reserves. Over the last decade, gas consumption in Abu Dhabi has doubled, and is projected to reach 4 billion cubic feet per day (bcf/d) by 2005.. The development of gas fields also increases exports of condensates, which are not subject to OPEC quotas.

In spite of the "oil crash" and its problems with oil revenues in 1998, the UAE spent approximately $10 billion in an effort to expand and modernize onshore and offshore gas extraction and distribution systems, and to transform the Taweelah commercial district into a gas-based industrial zone. One project was the second phase of a $1 billion onshore gas development program (OGD-2) at the Habshan natural gas complex located directly over the huge Bab oil and gas field. According to Middle East Economic Survey, this second phase includes the construction of three or four gas processing trains to process 1 bcf/d of wet sales gas, 300-500 tons per day (t/d) of natural gas liquids, 35,000 –55,000 t/d of condensate and up to

2,100 t/d of sulfur. The construction was carried out by France's Technip and Bechtel of the U.S. at an estimated cost of $1,200 million, and was completed in early 2001.

Another project linked with OGD-2 is the Asab gas development project, which was completed in 1999. The Asab development processes around 830 million cubic feet per day (Mmcf/d) of associated wet gas from the Thamama F and G reservoirs and produce up to 100,000 bbl/d of condensate for processing at the Ruwais refinery. The gas will also support other industries in Ruwais and be re-injected into Asab reservoirs to maintain field pressure. The $700 million project was awarded to Snamprogetti in June 1997 by UAE's Supreme Petroleum Council and was completed in the 1999. A second-phase of the project consisted of a $1-billiion onshore program at Habshan complex with four trains together producing 1 bcf/d. More capacity is planned for in the third-phase in the future[77].

At least one member of the UAE, however, is becoming a major gas importer. Dubai's gas consumption is expected to grow by nearly 10% each year , due to expansions in its industrial sector, a switch to gas by its power stations, and the need for an enhanced oil recovery (EOR) system based on gas injections for its dwindling oil formations. In May 2001, a pipeline from Abu Dhabi to Dubai commenced operations. The pipeline delivers 200 mmcf/d of natural gas.[78]

In February 1998, a deal was announced for the supply of gas from Abu Dhabi to Dubai. The deal reportedly stipulated that Abu Dhabi would sell gas to Dubai for less than $1 per million Btu, a price that undercut other potential suppliers. Dubai's gas deal with Abu Dhabi parallels a separate effort by Dubai to import gas from neighboring Qatar. The planned project, to be managed by an international consortium led by Arco, would deliver between 800 Mmcf/d and 1.2 bcf/d of gas to Dubai from Qatar's giant North Field. However, this project never really got off the ground, and has been supplanted by the UAE's ambitious Dolphin program.

Phase one of the Dolphin project involves the construction of a subsea pipeline from Ras Laffan in Qatar to a landfall in Abu Dhabi, which will then be extended to Dubai and Oman. In the first phase, the pipeline will supply 3,200 million cf/d of Qatari gas to the UAE and Oman by 2006 via a 450-kilometre-long pipeline. This equates to 30 billion cubic meters a year, and would account for nearly 10% of world gas supplies shipped by pipeline. In a second phase, the

pipeline will be extended along the seabed to Pakistan and handle another 1.5 billion cf/d of gas after 2005. The project is estimated to cost $10 billion over the next six to seven years, and could lead the way to greater GCC integration.[79] The proposed extension from Oman to Pakistan remains highly uncertain. This phase of the project is technically uncertain, its costs remain speculative, and is dependent on Pakistan's ability to afford the natural gas. Pakistan's weak economy might not be able to afford this project.

Oil production and exports, however, will continue to be the core of the UAE's strategic importance. In 2003, the EIA estimated that the UAE would increase its production from 2.5 million barrels per day in 2001, to 2.9 million barrels per day in 2005, 3.4 million barrels per day in 2010, 4.0 million barrels per day in 2015, 4.8 million barrels per day in 2020, and 5.4 million barrels per day in 2020.[80] These figures seem credible.

The UAE as an Energy Risk

While the UAE does have tensions with Iran over the control of three Islands in the Gulf, neither these tensions nor any of its various internal tensions seem likely to serious inhibit its future energy development. Short to mid-term risks are low, but Abu Dhabi's willingness to modernize its reservoir management and use of enhanced oil recovery technology merit close attention.

Bahrain

Bahrain, Qatar, and Oman are not major oil producers, but any geopolitical analysis of the Gulf must consider the risk that the rise of a radical or unfriendly regime could pose in any of these states. Qatar is also a major potential gas producer, with the third largest reserves in the world. All three states play an important role in U.S. power projection. Bahrain is the host to the U.S. 5th Fleet, Qatar has agreed to allow the U.S. to preposition a brigade set on its soil, and Oman provides prepositioning and port facilities.

The principal risk that Bahrain presents is that the long-standing political tensions between its Sunni elite and Shi'ite majority could explode into open civil conflict, lead to Iranian covert or overt intervention, and/or bring down its royal family. These problems are compounded by structural economic problems that are the result of the depletion of oil reserves, a growing

population, over-dependence on foreign labor, and the over-concentration of wealth in the hands of a relatively small elite.

Bahrain has, however, begun a series of political reforms that are easing these tensions. Bahrain also has received substantial economic support from Saudi Arabia, and has modernized its service, financial, and tourism sectors to diversify its economy. Real GDP grew by 4.1% in 2001, 4.5% in 2002, and is projected to grow at 4.1% in 2003 and 3.8% in 2004.[81] As a result, energy development risk is in the low to moderate category.

Bahrain has proven oil reserves of 125 million barrels. Bahrain has only one field, Awali, producing this output. Production has been declining at Awali, and in 2002, Awali field produced only 35,000 bbl/d of crude oil.

This situation could change in the future since Bahrain has potential oil reserves in the Gulf of Bahrain. These areas opened to exploration after the International Court of Justice awarded the sovereignty of the Hawar Islands to Bahrain. In late 2001, Bahrain awarded two blocks to Petroms (Malaysia) and one block to ChevronTexaco off the Southeastern coast of the country to start exploratory drilling.[82] In 2002, ChevronTexaco declared, however, that it had failed to find commercially viable opportunities in another concession to the north and west of the mainland.[83]

Sitra is Bahrain's only oil refinery, and has a capacity of 248,900 bbl/d. Sitra, which exports most of its product to India and the Far East, has been in operation since 1936 and has undergone many modernizations. The Bahrain Petroleum Company has announced a $900 million modernization program that will allow Sitra to produce a wider range of petroleum products.[84]

Bahrain produced 300 Bcf of natural gas in 2000 and 314 Bcf in 2001, all of which was consumed locally. Because Bahrain consumes as much as is produced, Qatar and Bahrain signed a Memorandum of Agreement in 2002 indicating Bahrain's intentions to purchase natural gas from Qatar.[85]

At present, Bahrain's role in regional energy supply is so limited that it cannot impose a meaningful risk in terms of energy supply. It has, however, taken important steps to both

improve its relations with Qatar and move towards political and social reforms that are easing the tension between its Shi'ite majority and ruling the Sunni elite. Risks are low.

Oman

Oman's oil and gas exports play a role in future global energy balances.[86] Oman's reserves are relatively small. Oman has proven crude oil reserves of 5.5 billion barrels, or only 0.5% of the world total. It has a reserve to production ratio of 15:7. British Petroleum and Petroleum Intelligence Weekly estimate that Omani oil production averaged 820,000 bbl/d in 1994, 895,000 in 1996, and 905,000 bbl/d in 1998.[87] The EIA estimates that total oil production slipped to just over 700,000 bbl/d in October 2003, down from a high of almost 1 million bbl/d in 1998.[88]

Omani Oil Development

Oman's oil fields are generally smaller, more widely scattered, less productive, and more costly to produce than in other Gulf countries. Most of the country's proven oil reserves are located in the northern and central regions. Most of the crude oil found in these regions is light, with gravities in the 32°-39° API range. Heavier oil is found in southern Oman.

Oman has been more successful in attracting foreign investment to its energy sector than most other Gulf states. Its main oil company, the PDO, is the country's second-largest employer after the government. It holds over 90% of the country's oil reserves and accounts for about 94% of production. The PDO is a consortium comprised of the Omani government (60%), Shell (34%), Total (4%), and Partex (2%). It is managed by Shell and operates most of the country's key fields, including Yibal and Lekhwair. Occidental oil is the only other major oil producing company. There are three other small producers and a number of other oil companies that are actively looking for oil and gas.

Oman cannot afford to conserve its oil resources, and this makes maximizing current export revenues and increasing production a key priority for the Omani government. Fortunately, successful exploration programs over the past several years have resulted in annual reserve increases that have offset production depletions. Some of these "newly" discovered reserves were in fact discovered previously, but were considered uneconomical to develop.

Horizontal drilling and other enhanced oil recovery (EOR) techniques have made production of these reserves more economical in many cases.

The major oil fields in Oman, however, are mature and face future declines in production. Oman has also had serious problems with its Yibal field, which was heavily water injected and where the use of horizontal drilling produced temporary gains. It reached a peak of 250,000 bpd in 1997, but then dropped to under 90,000 bpd in 2001 and around 40,000 bpd in 2004.[89] If new reserves are not discovered, Oman will become a minor oil-exporting nation. In the next 10 to 20 years. Oman signed a six year contract with Spectrum Energy and Information Technology (UK) to have old seismic studies reevaluated and try to discover new resources.[90]

Omani Refineries and Petrochemicals

In 1982, Oman constructed its first refinery at Mina al-Fahal. Subsequently, the 50,000 barrels per day plant was expanded to 85,000 barrels per day. In January 1997, the Omani government announced that it was considering plans for construction of a new refinery at Salalah, a port city located in the southern tip of Oman. Planned capacity has been set at 50,000 barrels per day. Bids for construction of the project were solicited in March 2002, and JGC Corporation (Japan) was awarded the contract in May 2003. To facilitate this, Oman announced plans in April 2003 to build a $1 billion pipeline that will run the 162 miles between the Oman Refining Company and the new refinery in Sohar. They should both come online in 2006, and the refinery's capacity is expected to be 51,000 bbl/d of gasoline and 30,000 bbl/d each of diesel and fuel gas.[91]

As part of its effort to diversify the economy and to develop domestic value-added industries, Oman is planning to seek foreign investment in petrochemical production. In addition, Oman and India have decided to move forward with a joint venture fertilizer plant. Plans are for the $1.12 billion ammonia/urea complex at Qalhat near Sur to export 1.45 million tons of urea a year to India, and approximately 315,000 tons of ammonia a year to other countries. State-owned Oman Oil Company owns 50% of the joint venture, while the two India firms, Krishak Bharati Co-Operative and Rashtriya Chemicals & Fertilizers, own 25% each.

Omani Natural Gas

The Omani government is attempting to transform Oman into a major natural gas exporter as key element of its economic diversification strategy. The PDO has carried out an extensive exploration program and has consistently increased its natural gas reserves in recent years. According to the *Oil & Gas Journal*, intense exploration raised Oman's proven natural gas reserves from only 12.3 Tcf in 1992 to just under 30 Tcf in 2002.[92] About one-third of this amount is associated gas, most of which is located in the Natih and surrounding fields. Over 10 Tcf of Oman's non-associated gas is located in deep geological structures, many of which are beneath active oil fields.

The PDO produces the majority of Oman's associated gas, as well as non-associated gas from Yibal and Lekhwair. In the late 1970s, MPM built a gas pipeline and processing facilities in order to utilize, rather than flare, associated gas. Much of Oman's natural gas is used either for electricity production, for water desalinization, or for reinjection into oil wells.

Oman is considering proposals to build two new gas pipelines. The proposed lines would link Sohar and Salalah to the existing gas network. The 420-mile pipeline from Saih Rawl to Rahud and then to Sohar would be designed to supply a planned aluminum smelter and petrochemicals complex and may meet some domestic power demands. The second 180 to 360-mile pipeline from Saih Nihayda gasfield, in northern Oman, to Salalah, in the south, will mainly serve short-term domestic power requirements. Although no timetable has been set for construction, Gasco, a new upstream company mostly owned by OOC, would construct both pipelines.[93]

More broadly, Oman's plans for its future economic development and political stability are heavily dependent on gas export projects whose economics are uncertain. Nevertheless, Oman is moving forward with one major gas export project, a $2.5-billion, 6.6-million ton per year LNG plant at Qalhat, near Sur. The project is under development by the Oman Liquefied Natural Gas Company (OLNGC), which is comprised of the Omani government (51%), Shell (30%), Total (5.54%), Mitsubishi (2.77%), Mitsui (2.77%), Partex (2%), and Itochu (0.92%).

So far, Oman has been able to contract for all the gas it can produce from its first two KLNG trains. In December 1998, Oman LNG signed a 20-year agreement with Enron to supply

1.6 million tons a year of LNG to India's Dabhol power plant. This raised the total level of production from a previously contracted level of 1.2 million tons a year, and largely offset reductions in the Thai market.[94]

Liquefied Natural Gas (LNG) exports constitutes a large part of Oman's plan to develop its natural gas sector, and the country is investing in it heavily. In 2002, Oman's total LNG production was 6.6 million tons, of which 6.5 million tons were exported. Since 2000, production has been evenly split between two liquefaction plants (or trains) in Qalhalt, each with a capacity of 3.3 million tons. A third train is expected to increase Oman's total capacity by 50% when it comes on line in 2005-2006.[95]

Omani Energy Risks

In terms of risk, Oman is one of the smaller oil and gas powers in the Gulf and faces serious future challenges. Oman has one of the highest birthrates in the world, and is still in the early phases of economic development. Oman's population grew by an average rate of 4.2% during 1980-1997, and more than doubled from 1.1 million to 2.3 million.[96] The CIA estimated that Oman's population was still growing at a rate of 3.38% in 2003.[97] Oman is heavily dependent on foreign labor, but it has a growing problem with the unemployment or underemployment of its native workers.

Oman's economy and stability are over- dependent on oil and gas income, and petroleum revenues account for 75% of total export revenues and state revenues, and about 40% of GDP.[98] Oman's non-oil exports, which only account for 9% of total exports, although they have risen 18% since 1996.[99] This helps explain why Oman has never joined the Organization of Petroleum Exporting Countries (OPEC) or the Organization of Arab Petroleum Exporting Countries (OAPEC). It has sought to maintain freedom of action in terms of oil and gas production.

Oman's relationships with many of its neighbors are complicated by its refusal to join either the Organization of Petroleum Exporting Countries (OPEC) or the Organization of Arab Petroleum Exporting Countries (OAPEC). It also has had strained relations with Yemen, and its border with the United Arab Emirates (UAE) continues to be undefined.

Oman has taken steps to liberalize its investment climate. In November 1994, the government revised its investment law, raising the maximum percentage of foreign ownership from 49% to 65%. Full foreign ownership was also permitted under special conditions, although there are no actual examples at present. Oman's 1997 budget included a new tax code aimed at providing tax relief to companies with foreign shareholders. Taxes on these firms now have a ceiling of 7.5%, the same as for Omani companies. Under the previous tax code, firms with foreign shareholders paid tax rates between 15% and 25%.

The Omani government has also sought to attract foreign investment, particularly in light industry, tourism, and electric power generation. Foreign investment incentives include a 5-year tax holiday for companies in certain industries, an income tax reduction for publicly held companies with at least 51% Omani ownership, and soft loans to finance new and existing projects.

However, the EIA reports that Omani nationals now constitute only 10% of private sector employment. Oman's population is growing very rapidly, and traditional pursuits like agriculture suffer from overcrowding, over production, and water problems caused by excessive use of aquifers. Job creation in other sectors is still very slow, and many prefer to hire foreign nationals. Oman is also increasing the strains on its budget and investment capabilities by keeping taxes low as an economic stimulus measure. As a result, Oman has sometimes been force to draw on its strategic reserve, which was designed to provide capital for the time when Oman ceased to be a major oil producer.

Oman's economic reforms have also left it with more bureaucratic restrictions than in neighboring Dubai, and Omani labor productivity remains low. It needs changes in its regulations to exploit tourism, and other promising sectors of the economy. In October 2002, Oman joined the World Trade Organization, and further economic reforms may well take place, but Oman to date has been less realistic about its reform plans that it should be.[100] It faces an uncertain future because of the lack of a clear successor to Sultan Qabus, growing demographic pressure, and the fact its over-ambitious economic goals may not be possible to implement in ways that preserve internal stability.

Sultan Qaboos bin Said al Said has ruled Oman since 1970, when Britain helped him depose his father in a bloodless coup. The Sultan is childless and 60 years old. Oman did establish rules governing the succession that were formalized in the 1996 Basic Law, but it is far from clear who will succeed the Sultan and what his competence and experience will be. This is critical because the Sultan still retains power in virtually every aspect of Oman's government decision making and act as the minister in the finance, defense, and foreign affairs ministries. This overconcentration of power has already had an impact in creating internal opposition, and in limiting the effectiveness of some aspects of Omani economic planning and reform. There are, however, some elements of political change. The Sultan has created two consultative bodies, the Majlis al-Dawla and the Majlis al-Shura, which make up the Council of Oman. The Majlis al-Dawla is appointed, but the Majlis al-Shura is elected, and Oman is experimenting with universal adult suffrage.

Oman has relatively good relations with Iran, but could face major problems in any major conflict in which Iran sought to close or limit traffic through the Strait of Hormuz. Relations with Saudi Arabia have improved to the point of being correct, but are scarcely warm. Oman has had tensions with Yemen and some aspects of its border with the UAE are not firmly demarcated.

In spite of these reservations, Oman has long shown in can cope with its problems and the present mix of short and mid-term risks is not yet serious enough to qualify Oman as more than a low to moderate energy risk.

Qatar

Qatar's economy depends almost solely on oil and gas revenues, which account for roughly 89% of its export earnings and 72-75% of its government revenues. Oil accounts for around 66% of Qatar's government revenues, and has an impact on production of condensate and associated natural gas.[101]. Most of Qatar's heavy industrial projects are tied closely to its petroleum sector. They include a refinery with 50,000-60,000 barrels per day capacity, a fertilizer plant for urea and ammonia, a steel plant, and a petrochemical plant. These industries use gas for fuel. Most of them are joint ventures between European or Japanese firms and the State-owned Qatar General Petroleum Company (QGPC).

Qatar has no arable land, irrigated land or permanent crops, and only 5% of its territory is suitable for light grazing. Even the limited agricultural production that does take place is extremely wasteful since there are very limited freshwater resources and agriculture must rely on desalinized water, foreign labor, and subsidies. As a result, Qatar's future depends upon its ability to exploit the full downstream potential of its oil and gas resources to maintain and increase oil and gas exports, increase exports of petroleum-related products, and develop gas and petroleum fueled industries. This is the only way Qatar can create new jobs for its native labor force, and encourage private investment outside the service industries. Qatar's greatest strength is gas. It has the third largest gas reserves in the world, after Russia and Iran.

Qatari Oil Development

Qatar has proven oil reserves of 15.2 billion barrels. The Dukhan field is Qatar's largest and only onshore oil field. The remaining proven reserves are held in six offshore fields: Bul Hanine, Maydan Mahzam, Id al-Shargi North Dome, al-Shaheen, al-Rayyan, and al-Khalij. It exports almost all of its oil to Asia- Japan is the largest customer. Qatar contains crude oil with gravities in the 24°-41° API range.

Qatar now has a number of oilfield developments underway, planning and development activities have improved sharply since a new Emir came to power in 1995. Qatar has initiated new policies aimed at increasing oil production, locating additional oil reserves before existing reserves become too expensive to recover. It has invested in advanced oil recovery systems to extend the life of existing fields. The government improved the terms of exploration and production contracts and production sharing agreements (PSA) in order to encourage foreign oil companies to improve oil recovery in producing fields and to explore for new oil deposits. In November 2003, foreign companies accounted for more than one-third of Qatar's oil production capacity.[102]

The EIA estimates that Qatar's oil production capacity will remain relatively constant, and go from 0.85-0.9 million barrels per day in 2001, to 0.6 million barrels per day in 2005, 0.6 million barrels per day in 2010, 0.7 million barrels per day in 2015, 0.8 million barrels per day in 2020, and 0.8 million barrels per day in 2025.[103] These figures seem credible, and the EIA estimates they could be higher if Qatari plans are successful.

Qatari Gas Development

The key to Qatar's energy future, however, is gas. Qatar's natural gas reserves rank third after Russia and Iran, and the Qatari government believes that the country's economic future is dependent upon developing its vast gas potential. Such development, however, is a challenging task. It costs roughly $1.0 billion to bring one million tons of gas export capacity on line, and Qatar has to make hard choices about which project to pursue and when.

According to the IEA, Qatar has proven reserves of 509 trillion cubic feet (Tcf). Most of Qatar's gas is located in its North Field, which contains 380 Tcf of in-place and 239 Tcf of recoverable reserves, making it the largest known non-associated gas field in the world. In addition, the Dukhan field contains an estimated 5 Tcf of associated and 0.5 Tcf of non-associated gas. Smaller associated gas reserves also are contained in the Id al-Shargi, Maydan Mahzam, Bul Hanine, and al-Rayyan oil fields. Additional fields may give Qatar a total producible gas reserve of up to 250.0 trillion cubic feet. This would give Qatar about 5% of all the world's gas reserves.

Qatari gas production has risen sharply in recent years, and gas exports and the domestic use of gas have only been heavily marketed since 1991. Qatar produced only 5.9 billion cubic meters (BCM) in 1988. This rose to 20.0 BCM by 1998.[104] Before 1991, most gas was reinjected, flared, or lost. The Qatari economy has also been boosted by the completion of the $1.5 billion Phase I of the North Field gas development in 1991. Qatar is now producing about 321 billion cubic feet of gas per year, and this total will rise sharply in the future. The future phases of North Field gas development, involving exports via pipeline and/or gas liquefaction, may cost $5-6 billion, and will make Qatar a major gas producer.

The IEA estimates that Qatar's capacity to produce LNG will reach 12.5 million tons by 2005. It estimates that Qatar can sustain this level for more than a decade and has the capability to reach export levels of 17.5 million tons. The IEA estimated that Qatar's contracted capacity to export LNG would reach 8.4 million tons by 2000, and its spare export capacity will be 4.6 million tons by 2005. The projected total upstream cost for Qatar's three LNG trains is $900 million, and downstream costs may reach as high as $3 billion. A consortium of Japanese banks

will provide the bulk of this downstream financing, mainly through a $2-billion loan that was finalized in June 1994.

Qatar is focusing on the development of its offshore North Field to increase its LNG exports and significantly expand the share of petrochemicals in Qatar's total export trade of crude oil, refined products, and LPG. Qatar currently has two major LNG projects, Qatar Liquefied Gas Company (Qatargas) and Ras Laffan (Rasgas), in development. The Qatargas downstream consortium comprises QGPC (65%), TotalFina Elf (10%), Exxon Mobil (10%), Mitsui (7.5%) and Marubeni (7.5%). The Qatargas LNG plant consists of three, 2-million-ton-per-year (Mmt/y) trains. A third train was completed in 1999. Current renovations and improvements should expand total capacity to 9.2 Mmt/y or 446 billion cubic feet (Bcf) by 2005. A forth train is also planned.

Ragas is Qatar's second LNG project. The two major shareholders are QGPC and Exxon Mobil. The first train was completed in 1999 and the second followed in April 2000. An additional third and forth trains are planned, and the third is expected to be the largest in the world with a 4.7 Mmt/y capacity upon completion in 2004. According to RasGas managing director Neil Kelly, "Qatar's LNG will be a force to be reckoned with in world terms."[105]

Qatar is pressing ahead with other high priority gas projects. These include the $300 million gas lift project at Dukhan, and the second phase of the Khuff pipeline development. They also include the construction of a $400 million NGL-4 plant at Mesaieed by QGPC.

One of Qatar's most ambitious projects is the Dolphin Energy Project, , an integrated natural gas pipeline grid for Qatar, UAE, and Oman, with a possible subsea extension linking Oman to Pakistan. This pipeline is to provide gas fuel for the UAE and Oman as their gas production declines, and allow them to free oil for exports and for downstream projects. The total project is expected to cost around $10 billion, including the costs associated with the development of more extensive gas distribution networks in the UAE and Oman.

The project has, however, had an uncertain history. The United Offsets Group (UOG), a UAE state-owned corporation supporting the project, signed preliminary memorandums of understanding with Qatar, Oman, and Pakistan in June 1999. ExxonMobil also signed a

preliminary agreement in June 1999 for the natural gas supply from ExxonMobil's production capacity in the North Field.

Qatar was to begin selling around 730 Bcf/y of North Field natural gas, starting in 2006, transported through a subsea pipeline linking the North Field to Abu Dhabi in the UAE. Links between Abu Dhabi, Dubai, and Oman were be added afterwards. The UOG announced in March 2000 that TotalFinaElf and Enron had been selected to implement the project, and each would have an equity stake of 24.5%. In May 2001, however, Enron announced in May 2001 that it was pulling out of the project, and UOG acquired Enron's equity stake, which it resold to Occidental Petroleum in May 2002.

The project is scheduled to have an initial capacity of 20 Bcm a year, and cost some $3.5 billion. It calls for the construction of an 800-kilometer gas pipeline from Qatar's north Field to Abu Dhabi in the UAE that will connect with the existing Jebel Ali pipeline to Dubai. Dolphin Energy projects its investment share at $2.5 billion but Total, Occidental, and the UAE Offsets group may increase their share of the total. Construction is scheduled to begin in 2004, with initial deliveries in 2006.[106] The EIA estimates that Pakistan's participation is now "highly doubtful, due to its financial condition and the possibility of imports from Iran."[107]

Qatar plans to start its biggest gas investment program during 2004-2005. This program will the $12 billion Qatargas II project. It will export 15 million tons a year (t/y) of LNG from the Qatar Liquefied Gas Company (Qatargas) to the United Kingdom. The first delivery is projected to begin in 2008.[108] Qatargas is also working on another project with ConocoPhilips(US). The cost of this project is estimated to be $7.5 billion and it would supply the US market. Its schedule is for the period 2006-2010.[109]

Qatar is also evaluating plans for pipelines to connect Kuwait, Saudi Arabia, UAE and Oman, and plans for pipeline or LNG shipments to Israel. These plans, however, have a total potential cost of $20.6 billion, and present serious political, financing, and technical problems. The most practical option is a sub-sea line to Kuwait through Saudi waters. Kuwait and Qatar signed a protocol for this project in 2002, and for the supply of 7.75 Bcm a year over 25 years beginning in end-2005. The Saudi government gave approval in early 2003, but no Qatari-

Kuwaiti government-to-government agreement has yet been reached, and shipments from Iraq to Kuwait may now be more economic.[110]

The EIA reports that Qatar has also been interested in potential development of Gas-to-Liquids (GTL) projects. Shell signed a contract with Qatar Petroleum in October 2003 for a 140,000 bbl/d GTL facility to be built at Ras Laffan. The first 70,000 bbl/d of capacity is expected to commence operation by 2009, with the rest in 2010 or 2011. If completed, it will be the world's largest GTL plant.[111] Therefore, Qatar will be GTL producer in late 2005. Although the project is still under construction at Ras Laaffan, the Qatar Petroleum and Sasol (South Africa) are working on another project to expand the plant to 120,000 b/d. The Chevron Texaco Corporation (US) will possibly participate in this project.[112]

Qatari Energy Risk

Qatar has settled its border disputes with Bahrain and Saudi Arabia in recent years, and has avoided any confrontation with Iran over the giant offshore gas field the two countries share in the Gulf. It now is home to a major US military presence that deters any foreign threats. Its main source of tension with its neighbors is the result of its tendency to start political feuds and aggressively assert its status and independence.

Qatar is so rich relative to its small native population that it is one of the few MENA status that can subsidize a petroleum-driven, subsidized economy indefinitely. Even so, it is opening up its economy to more efficient operation of its private sector, and has made major progress towards creating democratic institutions, a more effective rule of law, and protecting human rights. Its emir has had health problems, but Qatar has so far shown few signs of political instability, other than jockeying for power among members of the royal family. When its oil exports are combined with the growing exploitation of vast gas resources, effective state planning and management of energy development, and a reasonable pace of political reform, short to mid-term energy development risks are low.

Yemen

Yemen has limited to moderate importance to world energy markets because of its oil and natural gas resources and because of its strategic location overseeing the Strait of Bab el-Mandab, which links the Red Sea and the Gulf of Aden, one of the world's most active shipping

lanes. According to US sources, Yemen has 4.0 billion barrels of proven oil reserves, or 0.4 % of the worlds supply, and 16.9 Tcf of proven gas reserves, or 0.3% of the world's supply.[113] According to Yemen, the country's oil reserves stood at about 5.7 billion barrels in May 2000, and its gas reserves were about 15 trillion cubic feet. President Saleh announced these figures in a televised address to mark 10 years of unification between the north and south of the Arab state.[114]

Yemen's oil production rose from 170,000 bbl/d in 1988 to 180,000 bbl/d in 1990, and 350,000 in 1995. It averaged 350,000 bbl/d in 1996, 370,000 in 1997, and 385,000 in 1998. Its production was 440,000 barrels per day in 2000, 438,000 barrels per day in 2001, and 443,288 in 2002.[115] These increases came largely from the Jannah field, where production is projected to rise to 75,000 bbl/d, and the East Shabwa field, where production will increase 50% to 30,000 bbl/d.

Yemeni Oil Development

Nabil al-Gawsi, chairman of Yemen's oil ministry's petroleum exploration and production board, stated in May 2000 that, "We are trying to increase production from these blocks and also from exploration blocks…maybe 100,000, 200,000 bbl/d during the coming years." He said Yemen had 59 concession blocks, including the six blocks that were either already producing or would soon start, while 23 blocks were under exploration. The rest were open, he added. Gawsi said there were some 19 foreign firms operating exploration or producing concessions and more than 25 sub-contractors in the country.[116]

Exploration for additional reserves and the search for new investments from foreign companies has been affected by political instability. Foreign involvement began to decline in 1994, due mainly to the civil war between north and south Yemen, unattractive exploration and production contractual conditions, and the low success rate of new hydrocarbon discoveries. Exploration activity increased again in 1997 after the civil war ended and the government started to offer more attractive contract terms. By mid-1997, approximately 20 exploration agreements were in force with foreign oil companies.

After the border demarcation treaty with Saudi Arabia that was signed in Jeddah on June 12, 2000, new areas were opened for exploration. Four new blocks have been demarcated along

the Saudi border. Several companies have already declared their intensions to explore these new fields. In January 2001, Nexen signed a memorandum of understanding with the Yemeni government, covering Block 59, which is located by the Saudi border. In December 2001, the consortium of Austria's OMV, Cespa of Spain, and PanCanadian signed an exploration and production contract for Block 60.[117]

Yemeni Refining and Petrochemicals

Yemen currently has a crude refining capacity of 130,000 bbl/d from two refineries. Yemen signed an agreement in December 2002 with the Hadramawt Refinery Company, backed by Saudi investors, for a $450 million facility with a capacity of 50,000 bbl/d to be completed at Mukalla by 2005. A feasibility study is being conducted for a new 100,000-bbl/d refinery at Ras Issa, located on the Red Sea.

Yemeni Natural Gas Development

Yemen has proven natural gas reserves of 15-16.9 trillion cubic feet, about 0.3% of the world supply, and has some potential as a natural gas producer. The bulk of these reserves, in the form of both associated and non-associated gas, are concentrated in the Marib-Jawf fields, operated by the Yemen Exploration and Production Company (YEPC). However, few facilities for recovering and using associated gas have been installed. All of Yemen's gas production is either reinjected or sold as natural gas liquids.

In early 1996, France's Total and Yemen's General Gas Corporation set up YLNG to operate a $5 billion liquefied natural gas (LNG) project. The venture, Yemen's largest single energy project, is to develop natural gas from the Marib-Jawf and Jannah fields, and transport it via pipeline to a natural gas processing plant and export terminal in Balhaf on the coast of southern Yemen. The plant will have an export capacity of 5.3 million tons per year (Mmt/y) of LNG from two 2.65 Mmt/y trains.

Yemeni Energy Risks

Yemen has made progress towards political reform. It still, however, is politically divided and has a long history of political violence. It is also a country that has been the location of significant terrorist activity. In spite of its progress in energy development, it is an extremely poor country with a rapidly growing population and little success in broader economic

diversification and development. Short to mid-term energy development risks are medium to high.

The Levant: Egypt, Israel, Jordan, Lebanon, and Syria

The Levant acts as a major route for exporting energy, but its total oil and gas reserves – which include those of Egypt, Israel, Jordan, Lebanon, and Syria – are so limited that they have little strategic importance and impact on the world supply of energy. As has been described in Chapter II, Egypt is important to energy supply because of the Suez Canal and the Sumed Pipeline. The energy resources of the other states of the Levant are important largely because of their impact on regional stability of the MENA region, and because of the geopolitical impact of the Arab-Israeli conflict.

BP estimates Egypt's oil reserves at 3.7 billion barrels, about 0.4% of the world supply. Syria's reserves are 2.5 billion barrels, or 0.3% of world supply. [118] Egyptian oil production has slowly declined from around 0.9 MMBD in 1982 to 0.75 MMBD in 2003 – when it accounted for about 1.0% of world production. Syrian oil production has risen slightly from around 0.52 MMBD in 1982 to 0.58 MMBD in 2003 – when it accounted for about 0.8% of world production. This gives the Levant a total of 0.7% of the worlds proven reserves and about 1.8% of its total current production. Neither Egypt nor Syria is an OPEC state, and the EIA does not make long-term forecast of their national production.

Egypt continues to discover additional gas, and Israel and Jordan may have small resources. BP estimates Egypt's gas reserves at 22.7 billion cubic meters, about 0.9% of the world supply. Syria's reserves are 4.1 billion cubic meters, or 0.2% of world supply.[119] Egyptian gas production has risen steadily from around 8.4 billion cubic meters in 1982 to 22.7 in 2003 – when it accounted for about 0.9% of world production. Syrian oil production has risen slightly from around 1.6 billion cubic meters in 1982 to 4.1 in 2003 – when it accounted for about 0.2% of world production. This gives the Levant a total of 1.1% of the worlds proven gas reserves and about 1.1% of its total production.

Egypt

Egypt is currently a small exporter of energy, but Egypt's oil export revenues are one of the country's top four main foreign exchange earners, (along with tourism, Suez Canal fees, and

worker remittances from abroad). The EIA estimated in January 2004 that Egypt had 3.7 billion barrels of oil reserves and a reserve-to-production ratio of 10:4. Egyptian oil production comes from four main areas: the Gulf of Suez (over 50%), the Western Desert , the Eastern Desert , and the Sinai Peninsula. The Egyptian Ministry of Petroleum estimates it has 62.0 trillion cubic feet (Tcf) of gas.

Egyptian Oil Development

Successive years of declining crude oil production, and a lack of new major discoveries, have led to a steady deterioration in Egypt's petroleum trade balance. Net petroleum receipts amounted to approximately $1.6 billion in 1996, fell to only $156 million in 1998, and moved into deficit during 1999. Part of the reason was Egyptian payments to foreign partners for their share of gas production. As of February 2000, Egypt was negotiating with international oil companies on a new gas clause that could introduce an amended gas price formula for the production sharing agreements (PSAs) for all upcoming licensing rounds. The gas clause, originally introduced in late 1980s, was designed to encourage exploration for and the development of natural gas in Egypt by offering favorable terms to exploration companies. However, the expenditures contained in the clause are now becoming fully apparent.[120]

Estimates of recent average daily production differ, but are all under 1 MMBD. The EIA estimates that Egypt's crude oil output has fallen in recent years from 920,000 bbl/d in 1995, 922,000 bbl/d in 1996, 856,000 bbl/d in 1997, 866,000 bbl/d in 1998, and 866,000 bbl/d during the first five months of 1999. In January 2004, the EIA reported that Egypt averaged 752,000 barrels per day (bbl/d) in 2003, of which was 620,000 bbl/d is crude oil. Its domestic consumption had risen to 558,000 bbl/d, and net exports were only 194,000 bbl/d. BP estimates that Egypt averaged 921,000 bbl/d in 1994, 924,000 in 1995, 894,000 1996, 873,000 in 1997, 857,000 in 1998, 827,000 in 1999, 781,000 in 2000, 758,000 in 2001, and 751,000 in 2002.[121]

Egypt is hoping that exploration activity, particularly in new areas, will discover sufficient oil in coming years to maintain crude oil production comfortably above a level of 800,000 bbl/d. Crude oil from the Gulf of Suez basin is produced mainly by the Gupco (Gulf of Suez Petroleum Company) joint venture between BP Amoco and Egypt's General Petroleum Corp. Production in the Gupco fields, which have been in operation since the 1960s, has been falling rapidly, though it remains at levels over 300,000 bbl/d. Gupco seems to have been

successful in reversing the natural decline in its fields through significant investments in enhanced oil production as well as increased exploration. Production rose to 330,000 bbl/d, and BP Amoco announced a new discovery in the South Ghareb concession in the Sinai that flowed at 18,000 bbl/d by early 1998, with reserves of 25 million cubic meters. Next to Gupco, Egypt's second largest producer is Petrobel (Italian company Eni's Egyptian subsidiary), which produces around 290,000 bbl/d in a joint venture with EGPC. Petrobel is active mainly in the Gulf of Suez and Sinai.

Egyptian Refineries and Petrochemicals

Egypt's Petroleum Minister Hamdi el-Banbi proposed in the past that Egypt try to deal with this situation by shifting from exports of crude to exports of product, but it is unclear whether Egypt can do this. Egypt's refineries barely meet domestic demand and Egypt imports significant amounts of light product.

Egypt's nine refineries have the capacity to process 726,250 bbl/d of crude. Egypt's future plans include increased production of lighter products, petrochemicals, and upgrading and expanding existing facilities.[122] The Oriental Petrochemicals Company, a local private venture, is planning to build a polypropylene plant in Alexandria that will utilize natural gas from Western Desert fields as feedstock. The plant is expected to cost about $80 million and produce more than 120,000 metric tons of polypropylene annually. Additionally, Phillips Petroleum is looking to establish a joint venture in Egypt to build a polyethylene plant with an annual capacity of 150,000 tons. The plant would use natural gas (ethane) as a feedstock.

Egypt's Role in Energy Transport Routes

In addition to its role as an oil exporter, Egypt has strategic importance to Middle East energy because it controls two routes for the export of Persian Gulf oil: The Suez Canal and Sumed (Suez-Mediterranean) Pipeline, two routes for. This currently involves the flow of 3.5 million bbl/d of oil (1.1 million bbl/d through Suez Canal, 2.4 million bbl/d through Sumed Pipeline). The principal destinations are Europe and the United States. Closure of the Suez Canal and/or Sumed Pipeline would force tankers to go around the southern tip of Africa (the Cape of Good Hope), and increase transit time and cost. Such an event now seems very unlikely, but does represent a low-level geopolitical risk.

The Suez Canal Authority (SCA) is continuing enhancement and enlargement projects on the canal, although tanker traffic and revenues have declined over the last decade as a result of the competitive pipelines and alternative routes, such as South Africa. The canal has been deepened so that it can accept the world's largest bulk carriers, but it will need to be deepened further to 68 or 70 feet to accommodate fully laden very large crude carriers (VLCCs). Additional dredging reached a depth of 62 feet in the year 2000. It will need to be deepened further to 68 or 70 feet to accommodate fully laden very large crude carriers. The SCA is also offering a 35% discount to LNG tankers as well as some other discounts for oil tankers in order to increase the tanker traffic to its old levels.[123]

The Sumed pipeline is an alternative to the Suez Canal for transporting oil from the Persian Gulf region to the Mediterranean. The 200-mile pipeline runs from Ain Sukhna on the Gulf of Suez to Sidi Kerir on the Mediterranean. The capacity of the pipeline is 2.5 million bbl/d. An extension of the pipeline is being studied. This extension would traverse the Red Sea from Ain Sukhna to the closest point on the Saudi coast near Sharm al Sheikh, and then continue to link up with the terminal of Saudi Arabia's main east-west pipeline in Yanbu. Sumed consists of two 42-inch lines, and is owned by Arab Petroleum Pipeline Co, a joint venture of EGPC, Saudi Aramco, Abu Dhabi's ADNOC, three Kuwaiti companies, and Qatar's QGPC.[124] Egypt and Libya have also announced plans to build a crude oil pipeline. The 600 km (375 mile), 150,000 bbl/d line would transport Libyan crude from Tobruk to Alexandria for refining and sale in Egypt. The pipeline is expected to cost $300 million, and should take 3-4 years to complete. In exchange, Egypt may export 500 million cubic feet per day of gas to Libya.

Egyptian Natural Gas Development

As a result of increased domestic demand for petroleum products, Egypt is pursuing a policy of substituting natural gas for fuel oil as a means of reducing oil consumption and freeing up more oil for export. Eng. Sana'a El Banna, First Under Secretary for Technical Affairs at the Egyptian Ministry of Petroleum, stated that Egypt is "actively trying to maximize natural gas use in order to reduce dependency on liquid fuels."

Egypt's natural gas sector is expanding rapidly, as production nearly doubled between 1999 and 2003. Production averaged 1.6 billion cubic feet per day (Bcf/d) at the beginning of 1999, increased to 2.3 Bcf/d at the end of year, reached 3.0 Bcf/d at the end of 2002, averaged

about 3.3 Bcf/d in 2003, and expected to rise to around 5.0 bcf/d by 2007.[125] Proven natural gas reserves have increased significantly in recent years, with major discoveries along the Mediterranean Coast/Nile Delta region and in the Western Desert.

After an intensive period of exploration Egypt's proven gas reserves reached 62 trillion cubic feet (Tcf) in November 2003. This compares with 15 tcf in January 1993. Most of this increase has come about as a result of new gas discoveries in the Mediterranean offshore/Nile Delta region, and increasingly in the Western Desert. Offshore activity may also increase in the future, On 17 February 2003, Egypt and Cyprus signed an accord delineating their maritime border. Egypt aims to boost its oil and gas exploration in the Mediterranean offshore. Therefore, Egypt's proven gas reserves are expected to increase rapidly in 2004 due to the continuing oil exploration projects.[126]

In the Nile Delta, which has emerged as a world-class gas basin, recent offshore field developments include Port Fuad, South Temsah, and Wakah. In the Western Desert, the Obeiyed Field is an important natural gas area currently under development. Overall, more than half of Egypt's natural gas production comes from just two fields: Abu Madi (on stream since the 1970s) and Badreddin (since 1990). Abu Qir is the third largest field, and like Abu Madi is considered mature.

The International Egyptian Oil Company (IEOC), a subsidiary of Italy's ENI group, is Egypt's leading natural gas producer. In cooperation with BP Amoco, IEOC has been concentrating its natural gas exploration and development efforts in the Nile Delta region. The $1 billion development program is expected to yield about 365 billion cubic feet (Bcf) annually beginning in 2000. In November 1997, Amoco announced plans to develop the giant Ha'py gas field in the Ras-el Barr concession of the Nile Delta region at an estimated cost of $248 million. The gas, up to 2 Tcf annually, was marketed domestically beginning in 2000. The field came online in 2000 and produces an output of 280 million cubic feet per day.[127]

In October 1998, BP Amoco and Eni-Agip signed a gas sales agreement with EGPC and IEOC for the reserves at the Temsah gas field. Field development is expected to cost $700 million, as production began late 1999. Temsah's gas reserves are estimated at 3.9 Tcf, and the gas sales agreement is for 35 Mmcf/d initially, increasing to 480 Mmcf/d by 2003.[128] Two areas

in the Western Desert – Obeiyed and Khalda – have also shown great potential for increasing Egypt's gas production

The rapid increase in Egypt's natural gas reserves and production has encouraged ambitious plans for gas exports (either by pipeline or liquefied natural gas tanker) to such countries as Turkey, Israel, Jordan, and the Palestinian territories. Pricing issues have complicated these plans – specifically, how much exported gas should cost relative to domestically consumed gas. The International energy Agency, however, estimates that Egypt may complete five major LNG projects by 2007:[129]

Location	Start up	Cost ($Billion)	Capacity (Mt/year)	Status	Companies
Idku	2005	1.35	train 1:3.6	under construction	BG, Petrogas, EGPC, EGAS, GDF
	2006	0.55	train 2:3.6	under constructuon	BG, Petrogas, EGPC, EGAS
	2007	1.5	tran 3:4.0	planned	EGPC, BP, ENI
Damietta	2004	1.0	train 1:5.0	planned	EGPC, EGAS, Union fenosa, ENI
	2006	1.0	train 1:4.0	planned	EGPC/Shell

Egypt also plans to export gas to Jordan. In October 1997, EGPC and IEOC signed an agreement under which IEOC will build a $60 million, 140 Bcf-per-year natural gas pipeline from the Nile Delta offshore region under the Suez Canal into northern Sinai. In July 1997, Egypt and Jordan started negotiations on a possible gas pipeline across the Sinai and under the Red Sea to the southern Jordanian port city of Aqaba, where the line would link with Jordan's national gas grid. In November 1998, BP Amoco signed an agreement with Egypt and Jordan to build a relatively small capacity gas pipeline across the Sinai and under the Gulf of Aqaba to Jordan. A 270 km gas pipeline to Jordan was inaugurated by King Abdullah and Hosni Mubarak in July 2003, making Egypt's first exports of natural gas possible. Egypt aims to extend this pipeline into Syria, with eventual gas exports to Turkey, Lebanon and possibly Cyprus. The feasibility of this project, however, is questionable since Turkey has already agreed to buy Russian, Iranian, and Azeri gas.

The natural gas "Peace Pipeline" to Israel was stalled along with the Middle East peace process during the administration of Benjamin Netanyahu. There was increased hope for the project after the election of Ehud Barak in May 1999, but efforts halted again with the outbreak of the Second Intifada in September 2000. Italy's ENI completed a pipeline that goes up Egypt's Mediterranean coast to El-Arish, which might be perceived as a starting point for the export

pipeline to Israel. EIA, however, indicated that contacts between Egypt and Israel on the issue of extending the pipeline resumed in late 2003.[130]

Egypt as an Energy Risk

Egypt is a major power in the Arab world and one of the most influential states in the MENA region. It has a moderate secular regime, and is now the most powerful Arab military power, strengthened by its alliance with the US and US military aid. It has also been a key player in the Arab-Israel peace process.

Egypt has, however, made little progress in recent years towards political and economic reform. fought a decade long battle to control Islamic extremists and terrorism. It has large and growing population and – in spite of one economic reform effort after another -- has not succeeded in modernizing and diversifying its economy. The EIA reports that the private sector's percentage of the GDP has been growing by around 1.5% per year in recent years, at best a third of the required rate.[131]

Egypt's plans for the privatization of state-owned enterprises have moved slowly due to unrealistic calculations of the reforms necessary to make such firms competitive at market prices, the large debts, and massive overstaffing which current labor regulations make difficult to reform. Although some 40% of Egypt's state-owned enterprises have been privatized since 1994, there have been few practical benefits other than reducing the cost of inefficient entities. The government plans to target "strategic" areas for privatization, including telecommunications and other utilities, including the Egyptian Electricity Authority. It does not intend to privatize the Egyptian General Petroleum Corporation (EGPC) and the new natural gas entity, Egypt Gas (EGAS). Egypt talks a game it does not really play. It is burdened by a large, inefficient state sector ands private sector development has been limited by a variety of state barriers and disincentives.

Egypt also faces the problem of finding a successor to President Mubarak, and moving towards more political pluralism. Its economic reform plans are being implemented too slowly, and it still faces a challenge from Islamic extremism and terrorism. Short and mid-term energy risks are moderate.

Syria

Syria is not a major oil exporter, but could become a major transit route for oil shipments from the Gulf. Syria had about 2.5 billion barrels of proven reserves in 2000, or 0.2% of the world supply. The EIA reports that Syria's oil output increased dramatically in the mid-1980s and 1990s, peaking at 590,000 bbl/d in 1996. Since that time, its oil output appears to have begun a steady decline by as much as much as 6% per annum, as older fields, especially the 140,000 bbl/d Karatchuk field discovered in 1968, reached maturity. The EIA estimates that total Syrian oil production peaked at 590,000 bbl/d in 1996. It was 570,000 bbl/d in 1997, 546,000 bbl/d in 1999, and 525,682 bbl/d in 2002.[132] Production is expected to fall steadily over the next several years and domestic consumption continues to rise. Syria had net exports of only 257,000 bbl/d in 2002, not counting some 150,000-200,000 bbl/d of oil smuggle in from Iraq. The EIA estimates that Syria could become a net oil importer within a decade.

While Syria's oil exports have had little impact on world energy balances, they have been critical to Syria's economy, accounting for 55%-60% of Syria's total export earnings. Syria currently exports Syrian Light, a blend of light and sweet crudes produced primarily from the Deir ez-Zour and Ash Sham fields, and heavy Suwaidiyah crude produced from the Soudie and Jebisseh fields. The country also exports fuel oil and other products, including oil sent illegally from Iraq. Syria is a member of OAPEC (the Organization of Arab Petroleum Exporting Countries), although not of OPEC.

Syrian Oil Development

Syria's main oil producer is al-Furat Petroleum Co. (AFPC), a joint venture established in May 1985 between state-owned Syrian Petroleum Company, or SPC (50% share), Pecten Syria Petroleum (15.625%), and foreign partners Royal Dutch/Shell (15.625%) and Germany's Deminex (18.75%). Shell and Deminex have signed a new oil exploration contract with SPC for northeastern Syria.

The SPC's fields include: 1) Karatchuk—Syria's first discovery, located near the border with Iraq and Turkey; 2) Suwaidiyah—a giant heavy oil field located south of Karatchuk in the Hassakeh region and extending into northwestern Iraq; 3) Jibisseh—a major field producing both oil and gas; 4) Rumailan—a small field near Suwaidiyah which produces heavy oil; and 5) Alian, Tishreen, and Gbebeh—three small, depleting fields producing heavy oil. Other major Syrian oil

fields include: Maleh (production of more than 50,000 bbl/d); Qahar (40,000 bbl/d); Sijan (35,000 bbl/d); Azraq (30,000 bbl/d); and Tanak (18,000 bbl/d). Jafra, discovered in late 1991, was first expected to have potential for more than 60,000 bbl/d in production. Currently, Jafra is producing only 20,000 bbl/d, however. Besides conventional oil reserves, Syria also has major shale oil deposits in several locations, mainly the Yarmouk Valley stretching into Jordan.

Syria's oil development has been politicized and inefficient. Al-Furat's fields in the northeast – particularly the Deir ez-Zour region, where commercial quantities of oil were discovered in the late 1980s – produced about 350,000-360,000 bbl/d of high quality light crude in 1997-1998, a significant decline from 405,000 bbl/d in 1994. Al-Furat's main oil field is al-Thayyem, although production there has been declining since 1991. Another important field, Omar/Omar North, began production in February 1989 at 55,000 bbl/d.

Shortly thereafter, operator Shell was pressed by the cash-strapped Syrian government to step up production (against Shell's advice) to 100,000 bbl/d. The result was serious reservoir damage, and in April 1989, output plummeted to 30,000 bbl/d. Currently, Omar produces about 15,000 bbl/d from natural pressure and 30,000 bbl/d from water injection. Other al-Furat fields include: 1) al-Izba, with light oil production of 55,000 bbl/d; 2) Maleh, with output of about 50,000 bbl/d of 34o API gravity oil; 3) Sijan, at about 30,000 bbl/d; and 4) Tanak, producing around 18,000 bbl/d.

In 1996, al-Furat began a 5-year production cutback schedule of 10,000 bbl/d annually, but production has fallen even faster. Production from fields run by SPC peaked in the late 1970s at more than 165,000 bbl/d.

Syria's economic reforms have either failed or moved too slowly in virtually every respect, and oil is no exception. Oil exploration activity in Syria has been slow in recent years due to unattractive contract terms by SPC, and poor exploration results. For these reasons, only four companies (Elf, Shell, Deminex, and Marathon) out of 14 operating in the country in 1991 remain in Syria at present. Since June 1996, when Mohammed Maher Jamal, a geologist, replaced Nader al-Nabulsi as Oil and Mineral Wealth Minister (as part of an anti-corruption drive), exploration has picked up somewhat, although drilling activities are limited to a small number of companies. In November 1997, a new 12,000-bbl/d oil well ("al-Kashmeh") began

production near the Syrian-Iraqi border. The well represents a joint venture between SPC and the Irish company Tullow. In October 1998, however, Tullow withdrew its concession and closed operations in Syria, citing reduced oil revenues due to low oil prices. Similarly, officials at TotalFinaElf announced their intentions to scale back their Syrian operations in May 2002.[133]

Only about 36% of the country's estimated 800 potential oil and gas structures have been drilled. No major new oil reserves have been discovered since 1992. Without significant new discoveries in the next few years, Syrian and foreign oil company officials (including Shell, the main foreign operator) believe that the country could become a net oil importer as early as 2005. The last time Syria was a net oil importer was in 1987 (Syria bought from Iraq until April 1982, when it switched to Iran as an ally and oil supplier and closed the 1.1-1.4 million-bbl/d-capacity IPC pipeline from Kirkuk to Banias). The Syrian government has reacted and the Syrian Petroleum Company (SPC) decided to launch a new round of oil exploration licenses in early January 2004. Ten oil blocks are opened to international oil companies for exploration. [134]

Syria markets all of its crude oil, including that produced by foreign companies, through its state marketing company Sytrol. Prices for Syrian Light and Suwaidiyah blends are tied to the price of dated Brent and are adjusted monthly. At present, Sytrol has term contracts with more than 20 companies, including Agip, Bay Oil, ChevronTexaco, ConocoPhilips, Marc Rich, OeMV, Royal Dutch Shell, TotalFinaElf, and Veba.

Syrian Energy Export Routes

Syria's major oil export terminals are at Banias and Tartous on the Mediterranean, with a small tanker terminal at Latakia. Banias can accommodate tankers up to 210,000 dwt, and has a storage capacity of 437,000 tons of oil in 19 tanks. Tartous can take tankers up to 100,000 dwt, and is connected via a pipeline to the Banias terminal. Latakia can handle oil tankers up to 50,000 dwt. The Syrian Company for Oil Transport (SCOT), a sister of SPC, operates all three terminals.

SCOT is also in charge of Syria's pipelines. Main internal pipelines are: 1) a 250,000 bbl/d export pipeline from SPC's northeastern fields to the Tartous terminal with a connection to the Homs refinery; 2) a 500,000 tons/year refined products pipeline system linking Homs refinery to Damascus, Aleppo, and Latakia; 3) a 100,000 bbl/d spur line from al-Thayyem and

other fields to the T-2 pumping station on the old Iraqi Petroleum Company (IPC) pipeline; 4) a spur line from the al-Ashara and al-Ward fields to the T-2 pumping station.

A thaw in relations between Iraq and Syria before the Iraq War led Iraq to export oil once again through the IPC pipeline in Syria. On July 14, 1998, Syria and Iraq signed a memorandum of understanding on reopening the pipeline. Both the Iraqi and Syrian sections of the IPC pipeline were reportedly ready for operation in early March 2000. While Syria was using parts of it to transport its own crude oil to Mediterranean terminals, the UN will have to approve any Iraq oil exports through Syria.[135]

Syrian Natural Gas Development

Syria's proven natural gas reserves are estimated at 8.5 trillion cubic feet (Tcf), which do not equal even 0.1% of the world supply, and are located mainly in eastern Syria, while population is centered in western and southern Syria. Most (73%) of these reserves are owned by SPC, and approximately 54% of the country's gas production is associated gas. [136] In, 2001, Syria produced about 206 billion cubic feet (Bcf) of natural gas, a slight decline from the 213 Bcf produced in 2000.[137] In 1998, Syria produced about 208 billion cubic feet of natural gas, an approximately five-fold increase over the past decade. It plans to increase this production even further in coming years, as part of a strategy to substitute natural gas for oil in power generation in order to free up as much oil as possible for export. A number of new gas-fired power projects are currently under construction or being planned.

The Syrian government has enacted a new law to establish the Syrian Gas Company (SGC). The Company will be an independent public company, and will take over all gas-related responsibilities and operations that has been handled by the state owned Syrian Petroleum Company.[138]

SPC currently is working to increase Syria's gas production through several projects. The Palmyra area in central Syria is the site of much of this activity, including development of the Al Arak gas field, which came on stream at the end of 1995. Two other "sweet gas" fields in Palmyra include Al Hail and Al Dubayat, both of which came on line in 1996, while two "sour gas" fields – Najib and Sokhne – began production during 1998. Syria may, however, have somewhat larger reserves than most current estimates. The Syrian Petroleum Company (SPC) is

expected to award contracts for a $750-800 million project to develop the non-associated gas fields in the Palmyra region. Syria declared the it would give its decision by the end of January 2004. At least five major international oil companies submitted their bids for the contract; including, Total (France)- Sumitomo Corporation (Japan)-Japex (Japan) joint venture, Occidental Petroleum Corporation (US), PetroCanada, and Petrofac International. The project is planned to produce 9 million cubic meters a day of gas for domestic consumption and to supply the Lebanese market.[139] In early 2004, Syria will start exporting 1.5 million cubic meters/day of gas to Lebanon under an agreement signed in late 2001.[140]

Syrian Energy Risk

Syria remains a dictatorship under Bashir Asad, and has made little progress in serious economic reform although it is trying to create a climate that can attract more foreign investment. Syria is also seeking to improve its relations with the EU and to join the WTO. So far, however, early hopes that Bashir would offer political and economic reform after he succeeded his father on June 10, 2000 have produced cosmetic results at best. There has been some improvement in the banking industry, but scarcely enough. Privatization efforts have been replaced with ineffective efforts to make public companies more efficient, and the private sector remains crippled by over regulation and an administrative jungle. The government remains repressive in terms of politics, the economy, and human rights, and faces a massive demographic challenge in terms of employment and raising per capita income.

Syria faces a continuing risk of involvement in the Arab-Israeli conflict, and is treated as a sponsor of terrorism by the US. The present instability of Iraq compounds Syria's problems. Until Syria achieves significant political and economic reform, it will remain a moderate energy risk.

Jordan

Jordan has no meaningful oil resources of its own, and its importance in Middle Eastern energy is largely political. Jordan has relied on Iraqi oil for most of its needs (around 106,000 barrels per day (bbl/d) in 2002).[141] Jordan's oil imports from Iraq before the Iraq War were worth around $500 million, and were permitted by the United Nations under a special dispensation from the general UN embargo on Iraq. Jordan has discussed the possibility of reducing this dependence by importing oil from Saudi Arabia and Kuwait, but no agreements

have been concluded. The United States has been active in encouraging any move by Jordan away from Iraqi oil.

There are possibilities that Jordan's energy status could change. In February 1998, Jordan signed an agreement with Shell Oil to extract crude oil from the country's abundant (possibly as high as 40 billion tons) oil shale resources, but later dropped the project. Canada's Suncor conducts limited exploration digging in the Lajjun area, southwest of Amman. Jordan has looked into burning oil shale directly to generate electricity. Several tests of the physical and chemical characteristics of Jordan's shale oil resources have shown them to be of high quality. Other features of the shale oil include the likelihood of relatively easy mining due to a small overburden (the amount of dirt and rock), as well as proximity to water sources and other necessary infrastructure. The economics of these ventures, however, are tenuous unless substantial rises continue in world oil prices.

If Iraq does reemerge as a stable supplier of Jordan, it may construct a pipeline. In 1998, Jordan and Iraq agreed on construction of a joint oil pipeline with an initial capacity of 100,000 bbl/d. Such a pipeline would have considerable value to Jordan because it now receives nearly all its oil from Iraq, via 1,500 of tanker trucks. These trucks cost Jordan an estimated $60 million per year in damaged roads, traffic, and environmental damages. The proposed 400-mile, $250-$300 million pipeline would carry oil from Iraq to the existing Zarqa refinery northeast of Amman, as well as the new refinery in Aqaba.[142] What is not clear is that a new Iraqi government will have the same incentive to subsidize Jordanian oil that Saddam Hussein's government had while Iraq was under sanctions.

Jordan's state Natural Resources Authority (NRA) has been promoting exploration within the country, which has been relatively unexplored until now. In October 1995, the NRA signed agreements with Malaysia's Petronas and Houston-based Trans-Global Petroleum for possible exploration of northern and central Jordan. To help attract foreign investment, the Jordanian government has plans to privatize its oil sector. In October 1995, the country set up the state-owned National Petroleum Co. (NPC) to handle upstream oil and gas exploration and development. The intent is for NPC to operate as independently as possible, and eventually to be privatized.

It is unlikely that any of these developments will make Jordan a major energy producer, but the Department of Energy estimates that Jordan might become a major center for oil exports. It feels that a comprehensive settlement of the Arab-Israeli conflict could affect Middle East oil flows significantly because Jordan's geographic location between the Arabian peninsula and the Mediterranean coastal states of Israel and Lebanon offers a potential alternative route for exports of Gulf oil to the West. At present, these oil exports must travel either by ship (through the Suez Canal or around the horn of Africa), by pipeline from Iraq to Turkey (capacity 0.8-1.6 million bbl/d), or via the Sumed (Suez-Mediterranean) Pipeline (capacity 2.4 million bbl/d).

Utilization of the Trans-Arabian Pipeline (Tapline) could offer another potentially economic alternative. The Tapline was originally constructed in the 1940s with a capacity of 500,000 bbl/d, and intended as the main means of exporting Saudi oil to the West (via Jordan to the port of Haifa, then part of Palestine, now a major Israeli port city). The establishment of the state of Israel resulted in the diversion of the Tapline's terminal from Haifa to Sidon, Lebanon (through Syria and Lebanon). Partly as a result of turmoil in Lebanon, and partly for economic reasons, oil exports via the Tapline were halted in 1975. In 1983, the Tapline's Lebanese section was closed altogether. Since then, the Tapline has been used exclusively to supply oil to Jordan, although Saudi Arabia terminated this arrangement to display displeasure with perceived Jordanian support for Iraq in the 1990/1 Gulf crisis.

Jordan is also a potential customer for Egyptian gas. The Jordanian government awarded a contract in June 1998, to build a 170-mile natural gas pipeline from fields in Egypt's Nile Delta region across the Sinai and under the Red Sea to Aqaba. In July 2003, King Abdullah and Hosni Mubarak inaugurated the Egyptian portion of the Egypt-Jordan pipeline that reached to the Jordanian port Aqaba. The gas is to be used as a replacement for the diesel and fuel oil now used to generate electricity. Construction began on Jordan section of pipeline, which will be 393 kilometers long. The project is a part of a greater inter-regional project to export Egyptian gas to Jordan and then to Syria and Lebanon by 2006.[143]

Jordan is not a significant player in world energy supply, and has little impact on energy risk. It does, however, face serious demographic and economic pressures, and may not receive

low cost energy supply from Iraq in the future. Coupled to the problems created by the Israeli-Palestinian conflict, risk is moderate to high.

Israel

Israel now depends almost exclusively on imports to meet its energy needs. Israel has attempted to diversify its supply sources and to utilize alternatives like solar and wind energy. In general, however, Israel has relied on expensive, long-term contracts with nations like Mexico (oil), Norway (oil), the United Kingdom (oil), Australia (coal), South Africa (coal), and Colombia (coal) for its energy supplies. It currently imports about 300,000 barrels of oil per day.[144]

Improved relations with the Arab world encouraged Israel to pursue other, cheaper sources, particularly Egypt, before the collapse of the peace process in September 2000. In 1997, Israel received about 20% of its oil supplies from Egypt, although this share has reportedly fallen since. In November 1998, then National Infrastructure Minister Ariel Sharon said that the major decision on Israel's energy supply for the 21st century had been delayed by one year. This allowed more time to secure supply sources for natural gas, Israel's preferred fuel for several reasons (including environmental and financial), as opposed to coal. Israel hopes to significantly expand (to 25%) natural gas in its energy mix by 2005. [145]

Israeli Dependence on Oil Imports

The Israeli energy sector remains largely nationalized and state-regulated, ostensibly for national security reasons. Little progress on energy sector privatization has been made since the late 1980s, when Paz Oil Company (the largest of three main oil-marketing companies in Israel) and Naphtha Israel Petroleum (an oil and gas exploration firm) were sold to private investors.

Israel has virtually no oil output. Oil exploration in Israel itself has not proven successful in the past (current Israeli oil output is less than 1,000 barrels per day), although drilling is being stepped up. Oil was discovered near the Dead Sea town of Arad in August 1996, and is currently flowing at the rate of about 600 barrels per day.

In the future, Israel might have more importance as an oil shipment route. The U.S. Department of Energy estimates that a comprehensive settlement of the Arab-Israeli conflict could significantly affect Middle East oil flows. Israel's geographic location between the

Arabian Peninsula and the Mediterranean Sea offers the potential for an alternative oil export route for Persian Gulf oil to the West. At present, these oil exports must travel either by ship (through the Suez Canal or around the horn of Africa), by pipeline from Iraq to Turkey (capacity 1-1.2 million bbl/d), or via the Sumed (Suez-Mediterranean) Pipeline (capacity 2.5 million bbl/d).

Utilization of the Trans-Arabian Pipeline (Tapline) offers another potentially economic alternative. The Tapline was originally constructed in the 1940s with a capacity of 500,000 bbl/d, and intended as the main means of exporting Saudi oil to the West (via Jordan to the port of Haifa, then part of Palestine, now a major Israeli port city). The establishment of the state of Israel resulted in the diversion of the Tapline's terminus from Haifa to Sidon, Lebanon (through Syria and Lebanon).

Partly as a result of turmoil in Lebanon, oil exports via the Tapline were halted in 1975. In 1983, the Tapline's Lebanese section was closed altogether. Since then, the Tapline has been used exclusively to supply oil to Jordan, although Saudi Arabia terminated this arrangement to display displeasure with perceived Jordanian support for Iraq in the 1990/1 Gulf War. Despite these problems, the Tapline remains an attractive export route for Persian Gulf oil exports to Europe and the United States. At least one analysis indicates that oil exports via the Tapline through Haifa to Europe would cost as much as 40% less than shipping by tanker through the Suez Canal.

The Iraq War might also affect Israel's energy supplies, if a new Iraqi government establishes good relations with Israel – a questionable assumption. The EIA reports that there has been discussion of "reopening" the old oil pipeline from Mosul in northern Iraq to Haifa. This pipeline was built in the 1930s, and carried 100,000 bbl/d at its peak, but has been closed since Israel's establishment in 1948. The new regime in Iraq, however, has sparked Israeli interest in importing Iraqi oil from the Kirkuk field for use in the Haifa refinery.[146] This may or may not be prove feasible (The Iraqi section of the pipeline is completely rusted and the Jordanian section was sold as scrap metal several years ago). It would, would require hundreds of millions of dollars to repair/rebuild, even if this was politically feasible. Jordan has also strongly denied any

interest in rebuilding the pipeline at the present time, stating that "the pipeline no longer exists in Jordanian territory."[147]

Israel now has only one main operational oil pipeline, known as the "Tipline," built in 1968 to ship Iranian oil from the Red Sea port of Eilat to Haifa (via the Mediterranean port of Ashkelon). As of March 2003, the Eilat-Ashkelon Pipeline Company (EAPC) reportedly was working to reverse flows on the 1.2-million-bbl/d line, so that oil would run from the Mediterranean to Eilat. Russia's Tyumen Oil Company reportedly was interested in the possibility of pumping Russian crude leaving Black Sea ports through the Israeli line to Eilat, where it could be loaded onto tankers for shipment to markets in Asia.

Israeli and Palestinian Gas Development

Israel has looked seriously at importing gas from several countries. Israel and Egypt, for instance, have discussed a possible “peace pipeline” to transport large volumes of Egyptian natural gas across the Sinai Peninsula (or, alternatively, under water) directly to Israel. Whether or not this deal will ever take place, however, is complicated by several factors, both economic and political. For one, Egypt has shown signs that it places higher priority on Turkey as a potential customer. In December 1996, Egypt signed a deal with Turkey making it the most important market for Egyptian gas exports, and raising suspicions that Egypt would abandon its “peace pipeline” to Israel. Israel has also considered natural gas supplies from non-Middle Eastern sources, such as Russia, though a pipeline would be expensive. LNG supplies from Algeria, Australia, Nigeria, Norway, and Qatar also have been discussed, with a possible LNG regasification facility to be built in shallow waters offshore of Ashkelon, Israel. Such a plant would also be expensive.

Israel’s need for such gas imports may, however, be sharply diminishing. During 1999-2002, several energy companies (Israel's Yam Thetis group, Isramco, BG, and U.S.-based Samedan) have discovered significant amounts of natural gas off the coast of Israel (and even more off the Gaza Strip). Initial estimates of 3-5 trillion cubic feet (Tcf) in proven reserves would be enough potentially to supply Israeli demand for years, even without natural gas imports, although this now seems optimistic. [148]

Israel's new offshore gas reserves belong mainly to two groups: 1) the Yam Thetis group (comprising the Avner Oil, Delek Drilling, and Noble Affiliates' Samedan subsidiary); and 2) a BG partnership with Isramco and others. In August 2000, Isramco/BG announced that it had discovered a large gas field 12 miles offshore at its Nir-1 well. The field reportedly contains gas reserves of 274 Bcf, and represents the third gas field discovered offshore Israel during 2000 (the largest two being Mary and Noa, with combined reserves of nearly 1.5 Tcf). In early September 2001, Isramco announced that BG was abandoning the Tommy, Orly, Shira and Aya concessions after analyzing geological and geophysical findings.

Gas has also been discovered in areas that lie in Palestinian territorial waters off the Gaza Strip. The EIA reports that British Gas (BG), which first struck gas in this area with its Gaza Marine-1 well in August 1999, has signed a 25-year contract to explore for gas and set up a gas network in the Palestinian Authority. In December 2000, BG successfully completed drilling a second gas well offshore Gaza. The drilling confirmed findings from the Marine-1 well, which had flowed at 37 million cubic feet per day, indicating possible reserves of around 1.4 Tcf. BG plans to invest $400 million in its offshore Gaza gas finds, which could be used to supply Israel, along with other sources. These plans, however, have so far been blocked by the Israeli government. The exact reasons are not clear but may include a desire to deny the Palestinians the funding or to use the gas deal as a political lever.

Israeli Energy Risks

Israel is actively at war with the Palestinians, is subject to constant terrorist attacks, and could see its present structure escalate to include other Arab states. Near and mid-term energy risks are high.

North Africa

North Africa's energy exports do not approach the strategic and economic importance of the Gulf, but it does play a major role in supporting European markets and its exports have a far greater impact than their size as a percentage of world exports would otherwise indicate. BP estimates that Algeria had a total of 9.2 billion barrels worth of reserves in 2002 ((0.9% of world holdings) , Libya had 29.5 billion barrels (2.8%), and Tunisia had 0.3 billion (less than 0.5%). This is a total of 39.0 billion barrels or 3.7% of total world supply. [149]

Algerian oil production slowly increased from average annual levels of 1.3 MMBD in 1992 to 1.6 MMBD in 2002. It averaged 1.659 MMBD in 2002, or 2.0% of world production. Libyan oil production decreased from average annual level of 1.47 MMBD in 1992 to 1.38 MMBD in 20021.8% of world production. The limits to Libyan production were in part the result of UN sanctions. Tunisia declined from annual levels of 110,000 barrels a day in 1992 to 76,000 in 2002 – 0.1% of world production. [150]

If these figures are combined, the EIA reports that North Africa had a total production capacity of 2.8 MMBD in 1990 and 3.3 MMBD in 2001 – about 4.2% of world capacity. The EIA reference case estimate indicates that North African production capacity will rise to 3.4 MMBD in 2005, and projects a range of 3.2-3.5 MMBD in its low and high oil price scenarios. The figures are, 4.0 (3.5-4.2) MMBD for 2010, 4.3 (3.8-4.7) MMBD for 2015, 5.0 4.45-5.3) MMBD for 2020, and 5.7 4.6-6.1) MMBD for 2025. In 2025, North Africa will account for an estimated 4.5% of world production capacity , according to the EIA reference case estimate.[151]

The fact that Europe is North Africa's major customer is indicated by the fact that BP reports that North Africa exported 2.62 MMBD of petroleum per day in 2002. Some 1.77 MBD went to Europe, 283,000 went to the US, 116,000 barrels to Asian and Pacific states, and 103,000 barrels went to Canada. Exports to other regions averaged less than 100,000 barrels.

The EIA estimates that North African oil exports totaled 2.6 MMBD in 2001, of 4.6% of the world total. The EIA projects that this total will be grow to 4.8 MMBD in 2025, or 5% of the world total.[152] This is a far smaller level of energy exports than from the Gulf. Nevertheless, North Africa will still be an important part of the world market, and its exports will remain of major importance to Europe. North African exports will also be large in comparison with most other regions. The EIA estimates that by 2025, North Africa's exports will slightly exceed the estimated total exports of West Africa (4.7 MMBD, the Caribbean Basin (4.5 MMBD), the North Sea (4.3 MMBD), and Asia (2.1 MMBD). They will be only marginally smaller than the exports from Latin America (5.4 MMBD, and roughly half the combined total of Russia, Central Asia and the Caspian, (9.9 MMBD.)[153]

North Africa also is a major gas exporter. BP estimates that Algeria had a total of 4.52 trillion cubic meters or 159.7 trillion cubic feet of gas reserves in 2002 ((2.9% of world holdings)

, Libya had 1.31 trillion cubic meters or 46.4 trillion cubic feet (0.8%), and Tunisia had negligible reserves. This is a total of 5,83 trillion cubic meters or 206.1 trillion cubic feet -- 3.7% of total world supply. [154] North Africa serves key markets in Southern Europe, and North Africa is also an important gas exporter to Europe.[155]

Algerian gas production increased from average annual levels of 55.2 billion cubic meters in 1992 to 80.4 billion cubic meters in 2002 – 3.2% of world production. Libyan gas production decreased from average annual levels of 6.1 billion cubic meters in 1992 to 5.7 billion cubic meters in 2002 – 3.2% of world production. The limits to Libyan production were in part the result of UN sanctions. [156] As is the case for other regions, the rare no EIA or IEA projections of gas exports which match the projections of petroleum exports.

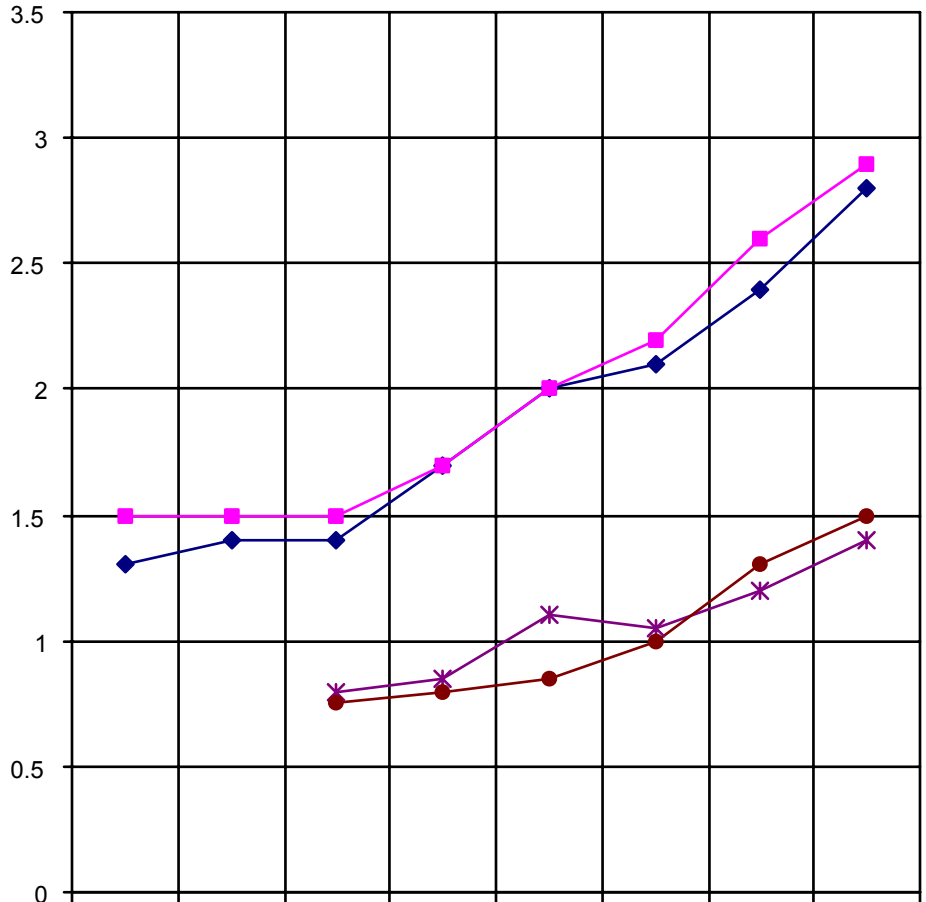
The fact that Morocco, Algeria, Libya, and Tunisia make up much of the southern coast of the Mediterranean gives them added strategic importance to Europe So does the problem posed by emigration from these countries to nations like France, Spain, and Italy. The end of the Cold War has largely ended the regional arms race and much of the terrorist threat from Libya, but many Europeans see internal instability in North Africa as posing a much more tangible future demographic threat than the region ever posed during the Cold War.

Both Algeria and Libya have serious internal stability problems. There is no way to know how long the political crisis and civil war in Algeria will last, or whether the low-level Islamic uprisings in Libya will ever reach more serious levels of civil conflict. Furthermore, it is possible that political unrest in Egypt might add a new North African dimension in terms of a threat to oil movements through the Suez Canal and SUMED pipeline.

- Chart IV.3 shows the EIA reference case projection of the increases in North African oil production during 2001-2025, and provides an illustrative projection of possible oil interruption scenarios.
- Chart IV.4 projects total North African oil exports, showing that Europe remains a dominant market.

Chart IV.3

Estimated North African Oil Production Capacity
(In MMBD)



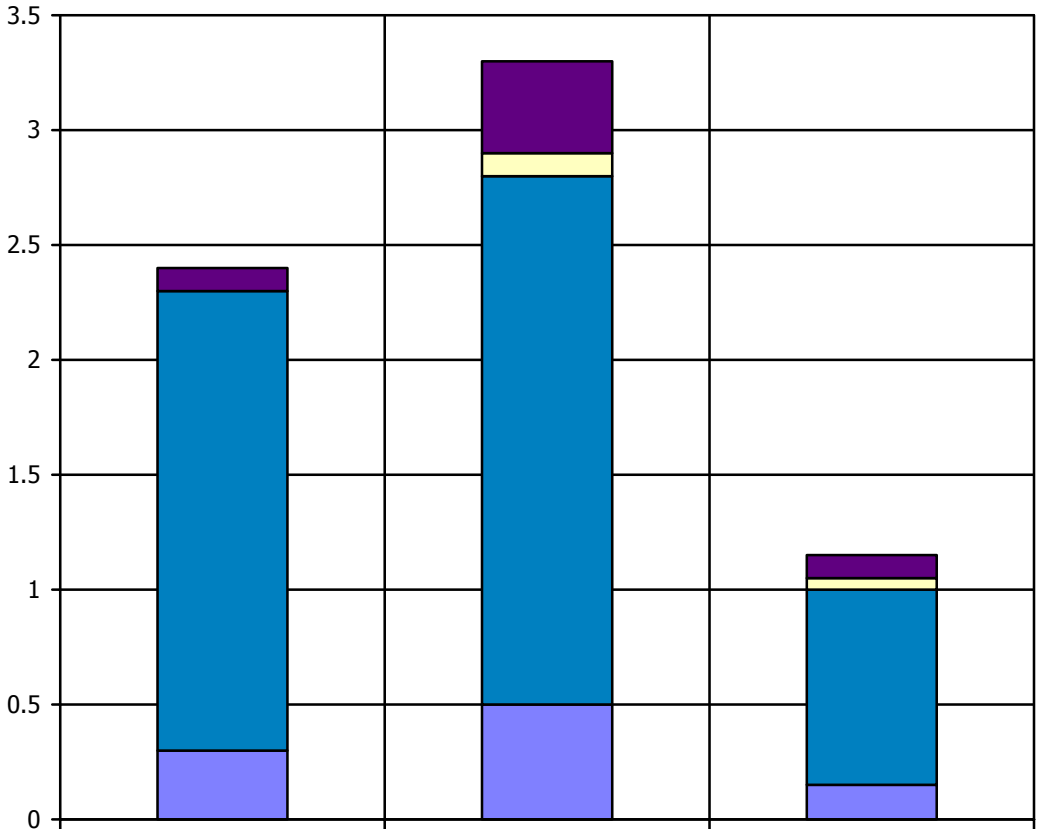
	1990	1996	2000	2005	2010	2015	2020	2025
Algerian - Reference	1.3	1.4	1.4	1.7	2	2.1	2.4	2.8
Libyan - Reference	1.5	1.5	1.5	1.7	2	2.2	2.6	2.9
Algerian - Turmoil			0.8	0.85	1.1	1.05	1.2	1.4
Libya -Turmoil			0.75	0.8	0.85	1	1.3	1.5

Source: Adapted by Anthony H. Cordesman from EIA, International Energy Outlook, 1998, DOE/EIA-0484 (97), p.239 International Energy Outlook 2002, June 2002, DOE/EIA-0484 (02) p 239; and International Energy Outlook 2003, June 2003, DOE/EIA-0484 (03), p. 235

Chart IV.4

Estimated North African Oil Exports: 2000-2025

(In MMBD)



	2000	2020 Reference	2020 Turmoil
Rest of World	0.1	0.4	0.1
China	0	0	0
Pacific Rim	0	0.1	0.05
Industrial Asia	0	0	0
Western Europe	2	2.3	0.85
North America	0.3	0.5	0.15

Source: Adapted by Anthony H. Cordesman from EIA, International Energy Outlook, 1998, DOE/EIA-0484 (97), April 1998, pp. 175-177, International Energy Outlook 2002, June 2002, DOE/EIA-0484 (02), p. 38; and International Energy Outlook 2003, June 2003, DOE/EIA-0484 (03), p. 42

Algeria

Algeria is a deeply troubled country which has been in a political and economic crisis since the late 1980s, and which began a brutal civil war in 1992, after the country's ruling military junta nullified a popular election that promised to bring the Islamic Salvation Party to power . The war has cost over 100,000 lives, but has largely been won by the junta, and there have been efforts at reform. [157]

The junta arranged the elections of President Abdelaziz Bouteflika on April 15, 1999 for a 5-year term. Bouteflika has since attempted to implement plans for national reconciliation and economic reforms like deregulation, privatization, often in ways that seem to have create problems with the junta (a pattern of conflict between the junta and various presidents that has been a problem in Algerian politics for several decades.) President Bouteflika offered amnesty to rebel groups on July 13, 1999. He then held a national referendum on September 16, and a large majority approved the offer. The government then claimed that nearly 80% of rebels (including members of the Islamic Salvation Army) accepted amnesty, but violence continued, and the most violent groups have carried out significant attacks.

, President Bouteflika replaced Prime Minister Ahmed Benbitour with Ali Benflis in August 2002, and the FLN picked up significant strength in a May 2002 election. The FLN has since become divided, however, by tensions between the President and ex-Prime Minister, and between the President and the army. President Bouteflika will stand for re-election in April 2004, and the result is uncertain.

Algeria has remained an important oil and gas state in spite of its civil war. Official estimates of Algeria's proven oil reserves remain at 11.3 billion barrels, but they are expected to rise significantly as a result of recent oil discoveries, plans for more exploration drilling, improved data on existing fields, and use of enhanced oil recovery (EOR) systems. Algeria also has at least 160 tcf of gas reserves. Algeria's National Council of Energy believes that the country still contains vast hydrocarbon potential and the government and its state-owned Sonatrach have made major efforts in recent years to exploit this situation.

Algerian Oil Development

Algeria's Saharan Blend oil, 45° API with 0.05% sulfur and negligible metal content, is among the best in the world. Algeria's has a reserve to production ratio of 18:8.[158] The EIA estimates that Algeria produced an average of 1.75 million barrels a day in 1990, 1.16 million in 1993, 1.20 million in 1995, 1.28 million in 1997, and 1.4 million barrels per day in 2000. Algeria's crude oil production quota was set at 782,000 bbl/d as of November 1, 2003, significantly below the country's crude oil production capacity of 1.2 million bbl/d. The EIA estimates that Algeria produced an average of 1.86 million barrels per day (bbl/d) in 2003, of which 1.17 million bbl/d was crude oil, 0.45 million bbl/d was lease condensates, and 0.25 million bbl/d was natural gas liquids. Domestic oil 1.65 million bbl/d.[159]

The U.S. Department of Energy estimates that Algeria will increase its oil production capacity from 1.6 MMBD in 2001 to 1.7 million barrels per day in 2005, 2.0 million barrels per day in 2010, 2.1 million barrels per day in 2015, 2.4 million barrels per day in 2020, and 2.8 million barrels per day in 2020.[160]

Algeria plans to increase its crude oil exports over the next few years by making a rapid shift towards domestic natural gas consumption and through increases in oil production by Sonatrach and its foreign partners. Approximately 90% of Algeria's crude oil exports go to Western Europe, with Italy as the main market followed by Germany and France. The Netherlands, Spain and Britain are other important European markets. The United States makes up a significant portion of the remaining 10% of Algerian crude exports.[161]

There have been significant oil and gas discoveries during the last six years, largely by foreign companies. Under a government program first launched in April 1996, Sonatrach and its foreign partners attempted – with only some success – to increase Algeria's crude oil production to 1.5 million barrels per day by 2000. The program included provisions for 300 exploration wells to be drilled between 1996 and 2000, half by Sonatrach and the other half by foreign companies. In 1998, the resulting efforts led to 15 new discoveries by some 19 different international oil companies. [162]

Sonatrach and its partners will drill over 200 exploration wells and will invest $20.8 billion, of which some $16.4 billion is intended for field development in the period between

2000-2005. Sonatrach will be responsible for 54.8% of the $20.8 billion estimated cost, while the foreign partners will account for 30.5% and Sonatrach and the partners will jointly share the remaining 14.7%.[163]

The largest foreign investor is the Anadarko Petroleum Company of the U.S. Its production is now only 300,000 bbl/d, but it hopes to raise production to as much as 500,000 bbl/d by 2005. In last decade, Anadarko has discovered 14 fields in Algeria with reserves totaling more than 2bn barrels.[164] In January 1999, Oryx Energy Company signed a five-year, $28.8 million exploration deal with Sonatrach. Oryx will carry out seismic and drilling activities in the Timissit area of southeastern Algeria. In September 2003, Petrobas (Brazil) signed a contract with Sonatrach to explore for oil in Algeria. A similar contract was also signed by Algeria and China's CNPC.[165]

The French firm Elf (now TotalFinaElf) returned to Algeria in 1999 for the first time since 1971 by buying a 40% stake in Arco Rhourde al-Baguel field, with an eventual production capacity estimated at 120,000 bl/d.[166] AmeradaHess and Sonatrach announced a joint company merger in 2000 to be called Sonahess. This joint operating company merger will invest $500 million over 5 years to enhance recovery from 30,000 to 45,000 bbl/d. In 2002, Sonatrach agreed to 6 new exploration contracts. .[167]

The current OPEC quota for Algeria is 782,000 million barrels a day (b/d). The Algerian government has been demanding from OPEC to increase its quota in line with the country's production capacity increases, which reached 1. 2 million barrels a day(b/d) at the end of 2003, will hit 1.5 million b/d by 2005, and 2.0 million bbl/d by 2010.[168]

Algerian Gas Development

Algeria ranks among the top ten nations in the world in terms of proven gas reserves, with 160 trillion cubic feet (Tcf) or 2.5% of the world supply. It accounted for one-fifth of EU's natural gas imports in 2000. The EIA estimates that Algeria produced 2.84 Tcf in 2003, consumed 0.79 Tcf, and exported 2.05 Tcf [169]

The ratio of its proven gas reserves to annual production is 50.7%.[170] Sonatrach estimates that Algeria's ultimate gas potential is around 204 Tcf, of which 135.5 Tcf is recoverable. Algerian officials indicated that natural gas production will reach 166 BCM by 2004, up from the

current level of 125 BCM.[171] Algeria's largest gas field is the super-giant Hassi R'Mel, which initially held probable and possible reserves of between 95-105 Tcf and proven reserves of about 85 Tcf. Hassi R'Mel produces 1.35 Bcf per day, one-fourth of Algeria's total dry gas production.

Algeria has had a long-standing policy to develop its gas reserves as a source of domestic energy and as a raw material for the petrochemical industry. As of mid-1997, approximately 95% of the country's electricity was generated by gas.

Algeria currently has four LNG plants, with a design capacity of 2.95 Bcf/d. Sonatrach's total upgrading program has boosted the country's LNG capacity to 3.29 Bcf/d. Algeria is a leading gas exporter, exporting 60 billion cubic meters a year (bcm/y) and almost all of its exports go to Europe.[172] Algeria has special strategic importance, however, because its pipelines allow it to ship gas directly to Europe. These gas pipelines could also suddenly take on far more importance if any disruption took place in Russia's gas exports.

Algeria's natural gas pipeline export capacity of 1.38 trillion cubic feet per year (Tcf/y) includes 988.6 billion cubic feet per year (Bcf/y) via the Transmed pipeline to Italy and 300.2 Bcf/y via the new Maghreb-Europe Gas (MEG) line to Spain and beyond to Portugal via an extension. As of 2002 Algeria's total natural gas export capacity was over 2 Tcf per year, and its expected to raise to 3 Tcf per year or more by 2010[173].

The 667-mile Transmed pipeline links the Hassi R'Mel gas field to Mazzara del Vallo in Sicily. Transmed comprises segments through Algeria (342 miles), Tunisia (230 miles), under the Mediterranean (96 miles) to Sicily and then on to Slovenia. The Hassi R'Mel-Oued Saf-Saf link to the Tunisia border originally consisted of 2 parallel 48-inch lines. With the signing of a revised gas supply contract, however, the three international links have been augmented with several 48-inch and 24-inch lines as well as at least four compressor stations.

Until recently, the Algerian segment of the Transmed pipeline had a slightly higher capacity (1.5 Bcf/d) than the Tunisia-Italy link (1.15 Bcf/d). Most of the gas from this line is taken by Italy's main gas utility Snam, which is under contract to buy 680 Bcf/y from 1997 until 2018. Tunisia purchases about 39 Bcf/y, with 14 Bcf/y committed until 2020 under a deal signed

in March 1997, and the rest bought on spot basis and in lieu of transit fees. Slovenia's Sozd Petrol is committed to 21 Bcf/y until 2007 under a contract signed in January 1990. Petroleum Economist reports that Algeria plans to expand the capacity of the Transmed line by 212 Bcf/y. [174]

The 1,013-mile long, $2.5 billion MEG pipeline was jointly financed by Sonatrach and Spain's Enagas, the line's main customers. MEG is made up of five sections: 324 miles from Hassi R'Mel to the Moroccan border, 326 miles from Morocco to the Strait of Gibraltar, 28 miles across the Strait at a depth of 1,312 feet, 168 miles from the Spanish coast to Cordoba, Spain, where it ties into the Spanish transmission network, and 168 miles to Portugal. The Algerian section of MEG was built by U.S.-based Bechtel and consists of a 48-inch line with a design capacity of 695 million cubic feet per day.

In late 2001 , Spain's Cepsa and Algeria's Sonatrach agreed to install a new natural gas pipeline, the Medgaz, linking Algeria directly to Spain. It will have a capacity of 7 bcm/y when it opens in 2005. The capacity is projected to increase to 16 bcm/y by 2020.[175] In September 2002, the consortium of partner companies completed a study of the line's feasibility, but the construction did not start in 2003 as had been expected. Sonatrach signed another deal in 2001 with Italy's Enel and Germany's Wintershall on a possible natural gas pipeline running from Algeria under the Mediterranean Sea to Sicily and onwards through Italy to France[176]. In 2002, Sonatrach and BP signed a deal to develop natural gas production in the in Amenas region. This $1.8-billion deal is projected to go online in 2005 and is expected to produce around 900 million cubic feet per day of "wet" natural gas.[177] These efforts are part of four major Algerian pipeline projects, and one Libyan project that are helping to increase the impact of Algerian gas exports along with the growth of LNG production and exports. [178]

Pipeline	Origin-Destination	Capacity *BcM)	Length (Km)	Year Operational	Cost ($Billion)
GME	Algeria-Spain via Morocco	expansion (+3)	1,620	2004	0.2
Medgas	Algeria-Spain	8	1,100	2006	1.4
Galsi	Algeria-Italy	8	1,470	2008	2.0
Trans-Saharan	Algeria-Nigeria	10	4,000	After 2010	7.0
Green Stream	Libya-Italy	8	540	2005	1.0

Algerian Energy Risk

Algeria has been implementing several economic reform programs. In December 2002, Algeria signed a pact with the European Free Trade Association (EFTA). This agreement will help Algeria to expand its trade with EFTA members. Moreover, Algeria has been pursuing membership in the World Trade Organization. In late 2001, Algeria and the EU reached an agreement, which was ratified by the European Parliament in October 2002. This agreement requires Algeria to cut its tariffs on EU agricultural and industrial products for ten years. In return, the EU will eliminate duties and quotas on many Algerian products.[179]

Unfortunately, energy development is still the only sector of Algeria's government that operates efficiently, and it has been under sporadic attack as the result of Algeria's civil war. While the struggle between Algeria's corrupt military junta and vicious Islamic extremists seems to have shifted in the government's favor, Algeria's civil government also remains far too much of a façade, hiding de facto rule by military leaders.

Economic reform is weak and falling far behind population growth and Algeria's "youth explosion." The EIA estimates that unemployment is officially around 30%, but is probably much higher, and is estimated at around 50% for the "under-30s" age group. There is violence by Islamic fundamentalists, serious labor unrest; and the economy relies on a large black market which the EIA estimates may be as large as 20% of the country's GDP.

Algeria has made some progress. Algeria signed a cooperation pact with the European Free Trade Association (EFTA) in December that encouraged expanded and liberalized trade with EFTA members (Iceland, Liechtenstein, Norway, and Switzerland. In late 2001, Algeria and the EU reached an Association Agreement, and the deal was ratified by the European Parliament in October 2002. Under the accord, Algeria is to cut tariffs on EU agricultural and industrial products over the next 10 years. In exchange, the EU will eliminate duties and quotas on many Algerian agricultural products. Algeria is also pursuing membership in the World Trade Organization.

The EIA reports, however, that Algeria has made little progress in the structural reforms and fiscal discipline it needs to compensate for fluctuating oil revenues and a steady long-term

decline in per capita energy export revenues. The EIA is particularly negative in regard to Algeria's efforts to reform its energy sector:

> "In January 2004, the International Monetary Fund (IMF) issued its annual "Article IV" assessment of the Algerian economy, urging that the government proceed with privatization and banking reform, while lowering tariffs aimed at protecting domestic industry and reducing dependence on hydrocarbons. The IMF praised the Algerian government for its strong macroeconomic discipline, while pointing out that high oil prices provide Algeria with an opportunity to make progress on implementing reforms and addressing the country's many problems.
>
> "…To date, however, little progress in this regard appears to have been made. For instance, an important hydrocarbons reform bill, which among other things would "corporatize" state oil company Sonatrach, had gone nowhere …
>
> "…In late 2001, an important new hydrocarbons reform bill was introduced, but progress stalled in 2002 and 2003. The bill would open Algeria's all-important energy sector to private (including foreign) investment, although state oil and gas company Sonatrach (see below) most likely would remain in public hands. The law faces opposition from trade unions and others, and already has been watered down somewhat from its original form, while Energy and Mines Minister Chekib Khelil has stated that "it is not necessary to privatize" Sonatrach. One study, by Bayphase, estimates that Algeria's oil and gas sectors will require total capital investment of $50-$73 billion over the next 10 years.
>
> "...In February 2003, a two-day strike among oil and gas workers was launched in protest of the proposed legislation. Algeria is scheduled to hold Presidential elections in April 2004, meaning that any new reform initiatives will probably have to wait until mid-2004. Meanwhile, it is likely that Algeria will pursue expansionary economic policies ...."

Short and mid term energy risk is moderate to high.

Libya[180]

Libya's strategic importance lies largely in the fact that it is a significant energy exporter. Libya currently has 12 oil fields with reserves of one billion barrels or more and two others with reserves of 500 million to one billion barrels. The U.S. Department of Energy estimates that Libyan production capacity will gradually increase from 1.7 million barrels per day in 2005 to 2.0 million barrels per day in 2010, and 2.6 million barrels per day in 2020. Libya produces high-quality, low-sulphur ("sweet") crude oil at very low cost (as low as $1 per barrel at some fields).[181]

At the same time, Libya has been involved in five major clashes with the U.S. and has been under sanctions for major acts of terrorism. The worst was the 1988 bombing of Pan Am flight 103 over Lockerbie, Scotland, that killed 270 people. On April 15, 1992, the United Nations imposed economic sanctions on Libya for refusing to extradite two Libyan nationals accused of carrying out the bombing of Pan Am Flight 103. These sanctions included the

grounding of all air traffic to and from Libya, a reduction in diplomatic relations and a ban on all arms sales to the country.

The United States imposed additional sanctions on Libya on August 5, 1996. The U.S. Iran-Libya Sanctions Act of 1996 (ILSA) extends U.S. sanctions on Libya to cover foreign companies that make new investments of $40 million or more over a 12-month period in Libya's oil or gas sectors. These sanctions were renewed for five years on July 27, 2001.

This situation is, however, being resolved and key issues like Libya's compensation for its acts of terrorism, putting an end to military adventures and its support of terrorism, and giving up its search for weapons of mass destruction seem to have been resolved.

President Qadhafi transferred two key suspects in the Lockerbie bombing on April 5, 1999. They stood trial in the Netherlands under Scottish law. In return for releasing the suspects, UN sanctions on Libya were suspended for ninety days, after which Secretary-General Annan reported to the Security Council on Libya's cooperation. Secretary General Annan reported his findings on Libya to the Security Council on July 2, 1999. According to Annan's report, Libya has, so far, complied with the provisions set forth by the Security Council. In response, the United Nations suspended economic and other sanctions

Libya has complied with the remaining requirements, including the compensation of victims' families after the guilty verdict in the Pan Am 103 trial. The US continues to adopt a tough stance towards Libya, and British and French moves towards rapprochement with Libya further isolate the U.S.[182] US and Libyan talks have eased the tensions between the two countries, however, and Libya indicated in May 2002 that it would pay $2.7 billion to the families of the victims (about $10 million per family). France has also renegotiated its compensation agreement for the victims of Libya's attack on UTA Flight 772, and has convicted six people in absentia for the crime. In late April 2003, Libya's foreign minister stated that Libya "has accepted civil responsibility for the actions of its officials in the Lockerbie affair." If Libya completes its claims settlements with the US and France, all sanctions are likely to be lifted. The US has already permitted some US firms to negotiate with Libya in preparation for this event.

Relations between the US and Libya are improving in other ways. The US no longer estimates that Libya is a major source of terrorism. The claims over the destruction of PA 103 seem to have been settled, and Libya declared in December 2003 that it would give up its programs for developing weapons of mass destruction and allow unconditional inspections. This has raised the hopes that the US government will lift sanctions.[183]

Libyan Oil Development

The Department of Energy estimates that Libya's ability to increase its oil production (and exports) has been hampered by sanctions, mainly due to a ban on needed enhanced oil recovery equipment. Moreover, Libya's state-operated oil fields are undergoing a 7%-8% natural decline rate, and Libya depends heavily on foreign companies and workers. Despite these problems, Libya generated $10.8 billion in oil export revenues in 2002 with a forecast of $12.9 billion in 2003. Nearly all (about 90%) Libya's oil exports are sold to European countries like Italy (580,000 bbl/d in 1996), Germany (258,000 bbl/d), Spain and Greece.

The EIA summarizes the present state of Libya's oil industry as follows:[184]

> Overall, Libya would like foreign companies help to increase the country's oil production capacity from 1.4 million bbl/d at present to 2 million bbl/d over the next five years, at a cost of perhaps $6 billion. This would restore Libya's oil production capacity to the level of the early 1970s. During the 1970s, the country's revolutionary government imposed tough terms on producing companies, leading to a slide in oilfield investments and oil production. In May 2000, Libya invited around 50 foreign oil and gas companies to a meeting to discuss exploration and production sharing agreements. In order to achieve its oil sector goals, Libya will require as much as $10 billion in foreign investment through 2010. Around $6 billion of this is to go towards exploration and production, with the rest going towards refining and petrochemicals. In addition, NOC has earmarked $1.5 billion for oil infrastructure investment. In January 2002, NOC appointed Abdel-Hafez Zleitni as its new chairman, with the specific mission to work on attracting foreign investment into the country's oil sector. Combined with the selection of reform-minded Prime Minister Shukri Ghanim, some privatization of the country's oil sector, particularly the downstream sector, now appears more likely than it has in the past.

The suspension of UN sanctions may offer Libya the means to revitalize its older fields. Sanctions have prevented the development of older fields run by NOC by banning the import of spare parts needed to maintain the fields and enhance production. Several fields operated by NOC affiliates are suffering from low pressure, which has held back production. The procurement of equipment for these fields is likely to be a priority. However, the situation is complicated by the fact that most of these fields were originally developed by U.S. firms and will need U.S.-manufactured spare parts. [185]

The decline in Libya's older fields has been offset by fresh discoveries by European operators. Spain's Repsol is now producing about 140,000 bbl/d in the Murzuk basin in the southwest, and announced discoveries in early 1999 that indicated potential reserves of between 100-200 million barrels. British firm Lasmo is developing its Elephant discovery in the same region and is due to produce the first oil there in 2000, with output rising to 150,000 bbl/d in 2002. Other international groups active in the upstream oil sector include Italy's Agip, Canadian Occidental, Canada's Red Sea Oil Corporation, Dublin-based Bula Resources, and France's Elf Aquitaine.[186]

Oil export revenues account for about 95% of Libya's hard currency earnings. In 2000, oil production stood at 1.5 million bbl/d, down from over 3 million bbl/d in 1970. Libya would like to boost production by at least 1-1.5 MMBD, but sanctions have caused delays in a number of field development and enhanced oil recovery projects, as well as deterred foreign capital investment. Faced with a mature oil reserve base, Libya's challenge is to maintain production at older fields while at the same time bringing new fields online. Reserve replacement, however, has been slipping since the 1970s.

A lifting of the US embargo would boost the country's current oil production, which is now about 1.4 million b/d. Several American oil companies are eager to start operations in Libya, and the Libyan government wants to expand its exploration and production sharing agreements. Much of Libya remains unexplored and there are more than 90 exploration blocks on offer. The Libyan government intends to boost the oil production capacity beyond 2 million b/d by 2010.[187]

Libyan Gas Development

Sanctions have also affected Libyan gas production. The Department of Energy estimated Libya's proven natural gas reserves at 46.4 trillion cubic feet (Tcf) in 2003. Libya believes the country's actual gas reserves to be considerably larger, possibly 50-70 Tcf. Large new discoveries have been made in the Ghadames and el-Bouri fields, as well as in the Sirte basin.

Continued expansion of gas production remains a high priority for Libya for two main reasons. First, Libya has aimed to use gas instead of oil domestically, freeing up more oil for export. Second, Libya is looking to increase its gas exports. Libya also produces a small amount

of liquefied petroleum gas (LPG), most of which is consumed by domestic refineries. Natural gas consumption has been rising at a 10% annual rate since 1990. Besides gas used for injection into oil fields, most of this consumption has been by the petrochemical industry at Ras Lanuf, and by electric power sectors. In recent years, several power plants have switched from fuel oil to natural gas, and four new gas-powered plants have been built recently.

Agip has promoted linking the reserves of both Egypt and Libya to Italy by pipeline. An agreement in principle to link Egypt and Libya's gas grids was reached in June 1997, following a visit to Libya by Egyptian President Husni Mubarak. Yet another proposal is to build a pipeline from Egypt and Libya to Tunisia and Algeria, from where it would hook up with the existing pipeline to Morocco and Spain.

During the fist half of 2003, Libya produced nearly 1.5 million bbl/d, an increase from 2002 levels but still only two-fifths of the 3.3 million bbl/d produced in 1970. Libya aims to increase oil output capacity by 175,000 bbl/d in 2004 with the help of European companies. In spite of U.N. and U.S. sanctions, international oil companies have continued to explore Libyan fields, and U.N. sanctions were suspended in April 1999, after two of the suspects in the Lockerbie bombing were turned over for trial. Libya is courting foreign oil companies, which view Libya as an attractive oil province due to its low cost of oil recovery, its proximity to European markets, and its well-developed infrastructure.

The EIA estimates that Libyan oil production will gradually increase from 1.5 million barrels per day in 1990 to 1.7 million barrels per day in 2005, 2 million barrels per day in 2010, 2.2 million in 2015, 2.6 million in 2020 and 2.9 in 2025.[188]

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been recently built. The Department of Energy reports that considerable potential exists for a large increase in Libyan gas exports to Europe.

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Potential exists for a large increase in Libyan gas exports to Europe. A joint venture between Eni (Italy) and NOC (Italy) on the $4,500 million Western Libyan Gas Project (WLGP) is reportedly moving ahead. Eni and NOC will produce 30,000 million cubic meters a year of gas and 60,000 b/d of condensate by 2005.[189] The gas is to be delivered via a 370-mile underwater pipeline (called "Green Stream") under the Mediterranean to southeastern Sicily and the Italian mainland.[190]

Low energy prices and sanctions have delayed gas pipeline projects in the past, but this situation may begin to change. A 160-kilometer pipeline is planned between Homs and Tripoli, and Sirte Oil Company signed a $200 million contract with MAN Oil & Gas of Germany in 1998 to build a 142 kilometer pipeline between Zuetina and Benghazi. [191]

The suspension of U.N. sanctions in April 1999 has led to progress in Libya's natural gas export program. In October 1999, the Russian company Zarubezhneftegazstroi signed a $182-million contract to build a 117-kilometer section of Libya's Khums-Tripoli pipeline. Libya is planning the pipeline as a step toward a gas network that will eventually run across its entire territory and connect with both Tunisia and Egypt.

In 1971, Libya became the second country in the world (after Algeria in 1964) to export liquefied natural gas (LNG). Since then, Libya's LNG exports have been of little importance, largely due to technical limitations which do not allow Libya to extract LPG from the LNG, thereby forcing the buyer to do so. Libya's LNG plant, at Marsa El Brega, was built in the late 1960s by Esso and has a capacity of about 100 billion cubic feet per year, but due to technical limitations only about one-third of this is available for export, mainly to Enagas of Spain. The EIA reports that efforts to refurbish and upgrade the El Brega LNG plant in order to deal with the

LPG separation problem have been delayed since 1992. If they were completed, the EIA estimates that Libyan LNG exports could triple.

Libyan Energy Risks

Libya is experiencing political and economic change. It has experienced economic growth over the past three years. Real gross domestic product (GDP) grew by around 6.5% in 2000, 3.1%-4.3% in 2001 and 1.2% in 2002. Real GDP growth of 2.1% is expected in 2003, and inflation remains under control.

Despite this economic growth, Libya's unemployment rate remains high. The US government also notes that other problems exist, "Libya's relatively poor infrastructure (i.e. roads and logistics), unclear legal structure, often-arbitrary government decision making process, a bloated public sector (as much as 60% of government spending goes towards paying public sector employees' salaries), huge public works programs (i.e., the "Great Man Made River" project), and various structural rigidities all have been impediments to foreign investment and economic growth."[192]

Nevertheless, Libya may be moving towards a variety of economic reforms and a reduction in the state's direct role in the economy. In January 2002, Libya announced its intention to open up its economy and to attract foreign capital to the country, while devaluing the official exchange rate on its currency, the dinar, by 51% as part of a move towards unification of the country's multi-tier (official, commercial, black-market) foreign exchange system. Among other goals, the devaluation aimed to increase the competitiveness of Libyan firms and to help attract foreign investment into the country.

In January 2002, Libya cut its customs duty rate by 50% on most imports in part to help offset the effects of its currency devaluation. In June 2003, President Qadhafi said that the country's public sector had failed and should be abolished, and called for privatization of the country's oil sector, in addition to other areas of the economy. Libya's Parliament also selected former Trade and Economy Minister Shukri Muhammad Ghanim, a proponent of privatization, as Prime Minister that same month.

Libya has continuing problems with anti-regime and Islamic extremist groups, and has a long history of erratic leadership and sudden reversals in policy. If it consistently pursues it

current policies of moderation and seeking foreign investment and technology, however, energy risk will drop from moderate-high to moderate-low.

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