



Feature

Making Sense of Middle Eastern Petroleum

[Rasoul Sorkhabi](#)

Another stream, smelling less of sulphur but more of oil, burst from under the rocks a little further on, and it is near here that attempts have been made in the past to tap the petroleum reservoir which probably exists somewhere beneath the ground. Some day a happy man may hit the right spot, and then his fortune is made; but it is a speculative business. Half a dozen inches to the right or left, and you are, as Fate may decide, a pauper or a millionaire.

E. C. Williams

An English traveler, in *Across Persia* (1907)

People have been using petroleum and bitumen in the Middle East for 5,000 years. But it was not until the 20th century that the Middle East entered the consciousness of the "Hydro-carbon Man" as the petroleum repository of the world, as Daniel Yergin describes in his 1992 book *The Prize: The Epic Quest for Oil, Money, and Power*. This transition took place over several decades, as modern drilling for oil, beginning in Iran in 1908, in Iraq in 1927, in Bahrain in 1932, and in Kuwait and Saudi Arabia in 1938, proved successful.

An offshore rig drills for petroleum in the Abu Sa'fah oil field of Saudi Arabia in the Persian Gulf. The Abu Sa'fah field was discovered in 1963 and has been in operation since 1966. Courtesy of Saudi Aramco.

With soaring prices of oil, natural gas and gasoline in recent years, and continuing violence in the Middle East, this region's petroleum geopolitics remains a major focus of international relations today. Given the volatile nature of the petroleum industry, it is imperative to understand both the numbers and the climate surrounding Middle Eastern petroleum.

Supply

Ten countries in the Middle East produce nearly all of the region's petroleum: Bahrain, Iran, Iraq, Kuwait, Oman, Qatar, Saudi Arabia, Syria, United Arab Emirates and Yemen. Except for Bahrain and Yemen, these countries are also members of the Organization for Petroleum Exporting Countries (OPEC), which has been dubbed in the West "the world's oil cartel."

These Middle Eastern countries together cover an area of 5.1 million square kilometers (about 1 percent of Earth's land surface) and are home to 168 million people (2.6 percent of the world's population). However, they possess the largest concentration of petroleum resources anywhere on Earth, thanks to a combination of several favorable geologic factors.

The Middle East was part of the giant equatorial Tethys Sea, which stretched from southern Europe to



south-central Asia from 265 to 55 million years ago. Organic-rich mud deposited on the continental shelf of the Tethys proved an effective source rock for petroleum. After the closure of the Tethys, the collision of the Arabian Plate with Asia and the formation of the Zagros Mountains in Iran that began about 55 million years ago, a foreland basin formed atop the Tethyan shelf sediments. Thus, a thick pile of sediments spanning the last 500 million years of Earth's history has developed multiple source, reservoir and cap rocks for petroleum in the Middle East.

This sedimentary sequence is sealed in many places by impermeable salt layers below Cambrian sediments and above Miocene reservoir rocks. Although the majority of reservoir rocks in the region are fine-grained limestone, physical and chemical processes have created sufficient spaces and permeability in these rocks to store and yield economic volumes of petroleum. Gentle folding, salt domes and faulting have formed large structural traps within which petroleum accumulated.

Despite what we know about the sedimentary basins in the Middle East, uncertainty remains regarding how much oil the region still contains, due to both geology and politics. Petroleum data are not always reported fully or correctly because of political and national security considerations. Additionally, varying methods of estimating and reporting reserves are responsible for our poor knowledge of the Middle East's oil reserves.

Data reported by the *British Petroleum Statistical Review of World Oil* in 2005, the *Oil and Gas Journal* in 2004, and the *OPEC Annual Statistical Bulletin* in 2003 indicate that the Middle East holds 730 billion barrels of recoverable proven oil. (Recoverable proven reserves are those quantities that exist geologically and can be reasonably recovered under existing engineering and economic conditions.) This estimate accounts for 61 percent of the world's recoverable proven oil (about 1.2 trillion barrels). Some petroleum geologists have questioned these figures, however.

In an April 4 article in the *Oil and Gas Journal*, for instance, retired petroleum geologist Colin Campbell argued that in the late 1980s, many OPEC countries suddenly and unjustifiably raised their reserves levels simply to obtain higher production quotas. The Middle East thus added 275 million barrels to its reserves. Although some of these reserves may reflect geologic discoveries or increased recovery efficiency, Campbell rightly cautions that these "political reserves" or "reserves on paper" remain doubtful.

Nonetheless, Middle Eastern countries may still hold potential for more petroleum discoveries and production. After the end of the Iran-Iraq war in 1988, large oil fields in the Zagros basin containing billions of barrels of oil, such as the Azadeghan and Yad Avaran fields, were discovered in Iran, and whole desert areas in central Iran still remain largely unexplored. Iraq, whose petroleum exploration and production have been severely hindered by decades of wars and economic sanctions, also holds a geological wild card in future petroleum developments. The Silurian-Triassic sediments in the deeper levels of the Middle Eastern basins, such as those in Iran, Iraq, Kuwait and Saudi Arabia, are also attractive targets.

According to the U.S. Geological Survey (USGS) *World Petroleum Assessment 2000*, undiscovered petroleum resources in the Middle East (within 50 percent confidence level) include 197 billion barrels of crude oil, 71 billion barrels of liquid natural gas and 1,204 trillion cubic feet of gas. Given that USGS has estimated about 649 billion barrels of undiscovered conventional oil and 4,669 trillion cubic feet of undiscovered natural gas for the world, the Middle East accounts for 30 percent and 26 percent of the total undiscovered resources of oil and gas, respectively.

Data on oil production are more certain than those on oil reserves. So far, the Middle East has produced close to 300 billion barrels of oil, which is nearly a quarter of the world's production to date. Last year, the Middle East produced 24.6 million barrels a day (about 30.7 percent of world production). What makes the Middle East's petroleum quite significant for the international economy is its net export: Oil production in the Middle East far exceeds oil consumption in the region.

In 2004, the Middle East consumed about 5 million barrels of oil a day, or nearly one-fifth of the oil it produced. This consumption resulted in the net export of 19.6 million barrels a day, which was imported by Southeast Asia (7.2 million barrels), Japan (4.0 million barrels), Europe (3.2 million barrels), the United States (2.5 million barrels) and China (1.3 million barrels). The export of Middle Eastern petroleum to East Asian countries has markedly grown in the last decade, due to those countries' rapid economic growth. U.S. imports from the Middle East accounted for 19.4 percent of its total petroleum imported. Over the past 45 years, the Middle East's share of U.S. petroleum imports has ranged from 3.5 percent in 1970 to 28

percent in 1977, averaging about 17 percent. However, as populous East Asian countries increase their demand for petroleum, the Middle East's oil flow to North American and European markets will become more competitive.

Demand

With rise in the world demand for oil, some analysts are questioning whether the petroleum-rich Middle East has the capability to raise its production sufficiently to meet demand. In his 2005 book *Twilight in the Desert: The Coming Saudi Shock and the World Economy*, energy investment banker Matthew Simmons raised this question specifically for Saudi Arabia by analyzing the reservoir performance history of 12 oil fields in that country. Simmons argues that nearly all of Saudi oil comes from seven fields, including Ghawar, the world's largest oil field, which alone has produced more than 5 million barrels a day in recent decades. Simmons warns that major Saudi oil fields reached their peak production years ago, and that "it is virtually impossible for Saudi Arabia ever to produce the 20 to 25 million barrels a day envisioned by the forecasters."



While Saudi officials dismiss Simmons' ideas about their inability to raise the production levels significantly, this important question is open to debate; given the geologic, technologic and economic uncertainties and the opaqueness of petroleum data, only time will resolve it. If, as Simmons suggests, all of Saudi Arabia's oil production comes from only seven fields, the implication is that a number of other oil fields in the country (not considered by Simmons) have great potential to boost production.

The central production facilities for the Qatif oil field in Saudi Arabia produce 500,000 barrels of crude oil per day. Photo courtesy of Saudi Aramco.

Currently, Saudi Arabia has a production capability of 10.5 million to 11 million barrels a day. Doubling that amount in the next decade or so will be an enormous task. If the rapid production increases come from the existing fields with existing technologies, the oil fields may suffer damage from the over-injection of fluids (a procedure that puts pressure on the subsurface to get oil to flow upward).

Perhaps the application of more expensive recovery techniques or drilling new wells will prolong the lifespan of the mature Middle Eastern oil fields. New geologic concepts applied to petroleum basins coupled with increased investments in exploration will also help new discoveries. The petroleum geology dictum that "we usually find oil in new places with old ideas, but we seldom find much oil in an old place with an old idea" is very valid for the Middle East.

As the world's demand for natural gas (which is less polluting than oil) increases, the gas resources of the Middle East will become more attractive. The planned gas pipeline from Iran to India is a telling example of this trend. Like oil, we do not have an accurate picture of the gas reserves, but current estimates of the proven gas reserves in the Middle East are 2,571 trillion cubic feet, or 41 percent of world reserves.

Economic changes within the Middle East also have implications for the petroleum industry worldwide. Population and economic growth in the Middle East are raising the domestic consumption of oil and gas. Current population growth in the region ranges from 1 percent in Iran to 3.4 percent in Yemen, and the growth of gross domestic product last year varied from 1.2 percent in Oman to 8.7 percent in Qatar. A recent report by the consulting company FACTS, based in Honolulu, Hawaii, shows that Middle Eastern oil demand has grown at an average rate of 4 percent in the past decade, and that these nations will continue to use more of their own petroleum resources to fuel their economies, industries and life styles. The increases in oil and gas prices are also enabling Middle Eastern governments to invest more in refineries and thus export more petroleum products rather than only crude oil.

Back to the Future

A huge threat to the stability of the oil industry and world economy is the continued political strife, terrorism and violence in oil-producing regions. Addressing these issues requires comprehensive measures,

including economic cooperation, security, proactive diplomacy, cultural dialog and grassroots understanding.

Experts on the Middle East have long debated the impact of petroleum on the political, economic and cultural development of this region. Some analysts view petroleum as an easy resource for investments in infrastructure, industrialization and raising living standards. Others see it as a hindrance for creativity and hard work and as a source of corruption. Both sides offer strong arguments. Nonetheless, it is evident that the Middle East needs to embark on a genuine development path with less reliance on petroleum revenue and more emphasis on industries, services, cultural products and digital technologies. Currently more than two-thirds of government revenue in Middle Eastern countries is from oil exports. A shift from this "raw-resource economy" would be helpful not only for world peace and stability, but also for the future of the Middle East in a post-oil era.

Global dependency on Middle East petroleum is too great, as is the Middle East's dependency on petrodollars. Regions such as the South China Sea, the Caspian Sea, and the Niger Delta have been claimed to be "another Middle East," but we have not discovered another Middle East yet. Taking some of the heat off Middle Eastern petroleum supplies will make the world economy less vulnerable to major crises. It also may actually help the spread of democracy in the region because as long as the governments feed on petroleum revenue rather than depend on taxpayers, they may have little incentive to engage their citizens. It is, however, highly unlikely that we can reduce our dependency on the Middle East's relatively cheaper petroleum without first reducing dependency on petroleum itself.

Sorkhabi is a research professor at the University of Utah's Energy and Geoscience Institute in Salt Lake City. Email: rsorkhabi@egi.utah.edu.

Links:

["With Oil or Without It? A glimpse at four more recent books on the future of petroleum in the 21st century,"](#) *Geotimes*, March 2005

["Assessing Iraq's Oil Potential,"](#) *Geotimes*, October 2003

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