

# **Twilight in the Desert Study Guide**

**Twilight in the Desert by Matthew Simmons**

(c)2015 BookRags, Inc. All rights reserved.



# Contents

<a href="#">Twilight in the Desert Study Guide.....</a>	<a href="#">1</a>
<a href="#">Contents.....</a>	<a href="#">2</a>
<a href="#">Plot Summary.....</a>	<a href="#">4</a>
<a href="#">Chapter 1.....</a>	<a href="#">6</a>
<a href="#">Chapter 2.....</a>	<a href="#">8</a>
<a href="#">Chapter 3.....</a>	<a href="#">9</a>
<a href="#">Chapter 4.....</a>	<a href="#">11</a>
<a href="#">Chapter 5.....</a>	<a href="#">13</a>
<a href="#">Chapter 6.....</a>	<a href="#">14</a>
<a href="#">Chapter 7.....</a>	<a href="#">16</a>
<a href="#">Chapter 8.....</a>	<a href="#">18</a>
<a href="#">Chapter 9.....</a>	<a href="#">19</a>
<a href="#">Chapter 10.....</a>	<a href="#">20</a>
<a href="#">Chapter 11.....</a>	<a href="#">21</a>
<a href="#">Chapter 12.....</a>	<a href="#">22</a>
<a href="#">Chapter 13.....</a>	<a href="#">23</a>
<a href="#">Chapter 14.....</a>	<a href="#">24</a>
<a href="#">Chapter 15.....</a>	<a href="#">25</a>
<a href="#">Chapter 16.....</a>	<a href="#">26</a>
<a href="#">Chapter 17.....</a>	<a href="#">27</a>
<a href="#">Characters.....</a>	<a href="#">28</a>
<a href="#">Objects/Places.....</a>	<a href="#">29</a>
<a href="#">Themes.....</a>	<a href="#">32</a>
<a href="#">Style.....</a>	<a href="#">34</a>
<a href="#">Quotes.....</a>	<a href="#">36</a>



Topics for Discussion..... 39



# Plot Summary

*Twilight in the Desert: The Coming Saudi Oil Shock and the World Economy* was written by Matthew Simmons, an investment banker from Houston, Texas, who specializes in the energy industry. Simmons believes that Saudi Arabia, the world's single most important oil producing country, is running out of oil, and no one is prepared to deal with the impact. Saudi Arabia claims to have the situation under control and ensures the world that the country can provide the world with however much oil it will need for the next fifty years. Saudi Arabian oil production data has been concealed for more than twenty years now, and Simmons believes this is an attempt to hide the fact that Saudi Arabia's most important oilfields are declining. In the absence of this crucial data, Simmons uses more than 200 technical papers written for the Society of Petroleum Engineers over the past few decades to build a persuasive case.

Saudi Arabia, a small, obscure kingdom in the Middle East rises to fame and global importance in the 1930s and 1940s with the discovery of vast oil reserves. While the United States and the Soviet Union hold the lion's share of global oil production, Saudi Arabia, with the help of Western oil interests, gradually builds its development and processing capabilities. The United States continues to be the world's top oil producer until the early 1970s, when environmental disasters and ecological concerns result in a significant reduction in exploration efforts. As oil production in the United States plummets, oil production in Saudi Arabia soars. The United States decline, which occurs just as the world's appetite for oil is increasing, opens the door of opportunity for Saudi Arabia. Fortunately, for Saudi Arabia, it is able to rise to the occasion and increase oil production in an incredibly short time. By the mid-1970s, Saudi Arabia has become the world's most important oil producer.

Oil production in Saudi Arabia has remained strong and steady for more than thirty years. Although numerous reserves have been discovered over the years, only a handful of reserves provide the bulk of Saudi Arabia's oil. All of these most productive fields are now quite old and, as oil reserve history in other countries has shown, aging oil reserves reach their peak and then suffer a severe decline. Specific data on production levels at Saudi Arabia's oilfields have been concealed since the early 1980s, so no one other than Saudi Arabian officials really knows how much oil is actually being produced. Saudi officials claim they have no problems with providing as much oil as the world needs, but technical documents indicate there are many problems facing the Saudi Arabian oil industry. Through an extensive review of more than 200 technical papers written for publication or presentation through the Society of Petroleum Engineers, an abundance of papers describing numerous technical issues facing Saudi Arabia's major oil producing fields are found. Many of these papers are written by oil experts working for Saudi Aramco, the kingdom's national oil company. Through these papers, a convincing case concerning the future of oil production in Saudi Arabia is built.

With Saudi Arabia's aging fields and no new significant reserve discoveries in recent history, what will happen when Saudi Arabia's key reserves decline and there are no

new reserves to replace them? How will the world, which is clearly not prepared for the coming Saudi oil shock, deal with this global energy crisis?



# Chapter 1

## Chapter 1 Summary and Analysis

*Twilight in the Desert: The Coming Saudi Oil Shock and the World Economy* was written by Matthew Simmons, an investment banker from Houston, Texas, who specializes in the energy industry. Simmons believes that Saudi Arabia, the world's single most important oil producing country, is running out of oil, and no one is prepared to deal with the impact. Saudi Arabia claims to have the situation under control and ensures the world that the country can provide the world with however much oil it will need for the next fifty years. Saudi Arabian oil production data has been concealed for more than twenty years now, and Simmons believes this is an attempt to hide the fact that Saudi Arabia's most important oilfields are declining. In the absence of this crucial data, Simmons uses more than 200 technical papers written for the Society of Petroleum Engineers over the past few decades to build a persuasive case.

Saudi Arabia was established in 1932, after years of internal conflict and war. Abdul Aziz (King Ibn Saud) seizes power and controls the nation, until his death in 1953. His two eldest sons, King Saud and Crown Prince Faisal, assume leadership of the poor country. Although oil production begins in Saudi Arabia in the 1940s, the country does not become an oil super power until the 1970s, when United States oil production dwindles. After the death of King Saud, the new King Faisal leads the country through tremendous growth and development, including advances in education and the education of women, due in large part to the kingdom's newfound wealth from oil production.

By the 1970s, Saudi Arabia is a small, extremely prosperous country. That prosperity, however, leads to a population explosion. The Saudi Arabian population quadruples in 30 years, bringing about a variety of challenges for the Saudi government and its people. These challenges include the need to modernize the oil industry and diversify the economy, provide social services and handle debt, reduce unemployment and create new jobs, and to grow the economy and develop new industries. The underlying question for the Saudi people, as well as the rest of the oil-dependent world, is whether or not Saudi Arabia's oil reserves will continue to produce at current rates. The Saudi government insists its reserves are sound, but there is little proof to back up these claims.

Saudi Arabia has been the world's top oil producer for decades. Saudi oil reserves are the richest ever discovered, but no one really knows how much longer they will last. Western energy experts seem to accept Saudi Arabia's claims of endless supplies, without any supporting evidence. Whether this is wishful thinking or blind trust on the part of the West, the question of how long Saudi Arabia will sustain its oil production levels remains. Most Saudi Arabian oil comes from a few super giant fields, which are extremely rare. The chance that newly discovered fields would produce at these levels is slim. In the meantime, the Saudi Arabian population explosion has created serious

socio-economic concerns in this country, so dependent upon the oil industry. If oil production begins to wane, not only will a global crisis occur, but also the Saudi people will face severe economic consequences.



# Chapter 2

## Chapter 2 Summary and Analysis

The Middle East becomes associated with oil production in the 1930s, mostly due to reserve discoveries in Iran, Iraq and Bahrain. The first significant oil reserves in the Middle East are discovered in Iran in 1908. Oil exploration in Saudi Arabia begins in the 1920s, although no significant amounts of oil are discovered until the late 1930s. Standard Oil Company of California (SOCAL) secures prospecting rights from Abdul Aziz in 1933, and on March 3, 1938, Damman 7, one of several wells drilled, begins pumping a significant amount of oil. Thus the Saudi Arabian oil era is born. In the midst of the Great Depression and with World War II looming, SOCAL brings in several partners. They are Texaco, Standard Oil Company of New Jersey (later Exxon) and Socony-Vacuum (later Mobil.) These help fund drilling and production in Saudi Arabia. The partnership is called Aramco.

During World War II, expansion on the Saudi Arabian oil project stops, but when the war is over, drilling resumes. In 1948, Ghawar reserve, the world's richest ever oil reserve, is discovered. Throughout the 1950s and 1960s, numerous reserves are discovered and several other oil companies are granted exploration rights. Although many other fields have been discovered, none come close to the production levels of the earlier discoveries such as Ghawar. New technology and techniques enable the oil industry to continue to collect from these aging reserves, however the cost of production and the complexity of retrieving the oil has increased significantly. For nearly 60 years, the majority of Saudi oil has come from seven huge reserves. They were Ghawar, Safaniya, Abqaiq, Berri, Marjan, Zuluf, and Abu Sa'fah. The two largest, Ghawar and Safaniya, were producing nearly 75 percent of Saudi Arabia's total oil. Despite this limited number of large reserves, by the 1970s, Saudi Arabia becomes the third largest oil producer in the world, right behind Russia and the United States.

The discovery of several enormous oil fields in Saudi Arabia establishes the country as an oil power, despite the fact that additional large reserves have yet to be found. As several of the larger fields gradually decline in production over the years, the future of Ghawar and Safaniya are in question. If no new large reserves are found and these major existing reserves begin to decline as others have, how will Saudi Arabia be able to maintain its current production levels and continue to feed the world's oils needs. The lack of discovery of additional giant reserves in Saudi Arabia is not due to a lack of effort. It is due to a lack of oil.





# Chapter 3

## Chapter 3 Summary and Analysis

In 1901, with the discovery of the Spindletop field in Southeast Texas, the United States becomes the world's top oil producer. Due to the abundance of oil, in the 1930s the state governments of Texas and Oklahoma limit the number of days per month oil companies can operate in order to protect oil prices. This practice, called prorating, continues into the 1960s. With the discovery of vast oil deposits in Alaska's Prudhoe Bay, America's future as the world's oil source looks bright. Several oil-related environmental disasters result in a huge and very effective environmental movement targeted at the oil industry. Construction on the Alaska Pipeline is delayed nearly a decade, and new offshore exploration is banned everywhere in the United States except for the Gulf of Mexico. United States oil production peaks in 1970 and then begins a gradual, but steady, decline.

Saudi Arabia and Iran are the only two oil-producing nations that are capable of filling the void left by the United States. Saudi Arabia rises to the occasion, replacing the United States as the world's leading oil producer. Within four years, Saudi Arabia increases its production from three million barrels a day to eight million barrels a day. Although the country enjoys a great financial benefit from their new role, the increase comes at great cost to the wells themselves. The rush to increase production strains the physical limitations of the reserves and causes pressure in several key fields to drop. Along with this drop comes an increase in water production within the wells.

In 1973, several decades of United States policy in the Middle East has angered King Faisal. Years before, President Franklin Roosevelt had promised King Faisal's father that Saudi Arabia would be consulted and considered in any United States policy decisions concerning Palestine. President Truman's support of the creation of a State of Israel was the first break in that promise. When President Nixon announces the United States will begin to re-arm Israel, King Faisal pulls his infamous "oil sword." Faisal uses the power of oil to protest American policy in the Middle East. Saudi Arabia, along with ten other Middle East nations, agrees to cut back on oil production. Saudi Arabia bans exports of oil to the United States. Although the cuts are relatively minor, the oil embargo creates panic and gas prices skyrocket. In the long run King Faisal's embargo has little bearing on United States policy toward Palestine, the embargo does demonstrate how dependent the world has become on oil and how that dependency has put Saudi Arabia and other Middle Eastern countries into a new position of power. This political clout, Saudi Arabia's new wealth, and the world's access to cheap oil may not last long, however, as overproduction threatens the long term productivity of the Saudi Arabian fields.

The significant rise in oil prices is actually a godsend for the oil industry, with the profit windfall enabling completion of major projects, such as the Alaska Pipeline. The reduction in Saudi Arabia also gives a much-needed break to the major oil fields that

have been overproducing for decades. Unfortunately, the break doesn't last long. Aramco management continues to overproduce in order to meet the increasing global demand for oil, despite the long-term damage to the fields. Some suggest that Aramco is intentionally overstressing the wells in order to collect as much profit as possible, before the operation is completely turned over to the Saudi Arabian government. Even after Aramco changes hands, however, overproduction continues. Although the Saudis try to slow production to protect their wells, the Iranian Crisis of the late 1970s and the first Gulf War in 1990 force Saudi Arabia to continue to overproduce regardless of the damage sustained by the wells.



# Chapter 4

## Chapter 4 Summary and Analysis

As Saudi Arabia tries to limit oil production to protect its wells from the damages of overproduction, the United States government, concerned about the world's growing dependence on Saudi Arabia's oil, charges the United States Government Accounting Office (GAO) with investigating Saudi Arabia's ability to meet global oil demands. The GAO's report concludes that Saudi Arabia can, in fact, sustain its production levels assuming that high reservoir pressures are maintained and that the current practice of water injection to keep pressures high can continue. Unfortunately, neither of these assumptions proves to be correct. Less than a year after the GAO report is released, a report to the United States Senate Subcommittee on International Economic Policy of the Committee on Foreign Relations is released. The report includes production levels at each of the key areas of Ghawar, Saudi Arabia's most productive reservoir. The report also concludes that if these rates are continued, the regions of the reservoir will suffer irreversible damage.

From 1950 through 1982, the primary members of the Organization of the Petroleum Exporting Countries (OPEC) publish detailed information concerning production levels for each field at least once a year. In 1982, however, led by Saudi Arabian oil minister Ahmed Zaki Yamani, the practice ends. Although no one knows the true reason for OPEC's secrecy, it is speculated that Saudi Arabia is trying to hide the fact that they are having problems with their wells, while others believe the veil of secrecy is designed to enable OPEC countries to cheat on their production quotas. Regardless of the reason, the lack of field-by-field data leaves the rest of the world in the dark about the true production capabilities and sustainability of Saudi Arabian and other Middle Eastern oil producers. During the OPEC secrecy, numerous technical papers written by Saudi engineers were presented to the Society of Petroleum Engineers at various conferences over the years. These technical papers shed some light on production levels and also indicate that in the mid-1990s, Saudi Arabia is still heavily dependent upon a handful of fields, particularly Ghawar, to produce most of its oil. Other publications, including several in-house brochures, indicate that Saudi Arabia has implemented new technologies to continue to meet global demand. These new technologies are generally associated with wells that have peaked and are beginning to decline in production.

By 2005, the world's demand for oil exceeds 86 million barrels a day and Saudi Arabia has become the only country in the world with any unused capacity. All other key producers have reached their capacities and hopeful new producers, such as Russia, prove disappointing.

As global oil demand surges, the world grows more and more dependent upon Saudi Arabia. Although the Saudi Arabian government continues to insist its fields will be able to meet the growing demand, the lack of production data to back up these claims makes it difficult to believe. With OPEC's secrecy regarding production levels, technical papers

detailing the need for new technologies to sustain production, and brochures showcasing new technology employed to maintain production levels, it is clear that Saudi Arabia is no longer able to simply open additional valves and let the oil pour in. Although most people seem oblivious to these clues, it is clear that Saudi Arabia is entering a new era in its oil production role and the future of Saudi Aramco, the Saudi Arabian economy and the world's oil supply may lie in the balance.



# Chapter 5

## Chapter 5 Summary and Analysis

When Saudi Arabia enters the ranks of the world's top oil producers, the oil is easy and inexpensive to generate. Although Saudi Arabian wells are still some of the most prolific wells in the world, it has become far more expensive and labor intensive to maintain the high rates of production. In the early days, Saudi Arabia's oil was pure and easy to process. This is no longer the case. The crude oil coming from Saudi Arabian wells now contain liberal amounts of salt water, gases, sulfur and hydrogen sulfide gas. To deal with these problems, Saudi Arabia invests a great deal of money in gas oil separation plants (GOSP), and other processing techniques to maximize the amount and quality of the oil coming from its wells. Saudi Aramco also begins to collect other usable resources from its wells, including natural gas. In addition to these huge investments, Saudi Aramco invests even more money to develop and employ the most advanced technology available for oil and gas exploration. With state-of-the-art reservoir simulation technology, including Parallel Oil, Water and Gas Reservoir Simulator (POWERS) that the Saudi Arabians developed themselves, Saudi Aramco uses the most advanced techniques to determine which wells to drill, how many wells to drill, and what types of wells to drill each year. Saudi Aramco also invests huge sums of money in seismic data surveys.

These enormous investments suggest that oil is becoming more and more difficult to find and collect in Saudi Arabia. An examination of Saudi Arabia's most productive wells and their geology indicate that certain geological formations, such as Arab D Zone 2B - which is responsible for about seventy percent of Saudi Aramco's current oil output yield far more oil than other geological formations. Arab D Zone 2B contains extremely porous rock which allows for maximum oil flow. Arab D Zone 2B also contains layers of even greater permeability called "Super K" zones. These "super K" zones enable exceptional flow capacity and are found in all three super-giant carbonate reservoirs (Ghawar, Abqaiq, Berri) in Saudi Arabia. Unfortunately, when water injection techniques are used in "Super K" zones, the water mixes with the oil rapidly and extensively. Although much of Saudi Arabia remains unexplored, the odds that another giant or super-giant field will be discovered are quite slim. History has shown that large fields are usually discovered early in the exploration process, rather than later, unless the wells are discovered through deep-water offshore drilling.

The in-depth survey of basic petroleum industry operations covered in this chapter provides a basis for forming an educated opinion on the future of oil in Saudi Arabia. The technical advances made by Saudi Arabia in recent years provide even more evidence that Saudi Arabia is reaching the end of its reign as the world's oil king. Saudi Arabia's desperate and expensive attempts to find more oil have not paid off and all signs point to a significant slowing of oil production in Saudi Arabia.



# Chapter 6

## Chapter 6 Summary and Analysis

Retrieving oil is a complicated process. Once oil is actually discovered, there are numerous complex steps involved in the development and production cycle of oil. The amount of oil in place is first estimated, followed by an estimation of the actual recoverable amount. This process is followed by the calculation of the field's production rate and depletion curve. Once these statistics are determined, production begins and the estimates are then adjusted based on actual performance data. When primary recovery is complete, a variety of technologies are employed for secondary and tertiary recovery. Making accurate estimates about the amount of recoverable oil in a reserve is difficult and is not an exact science. Techniques used in retrieving oil, such as water injection, in addition to the long-term production levels of a given well, can greatly impact the amount of oil eventually recovered.

The use of water in maintaining pressure in wells is both a blessing and a curse. Water is a natural part of the recovery process. The water produced by drilling in the world's oilfields now exceeds 200 million barrels a day, nearly three times the amount of oil produced. In addition to the cost of disposing of all of this water (estimated at about \$40 billion per year,) water also causes damage to the wells and expensive drilling equipment. New technology is improving the industry's ability to deal with water issues, but the delicate balance between oil and water is complex and costly. Saudi Aramco's water injection system is one of the world's most complex systems. The water (taken from the sea or a local aquifer) is injected into the flanks of the field to maintain pressure in the well. Some of the water mixes with oil as it rises to the wellbore and must then be separated from the oil. The separated water is then re-injected into the well to further maintain pressure. Initially, water injection was employed only as a secondary recovery technique. In the late 1970s and 1980s, however, water injection became a commonly used primary technique in the North Sea and Alaska's North Slope. Although Saudi Arabia's major reserves continue to produce a high volume of oil, the cost of maintaining pressure through water injection continues to rise and the question of when injection will no longer be economically feasible remains unanswered.

The science of oil discovery and production is complicated, and in some cases, inaccurate. The ability to predict the amount of oil that will be recovered from any particular well is limited. Even if early recoverability estimates are fairly accurate, a number of variables, such as production rates and water injection, can impact final recoverability efforts. In the late 1970s, the United States government estimates the total proven amount of reserves in Saudi Arabia to be about 110 billion barrels. By 1979, the Saudi Arabian government raises the estimate to 150 billion barrels. By 1988, despite the fact that no new reserves had been discovered, the estimate jumps to 250 billion barrels, and eventually reaches the 300 billion barrel mark. Considering the difficulty in making accurate estimates in the first place, the risks involved in using water injection technology, and the fact that in the past 17 years more than 46 billion barrels

have been produced in Saudi Arabia, questioning how Saudi Aramco can continue to estimate future oil recovery at 300 billion barrels is valid.



# Chapter 7

## Chapter 7 Summary and Analysis

Ghawar, the world's most productive oil reserve of all time, has been yielding the bulk of Saudi Arabia's oil since 1951, producing more than 55 billion barrels of oil. The 174-mile-long oil field covers more than 2,000 square miles. In the past years, Ghawar has accounted for 50-65 percent of Saudi Arabia's oil production - and continues to bear this burden. In 2004, after 20 years of secrecy, Saudi Aramco officials reveal that Ghawar continues to be Saudi Arabia's largest producer. Although Ghawar has encountered various water problems, those problems are under control. Saudi Aramco officials express great confidence in Ghawar's long-term sustainability, but the facts paint a gloomier picture. Ghawar, although considered to be one large oil field, is made up of several sites. The northern sites, including Shedgum, 'Ain Dar and north Uthmaniyah have always been more productive than the rest of the reserve. These three sites represent only 10 percent of the total field, however, they have produced nearly half of the total oil recovered in the last fifty years. Numerous papers presented at the SPF conferences over the years highlight problems with water-cut and production in the northern region of Ghawar.

The southern region of Ghawar is routinely described by technical experts as far more challenging and complex than the north. When global demand for oil decreases in the 1980s, Saudi Arabia is able to shut down production in the southern region where it is expensive and limited. When Iraq invades Kuwait in 1990, however, Saudi Arabia is forced to reopen the southern regions of Ghawar, in order to meet global oil demands. Despite this period of rest, problems with well pressure and water surface almost immediately after the northern wells are brought back online. In 2001, a paper written by four Saudi Aramco experts admits that Ghawar's most productive areas are mature and showing common signs of aging, including declining pressure, increased water and gas fractions. Another paper, published the following year, details problems with oil recovery in at Hadrah at the south end of Ghawar.

The region is an important target for new production to offset decreases in other sections of Ghawar. Hadrah has been split into three sections, with the first section coming online in 1996. Although the first section will only produce a small fraction of the oil produced in the north, it appears to be one of Saudi Arabia's last hopes for future oil. With all of the signs pointing to a significant decrease in production in Ghawar's northern region, it is clear that Saudi Arabia is making great attempts to find a replacement for the significant amount of oil that will be lost, when Ghawar closes permanently. With little success to date, all evidence points to the end of the Saudi Arabia oil era.

The vast resource of technical papers, many written by Saudi Aramco technical experts, builds a strong case for his argument that Saudi Arabia is running out of oil. The evidence that Ghawar, Saudi Arabia's massive oil producing field, is dying is convincing.



Considering much of the evidence comes from papers written by Saudi Aramco employees and consultants, the facts are difficult to ignore. As the primary source of Saudi Arabia oil for the past fifty years, the future of Saudi Arabia's oil industry is seriously threatened by the decline of Ghawar. Without any significant new discoveries, Saudi Arabia will lose more than half of its oil production, when Ghawar is closed down. This will not only create severe economic problems for Saudi Arabia, but it will cause a global energy crisis.

# Chapter 8

## Chapter 8 Summary and Analysis

After Ghawar, Saudi Arabia has three oilfields that produce significant levels of oil. There is Abqaiq, Sanfaniya and Berri. All three fields are experiencing technical challenges similar to those facing Ghawar. This is not surprising considering the problems are related to aging reservoirs and all of Saudi Arabia's huge oilfields are relatively close in age. Abqaiq oilfield is described by technical experts as extremely mature. Operating since 1946, Abqaiq has already produced most of its recoverable oil. Although Abqaiq is less than a quarter of the size of Ghawar, Abqaiq has historically produced extremely high quality oil. In 1956, Abqaiq becomes Saudi Arabia's first water injection site. The process begins as an experiment but becomes a permanent part of oil production at Abqaiq in 1963. A Society of Petroleum Engineers paper written in 2004 describes a multiphase pump project at Abqaiq that has been successful in reviving several of the area's dead zones.

Sanfaniya is Saudi Arabia's second greatest producer and the world's largest offshore oilfield. Although prolific for the past fifty years, Sanfaniya's oil is heavy and less valuable. In the late 1980s, Sanfaniya begins to experience problems with sand mixing with the oil, a fairly common phenomenon with sandstone oilfields. Sanfaniya also faces problems with water-cut, gas coning, and most recently, with increased levels of radioactivity. Sanfaniya holds the world's entire remaining spare daily oil supply of any magnitude. With this vital supply role, the uncertainty of Sanfaniya's future production is cause for alarm. Berri is one of the last giant oilfields discovered in Saudi Arabia (1964). Although the oilfield contains onshore reserves, only its offshore reserves have ever produced any significant amount of oil. Early into its production life, Berri's pressure dropped significantly and water injection was implemented in 1975. Shortly after, water began to flood some of Berri's wells.

By 1976, Berri's production peaked and by 1990, twenty-five percent of Berri's wells were shut down. Saudi Aramco called in technical experts from Mobil to help with Berri's problems. Mobil's team conducts geologic and engineering analysis using one of the first detailed 3D models ever used in Saudi Arabia. By 1994, Berri's daily production drops by more than sixty percent from its peak. Experts estimate that more than twenty percent of Berri's oil will remain unrecovered.

The future of Saudi Arabia's largest oilfields is uncertain. The evidence presented makes one believe that the three fields highlighted here (Abqaiq, Sanfaniya and Berri,) as well as Ghawar, are approaching the ends of their production lives. Although new techniques are being tested and implemented, the age of these reserves causes concern about the future of these reserves and the global supply of oil.



# Chapter 9

## Chapter 9 Summary and Analysis

With Saudi Arabia's major oilfields seemingly reaching, and perhaps surpassing maturity, Saudi Arabia has begun searching for alternative sources of oil in order to maintain its position as the world's oil supplier. Rather than seeking new discoveries, Saudi Arabia invests most of its capital in reviving several old fields. These fields, which were shut down years ago due to poor performance or poor quality oil, have now become Saudi Arabia's future prospects. To many, this is evidence that Saudi Arabia is running out of oil and prospects and are making a last-ditch effort to recover oil and save their national economy. Despite the history of problems and poor performance of these reserves, Saudi Arabian officials make impressive predictions about their future production levels. The pressing question is why (if these wells have in fact such great potential) they have not been developed sooner. In times of crisis, when Saudi Arabia pushed their major oilfields such as Ghawar, why didn't the government instead just revive some of these other reserves in order to alleviate stress on the major producers?

The fact that Saudi Arabia is desperately trying to revive these fields, rather than find new ones, also implies that Saudi Arabian officials are not optimistic about the prospects of new discoveries. Another effort in the development of the Shaybah field in the Empty Quarter also points to desperation. Development in this remote, harsh environment is extremely expensive, complex and risky. Although some people believe that Saudi Arabia's sudden interest in Shaybah is political due to its proximity to the United Arab Emirates and potential border issues, others suggest Shaybah has finally risen to the top of Saudi Aramco's prospect list, after a long list of disappointing prospects.

Only one new discovery, the Hawtah Trend, is on Saudi Arabia's official list of developments. This collection of six oilfields, discovered in 1989, becomes the first oil to be produced outside of the Eastern Province. For Saudi Arabian officials, this not only marks a new discovery, but also demonstrates that oil exists throughout the country, not just in the Eastern Province. Unfortunately, the discovery of the Hawtah Trend is followed by a series of disappointments. Although the oil is of extremely high quality, there are various challenges to recovering the oil. The final opportunity for Saudi Arabia to expand oil production is in the neutral zone, an area of fairly high oil production, shared by Saudi Arabia and Kuwait. The reserves in the neutral zone are experiencing the same age-related problems as most of the reserves in Saudi Arabia and production is in decline.



# Chapter 10

## Chapter 10 Summary and Analysis

From 1940 to 1968, exploration for oil in Saudi Arabia is extremely successful. Since then, however, Saudi Arabia has had only a few significant discoveries. Some suggest that this is due to a lack of effort on the part of Saudi Aramco. Many people claim that there is plenty of oil in Saudi Arabia, and that Saudi Arabian officials want to manipulate the market and do so, in part, by limiting exploration. Accounts of a continuous exploration effort, detailed in the Society of Petroleum Engineers papers over the years, contradict this claim. Saudi Arabia has led an extensive exploration effort for the past 30 years. The use of modern technology including seismic, magnetic and gravity surveys and advanced model simulations leads to a few major oil discoveries, such as the Hawtah Trend, as well as a few rich gas reserves, but new oil continues to be elusive. One of the most important discoveries is found in 1996, when geologists determine that the Arab D Zone outside of the Eastern Province has eroded away over the past few million years and has been replaced by younger rock. The hopes of other super giant oilfields due to the Arab D Zone are shattered.

Exploration in the other regions, including the northwest, the Greater Ghawar Area, and Yemen also prove to be relatively unsuccessful. Yerbin Field, discovered in 2003, is the first significant oil discovery in years. Saudi Arabian officials admit it has taken ten months of drilling to find oil at Yerbin Field, and this is not a promising sign. Nine other discoveries are made between 2004 and 2006, but only one is an "oil-only" reserve. There is still a lot of unexplored area in Saudi Arabia and no one knows whether oil will be found in these regions or not. Considering the lack of discoveries in the past three decades, the odds do not seem to be in the Saudi Arabia's favor.



# Chapter 11

## Chapter 11 Summary and Analysis

In the early days of oil exploration in Saudi Arabia, natural gas is seen as a worthless by product of oil production. In the 1950s, natural gas is recognized as a useful product for maintaining reservoir pressure. It was not until the 1970s that Saudi Arabia officials realized the true economic potential of natural gas. In 1975, Saudi Aramco establishes the Master Gas System to begin using the natural gas by product to create a petrochemical/chemical industry - SABAIC - in Saudi Arabia. Within a decade, natural gas becomes the primary fuel for creating electricity for domestic use in Saudi Arabia. One of the most important uses is to power desalination plants that convert seawater to potable water for Saudi Arabians.

The great demand for natural gas leads Saudi Arabian officials to begin exploration for natural gas not associated with oil production. In 1982, Saudi Aramco begins drilling for deep gas reserves and soon encounters problems with sand and saline water. Anticipating the discovery of huge gas reserves, Saudi Arabia invests billions of dollars in gas processing facilities. When it becomes clear that Saudi Aramco will not find the huge reserves necessary to make processing economically feasible, Saudi Arabian officials reach out to Western oil companies in hopes they will invest in the project. After several years, millions of dollars and a great deal of miscommunication, the partnerships with Western oil interests fall apart. The Saudi Arabian government re-evaluates and subdivides two of its major projects, awarding concessions to several non-Western oil companies. The gas initiative is a disaster.

Meanwhile, Saudi Arabia's internal dependency on natural gas continues to grow, as does its population. The natural gas that Saudi Arabia once burned off as waste, has become even more valuable to the people of Saudi Arabia than oil. The Kingdom's dependency on natural gas, to provide drinking water and electricity to its growing population, surpasses its economic dependency on oil. Without oil, the kingdom will suffer severe economic challenges. Without natural gas, however, the people of Saudi Arabia will not have water to drink or electricity to operate most of the Kingdom's industrial facilities. Saudi Arabia must find and develop huge natural gas reserves soon. If this happens, the price of natural gas will most certainly be more expensive than Saudi Arabian's are accustomed to, but this is better than the alternative.



# Chapter 12

## Chapter 12 Summary and Analysis

The amount of oil available in Saudi Arabia has been the subject of much speculation - but remains a mystery. No one really knows how much recoverable oil existed in the first place and no one knows how technical challenges and overproduction will affect the final amount recovered. The information contained in the various Society of Petroleum Engineers papers confirms the uncertainty of Saudi Arabia's estimated oil reserves. Estimating the amount of original oil in place (OOIP) is tricky and inaccurate. Ultimate estimated recovery figures are based on these inaccurate figures, which makes these figures also highly inaccurate.

Modern technology has proven to be a poor tool in predicting this outcome. A wave of technological advances in recent years leads many people to believe that technology has finally made it easy to recover more oil from older fields. In reality, the new technology only enables Saudi Aramco to recover the oil more quickly, giving false hope to a desperate industry. Modern technology has improved the process of oil recovery, but the art of estimating reserves is still a guessing game. The most accurate way to determine the true potential of a reserve is to drill appraisal wells. Due to the expense, however, this is done with less and less frequency. Although appraisal wells are an accurate way to estimate the amount of oil in a reserve, there is no way to determine the true recoverability figures - until the reserve is depleted and the reserve is shut down for good. If estimates of Saudi Arabian oil reserves made in the 1970s were fairly accurate, and the elevated figures touted by Saudi Arabia officials since that time were fabricated, then the end of Saudi Arabia's reign as global oil king may be coming much sooner than most people ever imagined.



# Chapter 13

## Chapter 13 Summary and Analysis

Oil in Saudi Arabia will not last forever. In fact, most signs indicate that the era of cheap and easy oil development in Saudi Arabia is coming to an end. Almost all of Saudi Arabia's oil output comes from a handful of giant and super-giant reserves. These heavy producers have been operating for 40-60 years. Only Shaybah is a relative newcomer. These fields have been producing at very high rates for an extended period of time and no new fields have been found to replace them. These facts paint a gloomy picture of the future of oil in Saudi Arabia. In order to be optimistic in the face of these harsh facts, one must hold one or several of the following assumptions. The secrecy surrounding oil production rates in Saudi Arabia has not been an attempt to conceal the truth about production. Saudi Arabia has developed new technology that will sustain production. Saudi Arabia's oil reserves will not suffer the same decline patterns as the rest of the world. Over production at key fields is not related to a lack of oil in other closed fields. Exploration efforts have completely missed major oil reserves. Ghawar will live on forever. Saudi Arabia has not increased oil production at the level possible, because there is not demand.

Giant oilfields around the world, including those in Norway, United Kingdom, Russia, China, Alaska and Mexico, have peaked and have then experienced sharp declines. Comparing the fate of these fields, as well as other fields in the Middle East, indicate similar outcomes for Saudi Arabian fields. Giant oilfields geographically and geologically similar to Saudi Arabian fields, such as those in Iran and Oman, have also peaked and declined. In Russia, overproduction and poor management contribute to an early decline in production, but nonetheless, the reserves still peak and then decline. The peak/decline phenomenon appears to be a natural part of the life cycle of all large oilfields regardless of their geographical location, geological makeup, or the techniques used to recover the oil or sustain pressure. There is no evidence to indicate Saudi Arabian fields will be any different. As demonstrated in by post-decline recovery efforts in Russia, this natural decline in production does not signal the end of oil production entirely. It does, however, indicate a severe decline in production levels that, in the case of Saudi Arabia, will have noticeable affect on global oil supplies.

This chapter brings all the most important facts together to create a persuasive argument that the end of Saudi Arabia's oil days is coming. By using the history of other fields from around the world, further convincing evidence suggests that Saudi Arabian oil production is in decline, and will only continue to get worse. The facts speak for themselves and anyone who doesn't see the reality of the situation, is either unusually optimistic or unwilling to see.



# Chapter 14

## Chapter 14 Summary and Analysis

The papers written for the Society of Petroleum Engineers and presented at Society of Petroleum Engineers conferences are intended to highlight the successful approaches to solve challenging problems taken by their authors. When one considers the papers in their entirety, however, they also detail the many challenges being addressed by Saudi Aramco's top technical experts. Papers written for the Society of Petroleum Engineers in 2003 and 2004 continue to shed light on the challenges being faced by Saudi Arabia's oil industry. At the October 2003 Society of Petroleum Engineers Annual Technical Conference in Denver, Colorado, twelve papers are presented by Saudi Aramco authors. The papers discuss a range of technical issues including computer modeling, water floods, advanced oil recovery needs, and permeability.

As a group, these papers represent a litany of technical challenges Saudi Aramco is currently dealing with in order to sustain its oil production levels. Additional papers published in recent years further demonstrate that all is not well in Saudi Arabia. Topics including problems with the rehabilitation of oilfields, cleanup problems and expensive new drilling strategies highlight some of the newest challenges. One paper, which discusses how conventional analytical techniques are not accurately interpreting data from horizontal wells, includes three case studies from the Ghawar Arab D Zone. All three cases detail complexities in what was once considered one of the world's most productive and free-flowing oil reserves.

A paper co-authored by Dr. Nansen Saleri, head of Saudi Aramco's reservoir management group, in December of 2003 is meant to showcase Saudi Aramco's advanced technology is multi-branched MRC wells. The paper also highlights the fact that the selection of the well configuration demands considerable pre-drilling engineering analysis. This confirms that finding oil even in Saudi Arabia's existing reservoirs has become far more challenging than it once was. The paper also clearly admits that the success of this new technology remains to be seen. It will take 3-5 years to provide a complete evaluation. A year later, Dr. Saleri, who had already admitted that the jury was still out on the capability of this new technology, tells leading United States energy planners that Saudi Arabia could produce twice its current rates for at least the next fifty years. Saudi Aramco officials appear confident in their ability to provide an endless supply of oil and are reluctant to admit they have any problems at all. The Society of Petroleum Engineers papers, on the other hand, provide details of multiple problems and cause reasonable concern for the future production levels of Saudi Arabia's oil industry. Some people, such as Dr. Saleri, dismiss the papers as exaggerated to make the authors look impressive, however, the sheer volume of papers and the number problems being addressed, makes this seem improbable.





# Chapter 15

## Chapter 15 Summary and Analysis

Eventually, free-flowing oil in Saudi Arabia will stop and secondary recovery efforts will be the only alternative remaining for Saudi Arabia. The super-giants, like Ghawar, will not be part of this secondary effort, because the use of water injection programs renders secondary efforts useless. A Society of Petroleum Engineers paper provides a case study of secondary recovery. The case study determines that relatively large quantities of oil left behind can be recovered, tertiary recovery efforts rarely recreate high oil flows;, and the best approach to steadily increasing water cuts is to choke back a well's rate of production.

During a visit to Saudi Aramco headquarters in 2003, the author, along with other industry visitors, is told that Saudi Aramco is invoking fuzzy logic to ensure maximum oil and gas recovery. Using an example of whether a 45-year-old man is young or old, the Saudi Aramco official explains that fuzzy logic describes the black and white area of interpretation. In other words, the future of Saudi Arabia's aging oil fields is no clear. What is clear, however, is that Saudi Arabia's handful of aging giant and super-giant oilfields is mature. Mature fields peak and decline, and there are probably not anymore giant oilfields in Saudi Arabia yet to be discovered. Non-OPEC oil production (with the exception of the Former Soviet Union,) is peaking. Using fuzzy or clear logic, it is obvious that Saudi Arabia's oil production is heading for decline. One of the most important technical challenges in Saudi Arabia now is recovering oil left behind. Due to the vast amounts of oil in Saudi Arabia, and despite the fact that many of the biggest producers are not candidates for secondary recovery, the future of Saudi Arabian oil production lays in the oil left behind.

# Chapter 16

## Chapter 16 Summary and Analysis

For the past 30 years, the world has assumed that Saudi Arabia can continue to maintain its incredible level of oil production. This assumption is encouraged by major international energy forecasters and other experts. In the past 20 years, no one has really questioned whether or not this is fact or fantasy. Yet, since 1982, very little data has been available to verify production levels in Saudi Arabia. Credible field production data would easily clarify this matter and would enable global energy planners to develop factual forecasts. Not only is Saudi Aramco no longer releasing this information, most other national oil companies as well as privately owned companies, now conceal this data. The only way to clear up this mystery, once and for all, is to return to the era of transparent oil production data.

In recent years, Saudi Arabia officials have insisted that their production data is in the public realm and all of the information necessary to verify Saudi Arabia's production levels and future capabilities is easily accessible. In 2005, *The Economist* ran an article about Saudi Arabian oilfields facing challenges. According to the article, Saudi Aramco now openly shares its field production data. However, when Abdullah Jumah, Saudi Aramco CEO, was asked about the need to bring in outside auditors to verify the data, he responded, "Why should we. We have never failed to deliver a single barrel of oil promised to anyone, anywhere." This is true. Saudi Arabia has always been an extremely reliable oil supplier. However, as Saudi Arabia's oilfields continue to age and global demand continues to increase, it becomes increasingly difficult to rely on blind trust. The stakes, a global energy crisis, are too high.



# Chapter 17

## Chapter 17 Summary and Analysis

For the past fifty years, oil has become an abundant and inexpensive fuel in most developed countries. With the end of cheap and easily recovered oil in Saudi Arabia, oil-consuming nations will need to adjust to a new world where oil is scarce and far less affordable. It is urgent that the world's energy planners begin looking at solutions now before it is too late. The twilight of Saudi Arabia's oil production era presents many questions that must be answered at a global level. These questions include the long-term price and affordability of oil, how to prolong or extend existing oil supplies, and how to allocate available supplies. There are also the questions of how the world's population can modify consumption patterns and an investment in conventional oil production and alternative energy forms. In a world of dwindling oil supplies, competition between energy-consuming nations will become fierce. To avoid future energy wars, the world must develop rational, orderly approaches to the problem before it is too late. Once oil supply peaks, the world will be forced to create ways to substantially conserve oil and other energy resources. As transportation is the biggest single user of oil, the world will need to find ways to transport people as efficiently as possible. Building fuel-efficient vehicles will not solve the problem. A major rethinking of human transportation is imperative.

Although a world of scarce oil will bring serious changes and adjustments, it will also have a positive impact. Higher oil prices will bring an influx of much-needed money to OPEC countries. Wise investments and proper management will finally enable these countries to establish a genuine middle class within their societies. Scarce oil will also result in a reduction of emissions and reduce the concerns surrounding global warming. Other advantages, such as the end of urban sprawl, may also be a welcome consequence.

The greatest challenge the world faces in the twilight era of Saudi Arabian oil is not being prepared to deal with the lack of oil. The most critical part of this transition is the development of a new energy source. History has shown that from great crises come ingenuity. In other words, necessity is the mother of invention, and the decline of Saudi Arabian oil will make it necessary for the world to find other means of fuel for transportation and feedstock, while the remaining oil supplies are used wisely and conservatively.



## **Characters**

**King Abdul Aziz Ibn Saud**

**Prince Faisal/King Faisal**

**King Saud**

**Everett Lee DeGolyer**

**Franklin D. Roosevelt**

**Harry S. Truman**

**Major Frank Holmes**

**Harry St. John Philby**

**Max Steinecke**

**Ahmed Zaki Yamani**

**Ali Bin Ibrahim Al-Naimi**

**J.J. Rebold**



# Objects/Places

## Saudi Arabia

The kingdom of Saudi Arabia was established in 1902, when Abdul Aziz (aka King Ibn Saud) and a large army of warriors recaptured the city of Riyadh. The kingdom was a small, relatively obscure nation, until oil was discovered in the 1930s. The discovery of oil brings Saudi Arabia international prominence and provides an enormous economic boost to the relatively poor country. By 1970, Saudi Arabia is the most important oil-producing country in the world.

## Aramco

In 1940, Standard Oil of California (SOCAL) launches a huge oil exploration campaign in Saudi Arabia. Due to the expense, SOCAL brings in three industry partners. Originally called the California Arabian Standard Oil Company, the name was changed to Arabian America Oil Company (Aramco) in 1944 to reflect the partnership between four major United States oil companies. These four, Exxon, Mobil, Chevron and Texaco were the sole owners of Aramco, until the Saudi Arabian government began buying control in the late 1970s.

## Saudi Aramco

Saudi Aramco is Saudi Arabia's government-controlled oil company. Years after control of Aramco totally ceded to the Saudi Arabian government, Aramco's official name was changes to Saudi Aramco in 1989 or 1990.

## Ghawar

Ghawar is Saudi Arabia's, and the world's, most productive oilfield ever. Ghawar first began producing oil in 1951 and since then has produced in excess of 55 billion barrels of oil. Through the last half of the 20th Century, Ghawar accounted for about 55-65 percent of Saudi Arabia's total oil output. The aging oilfield is beginning to show signs of decline, which will have a huge impact on global oil supplies.

## Berri

Berri is one of the last giant oilfields discovered in Saudi Arabia. The field was discovered in 1964, with oil-bearing reservoirs both on-and offshore, but only the off-shore reservoirs have ever produced any significant amount of oil.



## **Abqaiq**

Abqaiq oilfield was discovered in 1940. Full scale development and initial oil production began in 1946. Although it is significantly smaller than Ghawar, Abqaiq produces extremely high quality oil.

## **Safaniya**

Safaniya is Saudi Arabia's second most productive oilfield and the world's largest offshore oilfield. It was discovered in 1951 and has been producing oil since 1957.

## **Kuwait**

Kuwait is a small, oil-producing neighbor of Saudi Arabia. Iraq's invasion of Kuwait in 1990 resulted in the first Gulf War.

## **Neutral Zone**

Saudi Arabia and Kuwait share equally in the oil produced in an area between the two countries known as the Neutral Zone. The Neutral Zone contains three significant oilfields, two onshore and one offshore.

## **United States**

The United States became the world's dominant oil producer in 1901, when the Spindletop field was discovered in Southeast Texas. From 1930 on, the United States had so much oil that state agencies in Texas and Oklahoma prorated output among producers, allowing each to produce only a few days each month. With the discovery of Prudhoe Bay in Alaska in 1968, it appeared the United States would control the world's oil market for years to come. Environmental disasters and public concern led to strict limitations in oil exploration and drilling and by 1970, the United States was no longer the world's leading oil producer.

## **Prudhoe Bay**

In 1968, a super-giant oilfield was discovered on the Arctic Ocean in Alaska. Prudhoe Bay was expected to help maintain the United States as the world's leading oil producer.



## **Organization of Petroleum Exporting Countries (OPEC)**

An international organization established to represent the interests of the major oil suppliers. Saudi Arabian minister of oil and petroleum Al-Tariqi is credited as one of the originators of OPEC.

## **Society of Petroleum Engineers**

The Society of Petroleum Engineers is an international professional technical organization headquartered in Richardson, Texas. The author accesses the Society of Petroleum Engineers's extensive library to develop the thesis and arguments for this book.



# Themes

## Deception

The underlying question posed is whether Saudi Arabia is being forthright about their oil production. The entire book, in fact, is an effort to demonstrate that Saudi Arabia is not telling the truth about their oil production capability, the technical challenges they are facing and their future oil production capability. Saudi Arabian officials claim for years that they can provide as much oil as the world needs for at least another fifty years. There is a long paper trail, however, that suggests this may not necessarily be the case. Numerous papers written by various engineers, geologists and other oil technicians for presentation at the Society of Petroleum Engineers meetings provide strong evidence that perhaps Saudi Arabia is having more trouble maintaining their oil supplies than they are willing to admit and, perhaps, their oil reserves are actually running low. The evidence points to a concerted effort on the part of the Saudi Arabian government to deceive the rest of the world about the current state of the Kingdom's oil productivity. But, what is the motivation for Saudi Arabia's deception? It is unclear what Saudi Arabia stands to gain from fifty years of lying and deceiving the world. Yes, for now their role as oil supplier to the world is secure, but eventually the truth will come out and what will Saudi Arabia have gained? Is this a matter of national pride or is the Saudi Arabian government hoping to find a new giant oilfield in time to retain their position as global oil provider? If this is truly a case of intentional deception, Saudi Arabia could be responsible for a global crisis when their production levels severely decline, and the world is not prepared.

## Secrecy

From 1950 through early 1982, the primary nations that compose OPEC provided the world with detailed field-by-field production data. The data was published annually and sometimes semi-annually in public journals. In 1982, however, OPEC nations ceased to report field-by-field production data for their oil production facilities. From that point on, the production levels at the world's largest oilfields have been a mystery, hidden in a so-called "veil of secrecy." There are several possible explanations for the secrecy. One explanation is that Saudi Arabia is trying to hide the fact that its most productive reserves are in decline. This secrecy has huge ramifications for oil-consuming nations. Without the detailed production reports, there is no way to monitor the amount of oil being produced by Saudi Arabia and other OPEC nations, and no way to tell if Saudi Arabia's giant and super-giant fields have peaked. The secrecy has also opened the door for a huge amount of misinformation, gossip and distrust. Without any real data, numerous third party sources have provided unsubstantiated data to the media and business industry, creating a vast amount of unreliable data. This secrecy will take its toll, when the rest of the world realizes that Saudi Arabia is running out of oil and no one is prepared to deal with the shortage. Had the OPEC countries been forthcoming with





their production data, any potential global shortages would be public knowledge and the solution could be approached at a global level.

## Responsibility

Responsibility, or the lack thereof, is a recurring theme throughout this book. Saudi Arabia is responsible for a huge percentage of the world's oil supply. With this role comes the responsibility of providing accurate production data and reliable forecasts. If Saudi Arabia's reserves are reaching the end of productivity, it is the responsibility of Saudi Arabia to inform the world. In addition to Saudi Arabia, there is an entire group of international oil industry experts, who should have already begun questioning the apparent never-ending supply of Saudi Arabian oil. These so-called experts should be the first ones asking the hard questions about the future of Saudi Arabian oil. So far, these questions have remained unasked by the experts. A great deal of responsibility also belongs to the oil-consuming nations of the world, especially the United States. For the past fifty years, these nations have consumed oil as if it were an easily renewed resource, with little regard for conservation. Oil, like coal and gas, are non-renewable. This blatant irresponsible approach to natural resources has contributed to the overuse of oil around the world, and particularly in western cultures. The overuse - creating a magnified level of demand - has led to overproduction of oil in Saudi Arabia's fields. This overproduction may cause an early decline for many of Saudi Arabia's most productive fields. It is now the responsibility of the people in these countries to adjust their consumption patterns and change their lifestyles to protect what little oil remains. This will not be an easy transition, but it is necessary to avoid a global crisis and potential war and global mayhem.



# Style

## Perspective

Author Matthew Simmons is an investment banker from Houston, Texas, who specializes in the energy industry. Although not a technical expert, Simmons is an oil industry insider, who has access to information necessary to write this book. His leverage as an investment banker for the energy industry has also given him the opportunity to see firsthand many of the technical challenges and other issues facing Saudi Arabia's oil industry today. Although the primary sources for this book are the Society of Petroleum Engineers papers, Simmons also provides eyewitness accounts from his own experience, which adds credibility to his claims.

The intended audience for this book is the millions of people in oil-consuming countries, who have no idea of the precarious situation the world faces concerning Saudi Arabia's oil supply. Simmons clearly intends to scare readers into a thoughtful review and evaluation of oil dependency in the United States and other industrialized countries. Simmons appears to be making a plea to anyone who will listen that it is past time to develop energy alternatives to alleviate the world's dependency on Saudi oil before it is too late.

## Tone

The tone of this book is fairly pessimistic. The entire point of the book is that the Saudi Arabia's oil supply, once believed to be endless, is drying up and the global consequences will be severe. The book is written in a subjective tone and has clearly set out to persuade us that the oil situation in Saudi Arabia is severe. Presumably, many, if not most, of the readers will be from the US and other oil-consuming nations. The urgent tone of the book is designed to inspire action. Whether this response is a change in personal lifestyle or a call for political action, the message of change is clear. The effectiveness of the message, however, is less apparent. Although the author occasionally admits that his forecast for the future of oil is not absolute, he tends to be quite adamant about his views and does not appear to be the least bit objective. At times, this fierce approach may cause the reader to question his rationality and wonder if the author is not just a little bit paranoid.

## Structure

The 354-page book is divided into four parts. Part 1 contains four chapters that focus on the history of oil discovery and production in Saudi Arabia and the impact it has had on the people of that nation, and the world. Part 2 includes only two chapters, one that provides an overview of the oil and gas industry in Saudi Arabia and another that looks at major technical challenges in the industry. Part 3 provides a detailed look at oil and gas production at some of Saudi Arabia's largest reserves. Some of the information in

this section is highly technical, which many readers may find a little too detailed for their tastes. The final section, Part 4, serves as the book's conclusion, pulling together the evidence to support the argument that Saudi Arabian oil is nearly depleted. The book also includes three appendices. Appendix A describes the methodology used by the author in researching this book. The primary focus is on the more than 200 Society of Petroleum Engineers papers reviewed to form the thesis and conclusions in this book. Appendix B provides a vast amount of technical data, in the form of charts, spreadsheets and graphs. Appendix C is an overview of the proceedings of the 1974 and 1979 United States Senate hearings on the matter of Saudi Arabian oil.

The book's structure is fairly straight forward and easy to follow, although many facts are repeated multiple times throughout the text, which is a bit tedious. The book is written in an academic format, much like a thesis or dissertation, and lacks any real style or literary characteristics.



## Quotes

"Abdul Aziz was eager to further develop Saudi Arabia's bonds to the United States as balance to the strong British influence in the region. Access to Middle East oil was an Axis objective in WWII and the reason behind the North African campaign." Chapter 1, page 12.

"I will take no action in my capacity of Chief of the Executive Branch of this government, which might prove hostile to the Arab people," Franklin Delano Roosevelt, in a letter to King Aziz written April 4, 1945, eight days before Roosevelt's death. Chapter 1, page 13.

"The economic challenges embedded in Saudi Arabia's population explosion are staggering." Chapter 1, page 16.

"Shaybah was the twenty-eighth oilfield found in Saudi Arabia and the last of any great size." Chapter 2, page 37.

"Though Saudi Arabia's oil output was coming from a remarkably small number of fields, these fields allowed the kingdom to become one of the three largest producers in the world by 1970, ranking just behind the Soviet Union at its peak and the United States, which gleaned its large cumulative oil production from some 500,000 individual oil wells, most of which produced a mere trickle compared to the flow rates of typical Saudi Arabian wells." Chapter 2, page 41.

"In 1968, a super-giant oilfield was discovered in the Alaska at the shores of the Arctic Ocean. This find, called Prudhoe Bay, seemed to ensure that the United States would remain the world's largest oil producer for years to come." Chapter 3, page 44.

"Had Saudi Arabia not been able to increase its oil output as fast as it did between 1970 and 1974, it is difficult to gauge how high oil prices might have risen." Chapter 3, page 49.

"Faisal bitterly remembered the pledge that Franklin D. Roosevelt had made to his father, assuring Abdul Aziz that Saudi Arabia would always have a seat at the table when a resolution to the Palestinian problem was to be decided." Chapter 3, page 52.

"Saudi Arabia, through its long-standing desire to be a responsible and reliable provider of oil, probably inadvertently caused long-term, if not irreparable, damage to its great reservoirs by trying to keep pace with soaring global demand." Chapter 3, page 65.

"This discontinuation of detailed field-by-field reporting put an end to any semblance of oil data transparency. Ever since then, official OPEC production and reserve data has been sparse and utterly unverifiable." Chapter 4, page 79.

"Too often, however, the new tools merely acted as super-straws that quickly extracted the targeted oil and then led to decline rates steeper than the industry had ever seen." Chapter 5, page 117.



"The first principle to grasp is that nothing about this business is simple." Chapter 6, page 130.

"How is it possible that proven reserves effectively remained constant for the last 17 years, while Saudi Arabia produced another 46.5 billion barrels of oil?" Chapter 6, page 133.

"Ghawar is the greatest oil-bearing structure the world has ever known. Its superlative qualities cannot be overstated. It is unlikely that any new oilfield will ever rival the bounteous production Ghawar has delivered to Saudi Arabia and the international petroleum markets." Chapter 7, page 151.

"To fully grasp the colossal scope of Saudi Arabia's oil challenge, it is necessary to continue this analysis by examining the other great oilfields. The most significant feature of the situation Saudi Arabia faces may very well lie in the broad scope and commonality of these problems." Chapter 8, page 182.

"Saudi Arabia's oil production is balanced at a precarious tipping point. Aramco's current programs and initiatives may forestall the tipping into decline for a short time. To do anything more than that, the company will have to be either very good or very lucky. In truth, both skill and luck would be needed." Chapter 9, page 200.

"Conventional energy wisdom has assumed that little oil exploration was needed and that almost none took place in Saudi Arabia once all its giant oilfields had been found and brought into production. In reality, Aramco has been conducting extensive petroleum exploration for years and was at the forefront of exploration technology in 2004." Chapter 10, page 235.

"Unless some great series of exploration miracles occurs soon, the only certainty about Saudi Arabia's oil future is that once its five or six great oilfields go into steep decline, there is nothing remotely resembling them to take their place." Chapter 10, page 244.

"As its population grew at breakneck pace throughout the 1990s, Saudi Arabia's need for natural gas was increasing exponentially." Chapter 11, page 247.

"The gas challenge is now a serious threat to Saudi Arabia's long-term well-being. The oil challenge is mostly a monetary threat for the kingdom, although it is also a major concern for the rest of the oil-consuming world. Saudi Arabia's need for a substantial increase in natural gas supply is fundamental, a more compelling concern for the kingdom than flattening, or even declining oil production. The kingdom's natural gas needs are all about creating more kilowatts and more potable water." Chapter 11, page 260.

"What can be predicted, however, with absolute certainty, is that the decline is coming, and our oil-consuming world is grossly unprepared for it. Somebody needs to get busy writing the script for Act II." Part 4 Introduction, page 263.



"Estimating the remaining productive life of oil and gas fields is as challenging as it is to predict how long an aging person will stay productive." Chapter 12, page 278.

"The bottom line on Saudi Arabia's proven oil reserves is that the real number is hidden in obscurity. Like all proven reserve estimates, the final number will only be known with certainty when the last producing oil well has been capped." Chapter 12, page 279.

"But the outcome will be tragic only if we refuse to pay attention to what is happening, the evidence before us, and the historical record of the oil drama as it is played out in other producing regions." Chapter 13, page 281.

"Saudi Aramco clearly has great confidence in its simulation modeling capabilities, but it seems curious that it would advertise, in print, its ability to confidently predict any field's performance for 50 years, while also approving the publication of technical papers that cast doubt on these very same capabilities." Chapter 14, page 314.

"It is virtually impossible for Saudi Arabia ever to produce the 20 to 25 million barrels a day envisioned by the forecasters. The scenario is not totally inconceivable, but eh odds of it happening are so low that this possibility should be abandoned by all energy planners, once and for all." Chapter 16, page 336.



## Topics for Discussion

What evidence is presented to persuade you that Saudi Arabia's oil supply is running out? Is this evidence sufficient, or is the author overreacting?

What is the oil sword? Explain the circumstances leading to the 1973 drawing of the oil sword, and the effect it has on the United States and other countries.

Most of Saudi Arabia's giant and super-giant oilfields are aging. Discuss the most significant problems associated with aging oilfields, and the techniques used to battle these issues.

What is Saudi Arabia's "veil of secrecy?" Explain how it came about, and its impact on the global oil issue.

In recent years, natural gas production has become far more important to the people of Saudi Arabia than oil production. How and why did natural gas become so important to the kingdom? What is the outlook for future gas production, and how will this impact the people of Saudi Arabia?

The United States has played an important role in Saudi Arabia's oil history. Discuss the significance of United States involvement, from the early exploration years through the present day. In your opinion, has United States involvement helped or hindered Saudi Arabia's oil production efforts?

Saudi Arabia is the world's top oil-producing country, but there are many other nations that also play a vital role in global oil supplies. Identify the most significant oil-producing nations and discuss their current and future roles in providing oil to the world.

Evidence suggests that overproducing oilfields will ultimately result in less oil being recovered. Explain why Saudi Arabia has historically overproduced, the political issues that have contributed to this overproduction, and what it may mean to ultimate recovery amounts.

What solutions are offered for dealing with the coming decline of Saudi Arabian oil?