The Implications of Saudi Arabian Oil Declining

By Matthew R. Simmons

For the past several decades, virtually all energy planners have used Saudi Arabia's vast proven reserves and the knowledge that Saudi Arabian oil is the world's cheapest source of oil as the plug factor in how the world will continue to be supplied with ample and affordable oil, with little regard to rapidly growing worldwide oil demand.

In 2004, the Energy Information Agency (EIA) and the Paris based International Energy Agency (IEA) both forecast that Saudi Arabian oil production will need to rise from its current 7.5 - 8 million barrels per day to well in excess of 20 million barrels a day by 2025 or 2030. Most oil observers consider this leap will be easy since Saudi Arabia has already discovered over 260 billion barrels of proved oil reserves that will last for another 90 years without the need to find a single additional barrel of oil.

I am of the opinion that the world should be very concerned about the real state of the Saudi Arabian oil fields, as scores of technical papers written by inside technicians working for the Saudi ARAMCO, the Saudi Arabian national oil company, have been explicitly spelling out the challenges and growing list of problems each giant oil field in Saudi Arabia is facing. To fully appreciate the magnitude of these challenges, hundreds of technical papers need to be read and digested because each paper focuses on a specific part of any single giant field.

At the heart of the challenges facing Saudi Arabia's oil fields is the fact that only a small number of giant oil fields still account for virtually all the oil Saudi Arabia produces. The largest of these giant oil fields is Ghawar, the world's single largest oil field. Ghawar, alone, has accounted for approximately 60% of all the oil Saudi Arabia has ever produced. In 2004, Ghawar still produces approximately 5 million barrels a day of the 7.5 to 8 million barrels per day of Saudi oil output.

Five other key Saudi oil fields (Abqaiq, Safaniyah, Zuluf, Berri and Shaybah) produce virtually all of the other oil now flowing from the world's most important oil supplier. No other country has so few oil fields producing such large quantities of oil.

All six of these key oil fields were discovered over 30 years ago. Ghawar was discovered in 1948. Abqaiq was discovered in 1940. Safaniyah was discovered in 1951. Zuluf, Berri and Shaybah were discovered in the mid-1960's. All these fields, with the exception of Shaybah, have been producing oil for three to five decades.

Each of these oil fields have maintained high flow rates from a small number of oil wells by employment of a careful and rigorous program of water injection into the peripheral areas of these fields to keep reservoir pressures high. This program has essentially created a simultaneous primary and secondary recovery of Saudi Arabian oil.

Over the years, the oil column in each of these fields has steadily shrunk while the amount of processed water emanating from these key wells has grown. Almost a decade ago, Saudi ARAMCO stopped drilling vertical wells in these key fields as the well bores got too close to the oil/water table and would soon water out. Instead, they began drilling extended reach horizontal wells to keep the well bore a safe distance above the steadily rising oil/water contact. However, soon these horizontal wells also began experiencing rapid water cuts, a problem which inevitably stops the oil flow from a producing well. Multi-lateral well bores along the length of these extended reach horizontal wells then became the next generation wells. Once more, the problem of steadily rising water cuts was postponed. Recently, Saudi Arabia announced their recent employment of "intelligent well systems" with automatic shut off valves for any branch of the well system that encounters water or gas, another element which crowds out the precious oil.

Saudi ARAMCO's senior management are adamant that their oil fields are in great shape and can reliably produce as much as 15 million barrels of oil each day for another 50 years. They also insist that their proved reserves are actually conservative and there are still another 200 billion barrels of oil yet to be found in various unexplored pockets of Saudi Arabia.

This assurance might be correct, but the major proof offered to substantiate this case is that, to date, Saudi Arabia has successfully defied all odds and has kept the world supplied with oil for over 70 years. Saudi ARAMCO's senior management also believes with some passion that the new technological tools they are employing will allow the rise of water in these fields to be contained.

My worry is that too many other oil companies around the world also believed these same technological tools would allow them to steadily grow their production from a reduced amount of wells drilled. Instead, it turned out that virtually every key oil producer utilizing these same tools sadly ended up seeing their production growth peter out. While the tools did extract more oil per well, they also simultaneously accelerated the recovery of the oil that could economically be produced from the well. In turn, this created decline rates never seen before in existing production.

Whether Saudi ARAMCO and the Saudi Arabian Petroleum Ministry officials turn out to be right, or my worries prove accurate, will only be known as the future unfolds. However, if my concerns are correct, the warning signs should be very easy to detect if Saudi Arabia begins to adopt a far higher standard of petroleum data transparency and begins reporting timely field-by-field production statistics, which are supported by the average number of producing wells in each field.

What I will now address are the implications for the United States, and the world, if my worries turn out to be even half correct. Because the implications are so severe, the need for a radical change in petroleum transparency is extremely urgent.

The USA is still a society grounded on a steadily and ever increasing diet of fossil fuel energy. Of the three fossil fuels, natural gas, coal and oil, the latter is by far the most important in both volume and lack of substitutability if our oil supply was ever endangered.

Given the size of our country, our practice of routinely driving across many state borders, our practice of transporting a high percentage of our goods over our highways and via air, our

embrace of suburbia as the first choice of where most people live, and our lack of any significant form of mass transportation, we use more energy per capita that any other nation.

In oil terms and in terms of total energy, we use 25% of the world's total supply. Yet we have only 4% of the world's population. Some of this distortion is also due to our prosperity. The U.S. GDP is 33% of the world GDP. Thus, we are actually a more efficient energy user than the average other country.

A myth about our country's energy dependence is that we made ourselves far less reliant on energy than we were in the 1970s. We did reduce the amount of oil used as a percentage of our GDP, but this was due to several factors. We successfully introduced nuclear power into our energy mix in the late 1970s. Nuclear power accounts for 8% of our total energy mix. The advent of nuclear power essentially resulted in oil being used as a primary source to create electricity. At the same time, several of the U.S. heavy manufacturing sectors found it harder and harder to compete with the far newer plants in Japan and Germany. In a short few years, the U.S. lost its massive market share in automobile manufacturing, steel and aluminum and other key parts of our industrial sector. As the heart of America became the Rust Belt, we accidentally took our energy dependence down another notch.

When many energy experts warned that $50 to $200 per barrel oil prices were imminent, there was a clear shift to more energy-efficient appliances, cars, roofing material, etc., but all these improved energy efficiencies had only a modest impact on our energy use compared with the introduction of nuclear power and the unfortunate creation of our Rust Belt.

As the supply of U.S. oil peaked in 1970 and the only new source of domestic oil coming from Alaska also subsequently peaked in 1989, our country's reliance on imported crude oil and finished oil products refined outside the United States steadily grew. Our country's appetite for oil also increased. By the spring of 2004, U.S. oil consumption hovered at the 20 to 21 million barrel per day range while domestic oil supply dropped to just over 5.5 million barrels per day. Domestically produced natural gas liquids makes up another 2 million barrels a day. Refinery processing gains creates some additional supply but our country is now hooked on the need for a

steady daily import of 11 to 12 million barrels a day of foreign oil and finished oil products. This astonishing amount is far greater than any country in the world produces.

In this context, our need for a steady supply of Saudi Arabian oil is far more crucial to the wellbeing of our economy in 2004 than ever before. While we import oil from many other suppliers, none of them send us even close to the amounts we rely on from Saudi Arabia. Moreover, many of our other key sources of oil import (which I list below) are facing their own problems in maintaining a steady oil supply.

Canada's conventional oil supply is in serious decline. Thus far, they have been able to offset this decline by a steadily growing use of oil from bitumen (tar) and oil sands. But, both of these sources are extremely energy intense. It takes vast amounts of energy to convert almost all forms of non-conventional oil into usable oil. Whether Canada has ample natural gas (and water) to create the steam needed to melt this non-conventional oil into usable oil is becoming an increasingly serious concern.

Mexico's senior oil officials now publicly worry that their 3.5 million barrel per day oil supply could fall to under 1 million barrels a day by 2009/2010. This is why the budget at Pemex, Mexico's national oil company, has leapt from under
$3 billion per year to over $12 billion.

Venezuela has the world's oldest oil system. Some of its key fields have been producing oil for almost 90 years. Since so much of this oil is very heavy, it has lasted far longer than it would have if the oil was light and easy to get out of the ground. But, Venezuelan oil is also in decline and political uncertainties could at any time erupt resulting in serious supply problems.

Is the U.S. the only country that will be affected if Saudi's oil production does begin to decline? No, unfortunately the whole world would be impacted since the U.S. only imports 25% of Saudi Arabia's total daily exports, which average about 6 million barrels a day.

Oil is a global commodity so it is fungible, but no other oil producer can step up to the plate to fill the large void created as a result of a hiccup in Saudi Arabian oil output. Thus, all importing countries would be negatively impacted if this critical life-blood flowing through our global economy's veins started declining.

Is there an easy fix if this problem does begin to manifest? The easy and honest answer is no. Energy substitution does work to create electricity, but oil stopped being used as a significant source to create electricity over 20 years ago.

Since oil is so heavily employed for transportation fuels, including motor gasoline, diesel fuels, jet fuels, railroads and ships, a physical shortage of even a tiny amount would suddenly throw a genuine monkey wrench into the entire configuration of our globalized society.

The geopolitical implications of this problem are also severe. I have oftentimes said that I would not want to be part of any energy delegation charged with the responsibility of having to tell the leaders of either India, or particularly China, that their exciting emergence into prosperity is over because we have no spare energy to fuel their great dreams.

How real is the worry about Saudi Arabia's oil supplies? The senior oil officials in Saudi Arabia are certain there are no worries for decades to come. But other senior technical experts studying the same technical data I have read share my concern that a decline of serious magnitude could suddenly manifest itself. It has happened before in too many other giant oil fields to presume it could never happen in the giant oil fields of Saudi Arabia.

The problem is extremely serious. Thus, the need to insist on a new level of oil production data transparency has never been more urgent.