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## The Breaking Point

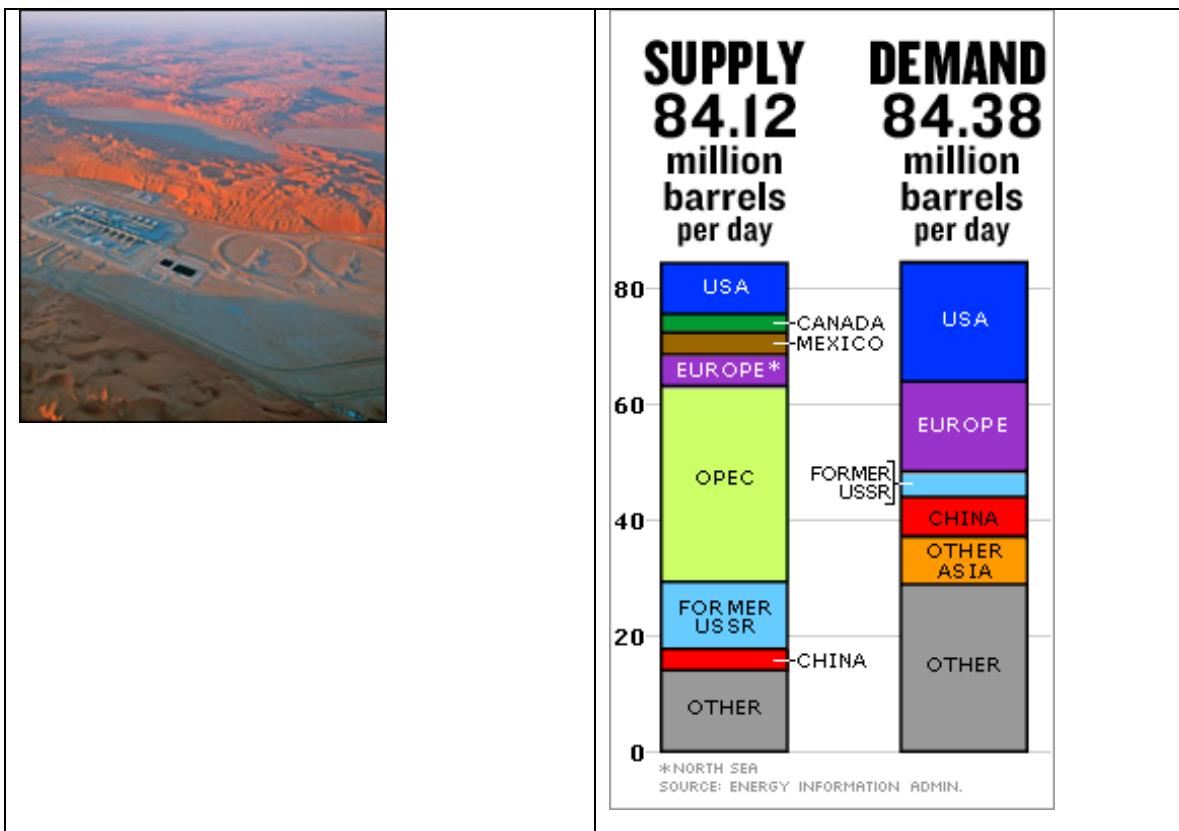
By PETER MAASS

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The largest oil terminal in the world, Ras Tanura, is located on the eastern coast of Saudi Arabia, along the Persian Gulf. From Ras Tanura's control tower, you can see the classic totems of oil's dominion -- supertankers coming and going, row upon row of storage tanks and miles and miles of pipes. Ras Tanura, which I visited in June, is the funnel through which nearly 10 percent of the world's daily supply of petroleum flows. Standing in the control tower, you are surrounded by more than 50 million barrels of oil, yet not a drop can be seen.

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George Steinmetz

Oil Runs Through It...for Now: Shaybah, one of Saudi Arabia's oil fields, which all told can produce 10.5 million barrels of oil a day. The Saudis say they can boost production to 12.5 million barrels a day, or 15 million, or more. But there is a limit to how much you can ask of the earth, and it is fast approaching, some experts say.



Stephanie Kuykendal/Corbis, for The New York Times

Future Shock? Sadad al-Husseini, a former Aramco executive, sees an oil shortage looming. But he says that it is consumers, not producers, who are to blame.

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The oil is there, of course. In a technological sleight of hand, oil can be extracted from the deserts of Arabia, processed to get rid of water and gas, sent through pipelines to a terminal on the gulf, loaded onto a supertanker and shipped to a port thousands of miles away, then run through a refinery and poured into a tanker truck that delivers it to a suburban gas station, where it is pumped into an S.U.V. -- all without anyone's actually glimpsing the stuff. So long as there is enough oil to fuel the global economy, it is not only out of sight but also out of mind, at least for consumers.

I visited Ras Tanura because oil is no longer out of mind, thanks to record prices caused by refinery shortages and surging demand -- most notably in the United States and China -- which has strained the capacity of oil producers and especially Saudi Arabia, the largest exporter of all. Unlike the 1973 crisis, when the embargo by the Arab members of the Organization of Petroleum Exporting Countries created an artificial shortfall, today's shortage, or near-shortage, is real. If demand surges even more, or if a producer goes offline because of unrest or terrorism, there may suddenly not be enough oil to go around.

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As Aref al-Ali, my escort from Saudi Aramco, the giant state-owned oil company, pointed out, "One mistake at Ras Tanura today, and the price of oil will go up." This has turned the port into a fortress; its entrances have an array of gates and bomb barriers to prevent terrorists from cutting off the black oxygen that the modern world depends on. Yet the problem is far greater than the brief havoc that could be wrought by a speeding zealot with 50 pounds of TNT in the trunk of his car. Concerns are being voiced by some oil experts that Saudi Arabia and other producers may, in the near future, be unable to meet rising world demand. The producers are not running out of oil, not yet, but their decades-old reservoirs are not as full and geologically spry as they used to be, and they may be incapable of producing, on a daily basis, the increasing volumes of oil that the world requires. "One thing is clear," warns Chevron, the second-largest American oil company, in a series of new advertisements, "the era of easy oil is over."

In the past several years, the gap between demand and supply, once considerable, has steadily narrowed, and today is almost negligible. The consequences of an actual shortfall of supply would be immense. If consumption begins to exceed production by even a small amount, the price of a barrel of oil could soar to triple-digit levels. This, in turn, could bring on a global recession, a result of exorbitant prices for transport fuels and for products that rely on petrochemicals -- which is to say, almost every product on the market. The impact on the American way of life would be profound: cars cannot be propelled by roof-borne windmills. The suburban and exurban lifestyles, hinged to two-car families and constant trips to work, school and Wal-Mart, might become unaffordable or, if gas rationing is imposed, impossible. Carpools would be the least imposing of many inconveniences; the cost of home heating would soar -- assuming, of course, that climate-controlled habitats do not become just a fond memory.

But will such a situation really come to pass? That depends on Saudi Arabia. To know the answer, you need to know whether the Saudis, who possess 22 percent of the world's oil reserves, can increase their country's output beyond its current limit of 10.5 million barrels a day, and even beyond the 12.5-million-barrel target it has set for 2009. (World consumption is about 84 million barrels a day.) Saudi Arabia is the sole oil superpower. No other producer possesses reserves close to its 263 billion barrels, which is almost twice as much as the runner-up, Iran, with 133 billion barrels. New fields in other countries are discovered now and then, but they tend to offer only small increments. For example, the much-contested and as-yet-unexploited reserves in the Alaska National Wildlife Refuge are believed to amount to about 10 billion barrels, or just a fraction of what the Saudis possess.

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But the truth about Saudi oil is hard to figure out. Oil reservoirs cannot be inventoried like wood in a wilderness: the oil is underground, unseen by geologists and engineers,

who can, at best, make highly educated guesses about how much is underfoot and how much can be extracted in the future. And there is a further obstacle: the Saudis will not let outsiders audit their confidential data on reserves and production. Oil is an industry in which not only is the product hidden from sight but so is reliable information about it. And because we do not know when a supply-demand shortfall might arrive, we do not know when to begin preparing for it, so as to soften its impact; the economic blow may come as a sledgehammer from the darkness.

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George Steinmetz

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Oil fires signal another well being put online at Shaybah, an oil field in Saudi Arabia, the world's sole oil superpower.

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Of course the Saudis do have something to say about this prospect. Before journeying to the kingdom, I went to Washington to hear the Saudi oil minister, Ali al-Naimi, speak at an energy conference in the mammoth Ronald Reagan Building and International Trade Center, not far from the White House. Naimi was the star attraction at a gathering of the American petro-political nexus. Samuel Bodman, the U.S. energy secretary, was on the dais next to him. David O'Reilly, chairman and C.E.O. of Chevron, was waiting in the wings. The moderator was an *éminence grise* of the oil world, James Schlesinger, a former energy secretary, defense secretary and C.I.A. director.

"I want to assure you here today that Saudi Arabia's reserves are plentiful, and we stand ready to increase output as the market dictates," said Naimi, dressed in a gray business

suit and speaking with only a slight Arabic accent. He addressed skeptics who contend that Saudi reservoirs cannot be tapped for larger amounts of oil. "I am quite bullish on technology as the key to our energy future," he said. "Technological innovation will allow us to find and extract more oil around the world." He described the task of increasing output as just "a question of investment" in new wells and pipelines, and he noted that consuming nations urgently need to build new refineries to process increased supplies of crude. "There is absolutely no lack of resources worldwide," he repeated.

His assurances did not assure. A barrel of oil cost \$55 at the time of his speech; less than three months later, the price had jumped by 20 percent. The truth of the matter -- whether the world will really have enough petroleum in the years ahead -- was as well concealed as the millions of barrels of oil I couldn't see at Ras Tanura.

For 31 years, Matthew Simmons has prospered as the head of his own firm, Simmons & Company International, which advises energy companies on mergers and acquisitions. A member of the Council on Foreign Relations, a graduate of the Harvard Business School and an unpaid adviser on energy policy to the 2000 presidential campaign of George W. Bush, he would be a card-carrying member of the global oil nomenclatura, if cards were issued for such things. Yet he is one of the principal reasons the oil world is beginning to ask hard questions of itself.

Two years ago, Simmons went to Saudi Arabia on a government tour for business executives. The group was presented with the usual dog-and-pony show, but instead of being impressed, as most visitors tend to be, with the size and expertise of the Saudi oil industry, Simmons became perplexed. As he recalls in his somewhat heretical new book, "Twilight in the Desert: The Coming Saudi Oil Shock and the World Economy," a senior manager at Aramco told the visitors that "fuzzy logic" would be used to estimate the amount of oil that could be recovered. Simmons had never heard of fuzzy logic. What could be fuzzy about an oil reservoir? He suspected that Aramco, despite its promises of endless supplies, might in fact not know how much oil remained to be recovered.

Simmons returned home with an itch to scratch. Saudi Arabia was one of the charter members of OPEC, founded in 1960 in Baghdad to coordinate the policies of oil producers. Like every OPEC country, Saudi Arabia provides only general numbers about its output and reserves; it does not release details about how much oil is extracted from each reservoir and what methods are used to extract that oil, and it does not permit audits by outsiders. The condition of Saudi fields, and those of other OPEC nations, is a closely guarded secret. That's largely because OPEC quotas, which were first imposed in 1983 to limit the output of member countries, were based on overall reserves; the higher an OPEC member's reserves, the higher its quota. It is widely believed that most, if not all, OPEC members exaggerated the sizes of their reserves in order to have the largest possible quota -- and thus the largest possible revenue stream.

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In the days of excess supply, bankers like Simmons did not know, or care, about the fudging; whether or not reserves were hyped, there was plenty of oil coming out of the

ground. Through the 1970's, 80's and 90's, the capacity of OPEC and non-OPEC countries exceeded demand, and that's why OPEC imposed a quota system -- to keep some product off the market (although many OPEC members, seeking as much revenue as possible, quietly sold more oil than they were supposed to). Until quite recently, the only reason to fear a shortage was if a boycott, war or strike were to halt supplies. Few people imagined a time when supply would dry up because of demand alone. But a steady surge in demand in recent years -- led by China's emergence as a voracious importer of oil -- has changed that. This demand-driven scarcity has prompted the emergence of a cottage industry of experts who predict an impending crisis that will dwarf anything seen before. Their point is not that we are running out of oil, per se; although as much as half of the world's recoverable reserves are estimated to have been consumed, about a trillion barrels remain underground. Rather, they are concerned with what is called "capacity" -- the amount of oil that can be pumped to the surface on a daily basis. These experts -- still a minority in the oil world -- contend that because of the peculiarities of geology and the limits of modern technology, it will soon be impossible for the world's reservoirs to surrender enough oil to meet daily demand.

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One of the starkest warnings came in a February report commissioned by the United States Department of Energy's National Energy Technology Laboratory. "Because oil prices have been relatively high for the past decade, oil companies have conducted extensive exploration over that period, but their results have been disappointing," stated the report, assembled by Science Applications International, a research company that works on security and energy issues. "If recent trends hold, there is little reason to expect that exploration success will dramatically improve in the future. . . . The image is one of a world moving from a long period in which reserves additions were much greater than consumption to an era in which annual additions are falling increasingly short of annual consumption. This is but one of a number of trends that suggest the world is fast approaching the inevitable peaking of conventional world oil production."

The reference to "peaking" is not a haphazard word choice -- "peaking" is a term used in oil geology to define the critical point at which reservoirs can no longer produce increasing amounts of oil. (This tends to happen when reservoirs are about half-empty.) "Peak oil" is the point at which maximum production is reached; afterward, no matter how many wells are drilled in a country, production begins to decline. Saudi Arabia and other OPEC members may have enough oil to last for generations, but that is no longer the issue. The eventual and painful shift to different sources of energy -- the start of the post-oil age -- does not begin when the last drop of oil is sucked from under the Arabian desert. It begins when producers are unable to continue increasing their output to meet rising demand. Crunch time comes long before the last drop.

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"The world has never faced a problem like this," the report for the Energy Department concluded. "Without massive mitigation more than a decade before the fact, the problem will be pervasive and will not be temporary. Previous energy transitions (wood to coal and coal to oil) were gradual and evolutionary; oil peaking will be abrupt and revolutionary."

Most experts do not share Simmons's concerns about the imminence of peak oil. One of the industry's most prominent consultants, Daniel Yergin, author of a Pulitzer Prize-winning book about petroleum, dismisses the doomsday visions. "This is not the first time that the world has 'run out of oil,'" he wrote in a recent Washington Post opinion essay. "It's more like the fifth. Cycles of shortage and surplus characterize the entire history of the oil industry." Yergin says that a number of oil projects that are under construction will increase the supply by 20 percent in five years and that technological advances will increase the amount of oil that can be recovered from existing reservoirs. (Typically, with today's technology, only about 40 percent of a reservoir's oil can be pumped to the surface.)

Yergin's bullish view has something in common with the views of the pessimists -- it rests on unknowns. Will the new projects that are under way yield as much oil as their financial backers hope? Will new technologies increase recovery rates as much as he expects? These questions are next to impossible to answer because coaxing oil out of the ground is an extraordinarily complex undertaking. The popular notion of reservoirs as underground lakes, from which wells extract oil like straws sucking a milkshake from a glass, is incorrect. Oil exists in drops between and inside porous rocks. A new reservoir may contain sufficient pressure to make these drops of oil flow to the surface in a gusher, but after a while -- usually within a few years and often sooner than that -- natural pressure lets up and is no longer sufficient to push oil to the surface. At that point, "secondary" recovery efforts are begun, like pumping water or gas into the reservoirs to increase the pressure.

This process is unpredictable; reservoirs are extremely temperamental. If too much oil is extracted too quickly or if the wrong types or amounts of secondary efforts are employed, the amount of oil that can be recovered from a field can be greatly reduced; this is known in the oil world as "damaging a reservoir." A widely cited example is Oman: in 2001, its daily production reached more than 960,000 barrels, but then suddenly declined, despite the use of advanced technologies. Today, Oman produces 785,000 barrels of oil a day. Herman Franssen, a consultant who worked in Oman for a decade, sees that country's experience as a possible lesson in the limits of technology for other producers that try to increase or maintain high levels of output. "They reached a million barrels a day, and then a few years later production collapsed," Franssen said in a phone interview. "They used all these new technologies, but they haven't been able to stop the decline yet."

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The vague production and reserve data that gets published does not begin to tell the whole story of an oil field's health, production potential or even its size. For a clear-as-possible picture of a country's oil situation, you need to know what is happening in each field -- how many wells it has, how much oil each well is producing, what recovery methods are being used and how long they've been used and the trend line since the field went into production. Data of that sort are typically not released by state-owned companies like Saudi Aramco.

As Matthew Simmons searched for clues to the truth of the Saudi situation, he immersed himself in the minutiae of oil geology. He realized that data about Saudi fields might be found in the files of the Society of Petroleum Engineers. Oil engineers, like most professional groups, have regular conferences at which they discuss papers that delve into the work they do. The papers, which focus on particular wells that highlight a problem or a solution to a problem, are presented and debated at the conferences and published by the S.P.E. -- and then forgotten.

Before Simmons poked around, no one had taken the time to pull together the S.P.E. papers that involved Saudi oil fields and review them en masse. Simmons found more than 200 such papers and studied them carefully. Although the papers cover only a portion of the kingdom's wells and date back, in some cases, several decades, they constitute perhaps the best public data about the condition and prospects of Saudi reservoirs.

Ghawar is the treasure of the Saudi treasure chest. It is the largest oil field in the world and has produced, in the past 50 years, about 55 billion barrels of oil, which amounts to more than half of Saudi production in that period. The field currently produces more than five million barrels a day, which is about half of the kingdom's output. If Ghawar is facing problems, then so is Saudi Arabia and, indeed, the entire world.

Simmons found that the Saudis are using increasingly large amounts of water to force oil out of Ghawar. Most of the wells are concentrated in the northern portion of the 174-mile-long field. That might seem like good news -- when the north runs low, the Saudis need only to drill wells in the south. But in fact it is bad news, Simmons concluded, because the southern portions of Ghawar are geologically more difficult to draw oil from. "Someday (and perhaps that day will be soon), the remarkably high well flow rates at Ghawar's northern end will fade, as reservoir pressures finally plummet," Simmons writes in his book. "Then, Saudi Arabian oil output will clearly have peaked. The death of this great king" -- meaning Ghawar -- "leaves no field of vaguely comparable stature in the line of succession. Twilight at Ghawar is fast approaching." He goes on: "The geological phenomena and natural driving forces that created the Saudi oil miracle are conspiring now in normal and predictable ways to bring it to its conclusion, in a time frame potentially far shorter than officialdom would have us believe." Simmons concludes,

"Saudi Arabia clearly seems to be nearing or at its peak output and cannot materially grow its oil production."

Saudi officials belittle Simmons's work. Nansen Saleri, a senior Aramco official, has described Simmons as a banker "trying to come across as a scientist." In a speech last year, Saleri wryly said, "I can read 200 papers on neurology, but you wouldn't want me to operate on your relatives." I caught up with Simmons in June, during a trip he made to Manhattan to talk with a group of oil-shipping executives. The impression he gives is of an enthusiastic inventor sharing a discovery that took him by surprise. He has a certain wide-eyed wonder in his regard, as if a bit of mystery can be found in everything that catches his eye. And he has a rumpled aspect -- thinning hair slightly askew, shirt sleeves a fraction too long. Though he delivers a bracing message, his discourse can wander. He is a successful businessman, and it is clear that he did not achieve his position by being a man of impeccable convention. He certainly has not lost sight of the rule that people who shout "the end is nigh" do not tend to be favorably reviewed by historians, let alone by their peers. He notes in his book that way back in 1979, The New York Times published an investigative story by Seymour Hersh under the headline "Saudi Oil Capacity Questioned." He knows that in past decades the Cassandras failed to foresee new technologies, like deep-water and horizontal drilling, that provided new sources of oil and raised the amount of oil that can be recovered from reservoirs.

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But Simmons says that there are only so many rabbits technology can pull out of its petro-hat. He impishly notes that if the Saudis really wanted to, they could easily prove him wrong. "If they want to satisfy people, they should issue field-by-field production reports and reserve data and have it audited," he told me. "It would then take anybody less than a week to say, 'Gosh, Matt is totally wrong,' or 'Matt actually might be too optimistic.'"

Simmons has a lot riding on his campaign -- not only his name but also his business, which would not be rewarded if he is proved to be a fool. What, I asked, if the data show that the Saudis will be able to sustain production of not only 12.5 million barrels a day -- their target for 2009 -- but 15 million barrels, which global demand is expected to require of them in the not-too-distant future? "The odds of them sustaining 12 million barrels a day is very low," Simmons replied. "The odds of them getting to 15 million for 50 years - - there's a better chance of me having Bill Gates's net worth, and I wouldn't bet a dime on that forecast."

The gathering of executives took place in a restaurant at Chelsea Piers; about 35 men sat around a set of tables as the host introduced Simmons. He rambled a bit but hit his talking

points, and the executives listened raptly; at one point, the man on my right broke into a soft whistle, of the sort that means "Holy cow."

Simmons didn't let up. "We're going to look back at history and say \$55 a barrel was cheap," he said, recalling a TV interview in which he predicted that a barrel might hit triple digits.

He said that the anchor scoffed, in disbelief, "A hundred dollars?"

Simmons replied, "I wasn't talking about *low* triple digits."

the onset of triple-digit prices might seem a blessing for the Saudis -- they would receive greater amounts of money for their increasingly scarce oil. But one popular misunderstanding about the Saudis -- and about OPEC in general -- is that high prices, no matter how high, are to their benefit.

Although oil costing more than \$60 a barrel hasn't caused a global recession, that could still happen: it can take a while for high prices to have their ruinous impact. And the higher above \$60 that prices rise, the more likely a recession will become. High oil prices are inflationary; they raise the cost of virtually everything -- from gasoline to jet fuel to plastics and fertilizers -- and that means people buy less and travel less, which means a drop-off in economic activity. So after a brief windfall for producers, oil prices would slide as recession sets in and once-voracious economies slow down, using less oil. Prices have collapsed before, and not so long ago: in 1998, oil fell to \$10 a barrel after an untimely increase in OPEC production and a reduction in demand from Asia, which was suffering through a financial crash. Saudi Arabia and the other members of OPEC entered crisis mode back then; adjusted for inflation, oil was at its lowest price since the cartel's creation, threatening to feed unrest among the ranks of jobless citizens in OPEC states.

"The Saudis are very happy with oil at \$55 per barrel, but they're also nervous," a Western diplomat in Riyadh told me in May, referring to the price that prevailed then. (Like all the diplomats I spoke to, he insisted on speaking anonymously because of the sensitivities of relations with Saudi Arabia.) "They don't know where this magic line has moved to. Is it now \$65? Is it \$75? Is it \$80? They don't want to find out, because if you did have oil move that far north . . . the chain reaction can come back to a price collapse again."

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High prices can have another unfortunate effect for producers. When crude costs \$10 a barrel or even \$30 a barrel, alternative fuels are prohibitively expensive. For example, Canada has vast amounts of tar sands that can be rendered into heavy oil, but the cost of doing so is quite high. Yet those tar sands and other alternatives, like bioethanol, hydrogen fuel cells and liquid fuel from natural gas or coal, become economically viable as the going rate for a barrel rises past, say, \$40 or more, especially if consuming governments choose to offer their own incentives or subsidies. So even if high prices

don't cause a recession, the Saudis risk losing market share to rivals into whose nonfundamentalist hands Americans would much prefer to channel their energy dollars. A concerted push for greater energy conservation in the United States, which consumes one-quarter of the world's oil (mostly to fuel our cars, as gasoline), would hurt producing nations, too. Basically, any significant reduction in the demand for oil would be ruinous for OPEC members, who have little to offer the world but oil; if a substitute can be found, their future is bleak. Another Western diplomat explained the problem facing the Saudis: "You want to have the price as high as possible without sending the consuming nations into a recession and at the same time not have the price so high that it encourages alternative technologies."

From the American standpoint, one argument in favor of conservation and a switch to alternative fuels is that by limiting oil imports, the United States and its Western allies would reduce their dependence on a potentially unstable region. (In fact, in an effort to offset the risks of relying on the Saudis, America's top oil suppliers are Canada and Mexico.) In addition, sending less money to Saudi Arabia would mean less money in the hands of a regime that has spent the past few decades doling out huge amounts of its oil revenue to mosques, madrassas and other institutions that have fanned the fires of Islamic radicalism. The oil money has been dispensed not just by the Saudi royal family but by private individuals who benefited from the oil boom -- like Osama bin Laden, whose ample funds, probably eroded now, came from his father, a construction magnate. Without its oil windfall, Saudi Arabia would have had a hard time financing radical Islamists across the globe.

For the Saudis, the political ramifications of reduced demand for its oil would not be negligible. The royal family has amassed vast personal wealth from the country's oil revenues. If, suddenly, Saudis became aware that the royal family had also failed to protect the value of the country's treasured resource, the response could be severe. The mere admission that Saudi reserves are not as impressively inexhaustible as the royal family has claimed could lead to hard questions about why the country, and the world, had been misled. With the death earlier this month of the long-ailing King Fahd, the royal family is undergoing another period of scrutiny; the new king, Abdullah, is in his 80's, and the crown prince, his half-brother Sultan, is in his 70's, so the issue of generational change remains to be settled. As long as the country is swimming in petro-dollars -- even as it is paying off debt accrued during its lean years -- everyone is relatively happy, but that can change. One diplomat I spoke to recalled a comment from Sheik Ahmed Zaki Yamani, the larger-than-life Saudi oil minister during the 1970's: "The Stone Age didn't end for lack of stone, and the oil age will end long before the world runs out of oil."

Until now, the Saudis had an excess of production capacity that allowed them, when necessary, to flood the market to drive prices down. They did that in 1990, when the Iraqi invasion of Kuwait eliminated not only Kuwait's supply of oil but also Iraq's. The Saudis functioned, as they always had, as the central bank of oil, releasing supply to the market

when it was needed and withdrawing supply to keep prices from going lower than the cartel would have liked. In other words, they controlled not only the price of oil but their own destiny as well.

Western diplomat in Riyadh told me recently. "Decreasing prices used to keep out alternative fuels. I don't see how they're able to do that anymore. This is a huge change, and it is a big step in the move to whatever is coming next. That's what's really happening."

Without the ability to flood the markets with oil, the Saudis are resorting to flooding the market with promises; it is a sort of petro-jawboning. That's why Ali al-Naimi, the oil minister, told his Washington audience that Saudi Arabia has embarked on a crash program to raise its capacity to 12.5 million barrels a day by 2009 and even higher in the years after that. Naimi is not unlike a factory manager who needs to promise the moon to his valuable clients, for fear of losing or alarming them. He has no choice. The moment he says anything bracing, the touchy energy markets will probably panic, pushing prices even higher and thereby hastening the onset of recession, a switch to alternative fuels or new conservation efforts -- or all three. Just a few words of honest caution could move the markets; Naimi's speeches are followed nearly as closely in the financial world as those of Alan Greenspan.

I journeyed to Saudi Arabia to interview Naimi and other senior officials, to get as far beyond their prepared remarks as might be possible. Although I was allowed to see Ras Tanura, my interview requests were denied. I was invited to visit Aramco's oil museum in Dhahran, but that is something a Saudi schoolchild can do on a field trip. It was a "show but don't tell" policy. I was able to speak about production issues only with Ibrahim al-Muhanna, the oil ministry spokesman, who reluctantly met me over coffee in the lobby of my hotel in Riyadh. He defended Saudi Arabia's refusal to share more data, noting that the Saudis are no different from most oil producers.

"They will not tell you," he said. "Nobody will. And that is not going to change."

Referring to the fact that Saudi Arabia is often called the central bank of oil, he added: "If an outsider goes to the Fed and asks, 'How much money do you have?' they will tell you. If you say, 'Can I come and count it?' they will not let you. This applies to oil companies and oil countries." I mentioned to Muhanna that many people think his government's "trust us" stance is not convincing in light of the cheating that has gone on within OPEC and in the industry as a whole; even Royal Dutch/Shell, a publicly listed oil company that undergoes regular audits, has admitted that it overstated its 2002 reserves by 23 percent. "There is no reason for any country or company to lie," Muhanna replied. "There is a lot of oil around." I didn't need to ask about Simmons and his peak-oil theory; when I met Muhanna at the conference in Washington, he nearly broke off our conversation at the mention of Simmons's name. "He does not know anything," Muhanna said. "The only thing he has is a big mouth. We should not pay attention to him. Either you believe us or you don't."

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o whom to believe? Before leaving New York for Saudi Arabia, I was advised by several oil experts to try to interview Sadad al-Husseini, who retired last year after serving as Aramco's top executive for exploration and production. I faxed him in Dhahran and received a surprisingly quick reply; he agreed to meet me. A week later, after I arrived in Riyadh, Husseini e-mailed me, asking when I would come to Dhahran; in a follow-up phone call, he offered to pick me up at the airport. He was, it seemed, eager to talk.

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It can be argued that in a nation devoted to oil, Husseini knows more about it than anyone else. Born in Syria, Husseini was raised in Saudi Arabia, where his father was a government official whose family took on Saudi citizenship. Husseini earned a Ph.D. in geological sciences from Brown University in 1973 and went to work in Aramco's exploration department, eventually rising to the highest position. Until his retirement last year -- said to have been caused by a top-level dispute, the nature of which is the source of many rumors -- Husseini was a member of the company's board and its management committee. He is one of the most respected and accomplished oilmen in the world.

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After meeting me at the cavernous airport that serves Dhahran, he drove me in his luxury sedan to the villa that houses his private office. As we entered, he pointed to an armoire that displayed a dozen or so vials of black liquid. "These are samples from oil fields I discovered," he explained. Upstairs, there were even more vials, and he would have possessed more than that except, as he said, laughing, "I didn't start collecting early enough."

We spoke for several hours. The message he delivered was clear: the world is heading for an oil shortage. His warning is quite different from the calming speeches that Naimi and other Saudis, along with senior American officials, deliver on an almost daily basis. Husseini explained that the need to produce more oil is coming from two directions. Most obviously, demand is rising; in recent years, global demand has increased by two million barrels a day. (Current daily consumption, remember, is about 84 million barrels a day.) Less obviously, oil producers deplete their reserves every time they pump out a barrel of oil. This means that merely to maintain their reserve base, they have to replace the oil they extract from declining fields. It's the geological equivalent of running to stay in place. Husseini acknowledged that new fields are coming online, like offshore West Africa and the Caspian basin, but he said that their output isn't big enough to offset this growing need.

"You look at the globe and ask, 'Where are the big increments?' and there's hardly anything but Saudi Arabia," he said. "The kingdom and Ghawar field are not the problem. That misses the whole point. The problem is that you go from 79 million barrels a day in

2002 to 82.5 in 2003 to 84.5 in 2004. You're leaping by two million to three million a year, and if you have to cover declines, that's another four to five million." In other words, if demand and depletion patterns continue, every year the world will need to open enough fields or wells to pump an additional six to eight million barrels a day -- at least two million new barrels a day to meet the rising demand and at least four million to compensate for the declining production of existing fields. "That's like a whole new Saudi Arabia every couple of years," Hussein said. "It can't be done indefinitely. It's not sustainable."

Hussein speaks patiently, like a teacher who hopes someone is listening. He is in the enviable position of knowing what he talks about while having the freedom to speak openly about it. He did not disclose precise information about Saudi reserves or production -- which remain the equivalent of state secrets -- but he felt free to speak in generalities that were forthright, even when they conflicted with the reassuring statements of current Aramco officials. When I asked why he was willing to be so frank, he said it was because he sees a shortage ahead and wants to do what he can to avert it. I assumed that he would not be particularly distressed if his rivals in the Saudi oil establishment were embarrassed by his frankness.

Although Matthew Simmons says it is unlikely that the Saudis will be able to produce 12.5 million barrels a day or sustain output at that level for a significant period of time, Hussein says the target is realistic; he says that Simmons is wrong to state that Saudi Arabia has reached its peak. But 12.5 million is just an interim marker, as far as consuming nations are concerned, on the way to 15 million barrels a day and beyond -- and that is the point at which Hussein says problems will arise.

At the conference in Washington in May, James Schlesinger, the moderator, conducted a question-and-answer session with Naimi at the conclusion of the minister's speech. One of the first questions involved peak oil: might it be true that Saudi Arabia, which has relied on the same reservoirs, and especially Ghawar, for more than five decades, is nearing the geological limit of its output?

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Naimi wouldn't hear of it.

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"I can assure you that we haven't peaked," he responded. "If we peaked, we would not be going to 12.5 and we would not be visualizing a 15-million-barrel-per-day production capacity. . . . We can maintain 12.5 or 15 million for the next 30 to 50 years."

Experts like Hussein are very concerned by the prospect of trying to produce 15 million barrels a day. Even if production can be ramped up that high, geology may not be forgiving. Fields that are overproduced can drop off, in terms of output, quite sharply and suddenly, leaving behind large amounts of oil that cannot be coaxed out with existing technology. This is called trapped oil, because the rocks or sediment around it prevent it from escaping to the surface. Unless new technologies are developed, that oil will never be extracted. In other words, the haste to recover oil can lead to less oil being recovered. "You could go to 15, but that's when the questions of depletion rate, reservoir management and damaging the fields come into play," says Nawaf Obaid, a Saudi oil and security analyst who is regarded as being exceptionally well connected to key Saudi leaders. "There is an understanding across the board within the kingdom, in the highest spheres, that if you're going to 15, you'll hit 15, but there will be considerable risks . . . of a steep decline curve that Aramco will not be able to do anything about."

Even if the Saudis are willing to risk damaging their fields, or even if the risk is overstated, Hussein points out a practical problem. To produce and sustain 15 million barrels a day, Saudi Arabia will have to drill a lot more wells and build a lot more pipelines and processing facilities. Currently, the global oil industry suffers a deficit of qualified engineers to oversee such projects and the equipment and the raw materials -- for example, rigs and steel -- to build them. These things cannot be wished from thin air or developed quickly enough to meet the demand.

"If we had two dozen Texas A&M's producing a thousand new engineers a year and the industrial infrastructure in the kingdom, with the drilling rigs and power plants, we would have a better chance, but you cannot put that into place overnight," Hussein said.

"Capacity is not just a function of reserves. It is a function of reserves plus know-how plus a commercial economic system that is designed to increase the resource exploitation. For example, in the U.S. you have infrastructure -- there must be tens of thousands of miles of pipelines. If we, in Saudi Arabia, evolve to that level of commercial maturity, we could probably produce a heck of a lot more oil. But to get there is a very tedious, slow process."

He worries that the rising global demand for oil will lead to the petroleum equivalent of running an engine at ever-increasing speeds without stopping to cool it down or change the oil. Hussein does not want to see the fragile and irreplaceable reservoirs of the Middle East become damaged through wanton overproduction.

"If you are ramping up production so fast and jump from high to higher to highest, and you're not having enough time to do what needs to be done, to understand what needs to be done, then you can damage reservoirs," he said. "Systematic development is not just a matter of money. It's a matter of reservoir dynamics, understanding what's there,

analyzing and understanding information. That's where people come in, experience comes in. These are not universally available resources."

The most worrisome part of the crisis ahead revolves around a set of statistics from the Energy Information Administration, which is part of the U.S. Department of Energy. The E.I.A. forecast in 2004 that by 2020 Saudi Arabia would produce 18.2 million barrels of oil a day, and that by 2025 it would produce 22.5 million barrels a day. Those estimates were unusual, though. They were not based on secret information about Saudi capacity, but on the projected needs of energy consumers. The figures simply assumed that Saudi Arabia would be able to produce whatever the United States needed it to produce. Just last month, the E.I.A. suddenly revised those figures downward -- not because of startling new information about world demand or Saudi supply but because the figures had given so much ammunition to critics. Hussein, for example, described the 2004 forecast as unrealistic.

It would be unfair to blame the Saudis alone for failing to warn of whatever shortages or catastrophes might lie ahead.

In the political and corporate realms of the oil world, there are few incentives to be forthright. Executives of major oil companies have been reluctant to raise alarms; the mere mention of scarce supplies could alienate the governments that hand out lucrative exploration contracts and also send a message to investors that oil companies, though wildly profitable at the moment, have a Malthusian long-term future. Fortunately, that attitude seems to be beginning to change. Chevron's "easy oil is over" advertising campaign is an indication that even the boosters of an oil-drenched future are not as bullish as they once were.

Politicians remain in the dark. During the 2004 presidential campaign, which occurred as gas prices were rising to record levels, the debate on energy policy was all but nonexistent. The Bush campaign produced an advertisement that concluded: "Some people have wacky ideas. Like taxing gasoline more so people drive less. That's John Kerry." Although many environmentalists would have been delighted if Kerry had proposed that during the campaign, in fact the ad was referring to a 50-cents-a-gallon tax that Kerry supported 11 years ago as part of a package of measures to reduce the deficit. (The gas tax never made it to a vote in the Senate.) Kerry made no mention of taxing gasoline during the campaign; his proposal for doing something about high gas prices was to pressure OPEC to increase supplies.

Hussein, for one, doesn't buy that approach. "Everybody is looking at the producers to pull the chestnuts out of the fire, as if it's our job to fix everybody's problems," he told me. "It's not our problem to tell a democratically elected government that you have to do something about your runaway consumers. If your government can't do the job, you can't

expect other governments to do it for them." Back in the 70's, President Carter called for the moral equivalent of war to reduce our dependence on foreign oil; he was not re-elected. Since then, few politicians have spoken of an energy crisis or suggested that major policy changes are necessary to avert one. The energy bill signed earlier this month by President Bush did not even raise fuel-efficiency standards for passenger cars. When a crisis comes -- whether in a year or 2 or 10 -- it will be all the more painful because we will have done little or nothing to prepare for it.