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ANOTHER DAY IN THE DESERT

A RESPONSE TO THE BOOK, *TWILIGHT IN THE DESERT*

BACKGROUND

We have reviewed *Twilight in the Desert: The Coming Saudi Oil Shock and the World Economy*, written by Matthew Simmons, CEO of Simmons & Company International, a Houston-based investment bank that specializes in the energy industry. As independent petroleum engineers, we disagree with the primary conclusion of this book that Saudi Arabia's oil production is teetering on the brink of steep, irrevocable production decline. We believe the process used by the author to arrive at the conclusion was impaired by incorrect interpretation of reservoir engineering concepts and common oilfield operations. The book posits a crisis where in our opinion none exists.

The author, through a review of more than 200 Society of Petroleum Engineers (SPE) research papers, contends he has discovered the "smoking gun" that until now was obscured for decades by the Saudi's limited disclosure. Our review offers some balance to the dire predictions of *Twilight*.

KEY POINTS

- We disagree that Saudi Arabia's oil production is teetering on the brink of steep, irrevocable decline, and see no evidence in the SPE research referenced in *Twilight* to support a case that Saudi reserves are overstated or Saudi production is in imminent danger of collapse. On the contrary we see evidence of well informed reservoir management and prudent operatorship.

- Unlike *Twilight*, we are comfortable with Saudi Aramco's reserve assignment methodology. Although unaudited, Saudi Aramco's practice of assigning reserves appears to be as conservative as any we have seen among North American companies. Further, we know of only a few North American companies with as disciplined an operating constitution as Saudis Aramco's.

- In terms of categorization, by not booking reserves that may be derived from enhanced recovery as the SEC allows, we feel Aramco's practice probably results in annual positive revisions to its proved developed reserves.

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- Unlike *Twilight*, we believe the probability of production collapse is extremely remote. Saudi production derives from thousands of wells completed to minimize water production and decline.

- *Twilight* interprets the fact that Saudi Aramco has taken steps to manage the water cut at Ghawar as evidence that things must be going very wrong. On the contrary, the water cut is low and has been reduced over four of the past five years. This does not happen by accident, and in fact points to proper reservoir management practices by Saudi Aramco.

- Although Saudi Aramco could suppress reserve write-downs, we do not believe any resulting overstatement would be significant. Reservoirs in the long run have a tendency of being very pitiless in exposing overstatements.

- We do not agree with *Twilight*'s premise that prospectivity for producible oil in Saudi Arabia is limited, despite Aramco's "intense search" for it. In fact, in 2000, the US Geological Survey (USGS) ranked Saudi Arabia number one worldwide in terms of undiscovered resource potential, a fact overlooked by *Twilight*.

- Fundamentally we take issue that *Twilight* fails to emphasize the connection between the Saudi Aramco SPE authors and the technical professionals who are responsible for reserve booking, reservoir management and production forecasting. These professionals would be intimately familiar with all of the SPE published insight and in our view have acted accordingly and managed the Saudi reservoirs expertly.

- Overall, contrary to the claim that the Saudis have run a closed operation, the paper trail of SPE research provides an unparalleled operational history.

AN INDEPENDENT RESERVOIR ENGINEERING PERSPECTIVE OF *TWILIGHT*

As petroleum engineers, we do not support the key conclusions and speculative theories contained in *Twilight*, and notice numerous technical gaffes.[1] We think there is a lack of clear context and consideration of market dynamics around the key issues identified in *Twilight*.

In general, the SPE papers referenced in *Twilight* comment on the unremarkable operations that oil and gas companies carry out all over the world on maturing producing properties. In Saudi Aramco's case, these operations are carried out on truly remarkable reservoirs.

[1] *For example, Twilight implies the 'dew point' is the pressure at which a well stops flowing or producing. In fact, dew point is a thermodynamic state of pressure and temperature such that for a gas at a given temperature, lowering the pressure below the dew point will cause natural gas liquids to condense from the gas. As another example, Twilight indicates that reservoir pressure will "fade away" as a water flood matures. Rather, a key purpose of a water flood is pressure maintenance. The abandonment pressure typically is the water flood operating pressure. Furthermore, water injection does not erase the possibility of having secondary recovery, asTwilight states. It is secondary recovery. In another example, SPE 71339 focuses on attempts to understand the tilted oil-water contact found in the Haradh structure in the south of Ghawar. Following a recommendation of Exxon, a reservoir model was constructed. Saudi Aramco engineers were then able to mathematically recreate the tilted oil-water contact by simulating the injection of 5,000 barrels of water per day over a period of 20,000 years along Haradh's west edge. Twilight concludes that "At that rate it would only take 20,000 years to push the oil water contact to the top of Ghawar's southern end."In our view, this statement misses the point. The paper is simply a description of a successful modeling exercise designed to interpret one of a myriad of reservoir characteristics in a big field. Another example comes from an observation that original oil in place (OOIP) estimates can miss the mark by 60 to 80%. In fact they can be out by thousands of percent: imagine the OOIP estimate after the first well in Ghawar. However, as fields are drilled up, estimates are tightened and ultimately, in high quality reservoirs, OOIP actually becomes one of the more reliable reservoir estimates.*

We believe *Twilight* attempts to turn benign technical matters into crisis-level evidence. It could be that what is regarded as normal is based on the author's exposure to North American reservoirs operated by public companies. These companies do not produce to quotas, but instead deplete reservoirs as fast as commercially possible and rarely allow reservoirs to produce at peak rates for more than five years. By comparison, Saudi Aramco has carried excess capacity in its key reservoirs for more than 50 years.

The author appears to have been set off by a Saudi Aramco official who explained that the company's reserve determinations are aided by the use of "fuzzy logic." Apparently concluding that fuzzy logic means fuzzy numbers, *Twilight* suggests there is reason to be concerned about Saudi reserve assignment methodology.

Fuzzy logic is actually a probabilistic method for gaining insight on large data populations developed at the University of California – Berkley in the 1960s. It models probabilistic relationships between variables and is often called stochastic modeling. In the case of reservoir engineering, for example, "If permeability is low and natural fractures are vertical, then there is a high probability that water breakthrough could occur at various (but early) times." Fuzzy logic is a valuable analytical tool and has proved to be very useful in expert systems, artificial intelligence and other applications for reservoir scientists and engineers. Whether it is conservative or not depends on the probability relationships of the input parameters, the definition of which improves the more history there is.

We focus in this report on three key issues:

1) Are Saudi oil reserves grossly overstated?

2) Can Saudi production rates collapse?

3) Are the Saudis exploring enough or not enough?

1. ARE SAUDI OIL RESERVES GROSSLY OVERSTATED?

In Chapter 12, "Saudi Oil Reserves Claims in Doubt," *Twilight* disputes the veracity of Saudi Aramco's estimated 260 billion barrels in remaining conventional proved oil reserves.

1 a) Reserve Assignment Methodology

The assignment of reserves is rooted in engineering judgment and a formal opinion about Saudi reserve levels would require a detailed look at all reservoir information. When that is not available, a review of reserve booking methodology or practice is a legitimate way to gauge diligence, reservoir understanding and ultimately reasonableness. The methodology adopted by the Saudis to book reserves, as described in their February 24, 2004 presentation to the U.S. Center for Strategic Institute Studies (CSIS), is in our opinion as conservative as that used by any publicly traded E&P company following SEC reserve assignment guidelines.

Twilight is suspicious about Saudi Aramco's practice of assigning reserves based on probabilities. We think this approach is not unique to the Saudis or any more uncertain than the way every publicly traded North American E&P company books reserves under closely regulated SEC guidelines. Have the Saudis overbooked their reserves? Let's look at what we know.

In the CSIS presentation, Saudi Aramco's manager of reservoir management, Dr. Nansen G. Saleri, described the company's reserve assignment methodology in some detail. Saudi Aramco follows a "Constitution" that prescribes principles of management, production and depletion for their reservoirs.

The first principle is to maximize recovery. The second is the requirement for reservoir surveillance and monitoring; third is the maintenance of low depletion or decline rates. As a fourth principle, Aramco relies on advanced diagnostics that use quantitative methods such as reservoir simulation – a lost art in North America – to characterize reservoirs in extreme detail. Advanced seismic also allows better well placement. At RSEG, we use reservoir simulation when evaluating properties because it is an efficient way to compile data and can provide an accurate characterization and production forecasts.

Saudi Aramco's fifth governing principle is to consider cutting edge technologies and use them when appropriate.

1 b) Reserves Categorization

Of the 260 billion barrels of proved reserves, 50% are proved developed – a classification that *Twilight* neglects to cite. By SEC standards, developed reserves have been drilled, tested and tied in. They produce at commercial rates and can be forecast, or require little capital to do so. Proved developed reserves should receive the highest valuation of any class of reserves because they are cash generating assets. The ambition of every E&P operations department is to convert as much of the reserve base to proved developed reserves as possible.

What do we know about the Saudi's criteria for categorizing developed reserves?

When Saudi Aramco takes a reservoir off line for market reasons – such as the giant Manifa and Khurais fields, with combined proved reserves of 41 billion barrels – the associated reserves are reclassified as undeveloped, despite the fact they are tied in and no additional capital is required to turn them back on. We have never seen a North American energy company reclassify reserves in this manner. Furthermore, in classifying proved reserves, Saudi Aramco excludes enhanced recovery upside, even when performance dictates otherwise. This is in contrast to SEC guidelines, which allow for such assignments. Aramco's practice probably results in annual positive revisions to proved developed reserves because the fields likely deliver better than forecast performance.

1 c) Subcommittee on Foreign Affairs Report of 1979

In Appendix C, *Twilight* attaches importance to 1974 Senate subcommittee hearings and an April 1979 report titled *The Future of Saudi Arabian Oil Production: A Staff Report to the Subcommittee on Foreign Relations, United States Senate*. The author of *Twilight* writes: "These records contain the smoking guns to back up the findings of my SPE paper research and confirm that they are neither misleading nor overblown." The 1979 report is described as having identified a growing series of problems that were documented in the SPE papers. *Twilight* recounts how the staff report predicted that irreversible decline would commence in north Ghawar between 1989 and 1992, should the reservoirs continue to produce at 4.4 million barrels per day.

This decline didn't happen.

We believe the 1979 report was published in the wake of Ghawar's first serious water breakthrough and pressure decline. The prediction of imminent oil production decline probably resulted from the report's authors assuming the water breakthrough was unmanageable and would continue, a reasonable assumption at the time.

As we know now, not only was Ghawar's water cut increase arrested when it peaked at 37% in 1999, it was reversed thereafter. The predictions made in the 1979 Staff Report did not have the benefit of decades more of data gathering, reservoir characterization or an appreciation of the benefits available from new technologies such as horizontal and multilateral drilling. While provocative then, the concerns of the 1979 report have been proven wrong and are irrelevant now.

1 d) How can you Control an Increasing Water Cut in a Mature Waterflood?

The manner in which a water cut will behave after breakthrough at a well depends on the "fractional flow relationship" between the oil-water-rock system. Generally speaking, the higher the viscosity of the oil, or the thinner the reservoir, or the harder you pull a well, the more abrupt and serious water breakthrough can be. In the key Saudi fields that operate under peripheral water injection there is light oil and very thick reservoirs, both of which would contribute to a more gradual water cut increase after breakthrough. How hard you produce a well is decision that comes from the operator.

Twilight reports that because the water cut has increased, Saudi Aramco is pulling harder on the wells in Ghawar, to produce more oil and that the 1979 Staff Report supports this conclusion. Pulling harder means increasing the pressure drawdown in a well. The greater the drawdown, the higher the likelihood of pulling up, or coning water into the well. *Twilight* muses, "It seems fair to ask whether these key fields are now being produced, or rather overproduced, at unsustainably high rates that will accelerate reservoir pressure decline." In fact, the opposite is true – Saudi Arabia's current wells actually are being pulled 'softer' not harder.

Reservoir engineers recognize a well's "productivity index" as a measure of its production capability. The units of the index are barrels per day per psi of pressure drop. The harder you produce a well (larger the pressure drop), the more production you get. A prolific vertical well might have a productivity index of 15 bpd/psi, meaning for a 100 psi pressure drop, the well produces 1,500 bpd. And in this vertical well, the pressure drop is concentrated around its vertical penetration of the producing formation.

We understand that for more than a decade, essentially all drilling at Ghawar has been conducted with horizontal wells and, more recently, multilateral horizontals. A multilateral well may have half a dozen horizontal laterals that spread out over several square miles of reservoir. The productivity index of these wells can be 10 times or more that of a vertical well, meaning half the pressure drop can produce five times the production rate. Furthermore, the drawdown of a multilateral well is distributed over a large area, meaning water coning potential is greatly diminished compared to that of a vertical well.

This is how oil production rates can be held flat, while lowering the water cut. The impact of multilateral wells on water production control is explained in a series of SPE papers. One such paper, SPE 84923, was authored by Dr. Saleri, two months before his CSIS presentation. It was referenced in *Twilight* only to point out that the uncertainties discussed therein contradict the assertions of Dr. Saleri's CSIS presentation, ignoring the technology's demonstrated benefits.

1 e) How do these Operations Affect Oil Production Declines?

The resulting modest pressure drawdowns from multilateral wells also enable reservoirs to be produced at extremely low decline rates. Why is that? If you are maintaining reservoir pressure and the cause of production decline is water encroachment, then as water is drawn into the well more gradually, the decline will be correspondingly more gradual. Accordingly, the decline in capability is slower. The production-weighted average decline in Saudi reservoirs over the recent past is about two percent according to Dr. Saleri. In other words, only 200,000 bopd need to be added to maintain 10 million barrels per day production.

1 f) Resource Play Methodology?

Another advantage of producing slowly is for advances in diagnostics and improvements in technology to catch up. Saudi Aramco's SPE paper trail represents to us an unprecedented effort to characterize and address reservoir performance using state of the art methodologies.

For example, had the authors of the 1979 Staff Report evaluated any of EnCana's current properties such as the Piceance Basin, or any Canadian oilsands operation, they would have struggled at the time to see any producible reserves given the prevailing technologies of the time.

1 g) Examples of Challenges with Key SPE Research

In Chapter 12, "Saudi Arabian Reserves Claims in Doubt," the lynchpin of *Twilight*'s discussion on Saudi reserves, we find only one SPE paper referenced. This paper, SPE 68603, does not address the subject of Saudi Arabia oil and gas directly. It describes a benign concept about the value of information, indicating that risk reduction may be achieved by drilling wells. We couldn't agree more.

In Chapter 13, "Facing the Inevitable," *Twilight* says: "Assuming that the Saudi sponsored papers present an accurate description of the problems affecting the kingdom's oilfields (and further assuming that I [the author] have performed a reasonable, unbiased review and analysis of these papers and properly connected the dots), it would seem safe to conclude that Saudi Arabia's oil output is unlikely to grow in coming years and soon could decline."

Twilight dedicates two-plus pages in Chapter 13 on SPE paper 84459, *Quantification of uncertainty in recovery efficiency predictions: Lessons learned from 250 mature carbonate fields*. We believe *Twilight*'s key conclusions are incorrect:

1. *Twilight* says: "…the average ultimate recovery for carbonate reservoirs with medium to light gravity oil is about 35% of OOIP. "

   What SPE 84459 actually says is, "Overall, the carbonate oil reservoirs have an average ultimate recovery factor of 36%…" That includes lower recoveries from heavy (<22 degree API) reservoirs. Contrary to *Twilight*'s conclusion, recovery in the light and medium crude reservoirs therefore must be higher.

2. *Twilight* also claims that SPE 84459 indicates "..some of the worst recovery efficiencies in reservoirs with a strong water drive resulted from poor or improper management during the field's natural water-driven production phase." It reports that the SPE authors say "the best way to avoid such problems is to control the production rate carefully by reducing the choke size as soon as water cut reaches even two percent." The report discusses how management (at the time, Repsol, the Spanish state company) of the Casablanca field, a Type II fractured/karstic carbonate reservoir in Spain's offshore, carefully controlled the water cut by reducing choke size. *Twilight* observes that "these prudent practices were obviously not followed in Saudi Arabia's giant oilfields," implying poor and inappropriate reservoir management by Saudi Aramco.

The SPE report actually explains that "A few Type II fractured/Karstic oil reservoirs with strong water drive did not deliver optimal recoveries because of poor management of water production."

However, the Arab D reservoir is not a Type II fractured/Karstic reservoir. Many of the SPE papers *Twilight* references document it as a grainstone, a cleanly washed, well sorted carbonate sand that has been dolomitized and sometimes naturally fractured. SPE 84459 classifies these grainstones as "conventional carbonate reservoirs."

According to SPE 84459, grainstone reservoirs enjoy the highest recovery factors of any carbonate. The report notes ExxonMobil's Jay Field in north Florida as having the highest observed ultimate recovery (68%) among grainstone reservoirs. The Smackover formation in the Jay Field has an average porosity of 15% and permeability that reaches 100 md. According to SPE paper 85, also cited by *Twilight*, the Arab D zone in Abqaiq, for example, has an average porosity and permeability of 21% and 410 md, respectively, vastly superior reservoir quality than the Jay Field, and all else remaining equal, should result in a higher ultimate recovery factor.

Therefore, our reading of SPE 84459 predicts a recovery factor for Arab D significantly in excess of the Jay Field – opposite to *Twilight*'s conclusion.

RESERVE INTEGRITY SUMMARY:

In summary, we have a much more benign view of Saudi Aramco's reserve booking practices than indicated in *Twilight*:

- In our opinion, Saudi technical reserve assignment methodologies are at least as conservative as SEC standards.
- Except for EOG Resources and EnCana, we have seen no one with a comparable reservoir management "constitution" to Saudi Aramco's.
- Management of their reservoirs according to this constitution has enabled an extremely flat ~2% decline.
- Producing their reserves over a long time period has allowed Saudi Aramco to accurately characterize the reservoirs and to choose and fine tune appropriate new technologies, in much the same way that EnCana benefits from their "resource plays."
- By not booking reserves that may be derived from enhanced recovery as the SEC allows, better than expected performance probably results in periodic positive reserve revisions.

2. CAN SAUDI PRODUCTION RATES COLLAPSE?

On Lou Dobbs' CNN show on August 23, 2005, Mr. Simmons, the author of *Twilight*, said: "The real issue is only a handful of fields have produced all the oil Saudi Arabia has ever produced. And they're all old. And they're all at risk of production collapse."

We believe the data show no evidence of collapse.

2 a) What would make a reservoir performance collapse?

We have earlier discussed how the implementation of multilateral wells can replace a locally concentrated pressure drawdown associated with vertical wells, with a lower overall pressure drawdown spread over several square miles. This increases the time that the oil-water contact, which is rising due to water injection and oil production, is "gravity stable" or flat. The longer that Saudi Aramco can keep the oil water contacts flat, the more that recovery is maximized.

Pioneer's deep GOM Harrier field, for example, collapsed because it was a one vertical well pool over water that was produced too hard. Chevron's Northwest Territories, Fort Liard play collapsed for much the same reason. In the Deep Gulf, Anadarko's Marco Polo and Nexen's Aspen also experienced premature water breakthrough shortly after start up due to production rates from key wells that in retrospect were too high. Unexpected behavior typically occurs because of reservoir depletion strategies underpinned by an inadequate understanding of the reservoir. Reservoir understanding was not adequate partly because these reservoirs were new, an issue that the Saudi reservoirs do not have.

At RSEG, we evaluate and characterize the risk of unpredictable production failure for each E&P company we cover. Having a diversified production base and being less dependent on a few wells means some wells can fail without a material impact or collapse of total production.

Among Saudi Aramco's key assets, there are hundreds of wells with unprecedented, well- documented operating histories. The gathered production data provides evidence of rate sensitivities in each region of each mature field. Note that each of the reservoir failures referenced above involved early stage production before such characterization or rate sensitivity was possible. Further, forecasting becomes more reliable as more history is gathered, trends are established and reservoir behavior is understood. Among the other factors we consider are:

- Does the operator have the expertise to operate their projects?
- Does the operator have an adequate monitoring system?
- Are the recovery schemes new or is there a long history enabling reliable forecasting?
- Is there a well established production decline and water cut trend?
- Is the water cut under control?

We are satisfied that all these check out with respect to the reservoirs Saudi Aramco has reported on.

On pages 117-118, *Twilight* states, "The remarkable Arab D Zone 2-B is responsible for at least 70% of Saudi Arabia's current oil output." If this were true, it would be the opposite of diversification and we would be very nervous. However, on page 91, *Twilight* reproduces a statement from a 2003/2004 Saudi Aramco brochure indicating "The horizontal wells being drilled into the super-giant Ghawar are penetrating into thin, unproduced pockets of oil in areas like the Post D stringers, low permeability zones scattered amid Zone 2-B's now drained but once high permeability reservoirs…"

In our view, these statements are contradictory; either the zone is responsible for 70% of current output or it is drained. If zone 2-B is now drained, there is far more asset diversification and significantly lower "collapse risk" than asserted by *Twilight*.

Twilight observes that the average water cut of current Saudi wells is around 35%, which agrees with SPE research and Dr. Saleri's CSIS presentation material. Since pressure maintenance through water injection is the predominant recovery mechanism in Saudi reservoirs, unpredictable and massive water breakthrough would be the cause of any reservoir-controlled oil production collapse. SPE 89764 reports that more than 8,000 wells have been logged in the Kingdom. So, if wells begin to show increases in water cut, the increase will be gradual and as the Saudis have shown, manageable. It would be unusual (to put it mildly) for all producers to suffer a catastrophic and unpredictable water breakthrough at exactly the same time. Conclusion: we think none of the Saudi reservoirs is on the brink of collapse; on the contrary, they appear to enjoy a gradual and well-managed depletion.

In summary:

- Saudi production comes from a very diverse base of thousands of wells.
- The aggregate water cut is low, recently around 35%.
- The wells have optimum completion designs, which minimize pressure drawdown, maximize recovery and reduce the risk of catastrophic water production.

3. ARE THE SAUDIS EXPLORING ENOUGH OR NOT ENOUGH?

Besides the notion that "all" Saudi fields are on the verge of collapse, the *Twilight* scenario relies on the premise that remaining prospectivity for producible oil in Saudi Arabia is limited, despite Aramco's "intense search" for it.

In fact, only 69 exploration wells have been drilled in Saudi Arabia in the past 10 years. With up to 5 million bopd in excess producing capacity on their books over much of this period, 260 billion barrels of proved reserves in the kitty, and low decline rates, why would the Saudis want to look more strenuously for more reserves? Why would they pour money into drilling new discoveries, when only 23 developed reservoirs out of 80 defined discoveries have provided them with adequate production capacity to meet market needs for more than 50 years? And even if, for argument's sake, Saudi proved reserves are only half Aramco's estimate, replacement at the current production rate would only be 2.6% - hardly a challenge.

On the topic of remaining reserve potential, *Twilight* ignores a prominent and in this case unbiased independent opinion. In 2000, the US Geological Survey (USGS) ranked Saudi Arabia number one in the world, in terms of undiscovered resource potential, with a mean expectation of 87 billion barrels of oil and a range between 29 billion and 160 billion. The USGS figure also is conservative, dating from a time when the outlook for real long-term oil prices was much less bullish than it is now. Price expectations then were absolutely miniscule compared to *Twilight*'s current forecast of $200 per barrel oil by 2010.[2]

[2] The New York Times, 23 August 2005.

4. CONCLUDING REMARKS

We were guided by the February, 2004 presentation to CSIS by Dr. Saleri titled *Fifty Year Crude Oil Supply Scenarios: Saudi Aramco's Perspective*. The presentation included depletion levels, decline rates, water cuts, a discussion and comparison of reserve assignment methodology, historical drilling success rates, production forecasts and supporting documentation and details of the USGS report on the undiscovered potential of the kingdom. This is one of the most in-depth presentations we have seen. Please see the following page for the presentation and, as importantly, the companion speaking notes of Dr. Saleri: http://www.saudi-us-relations.org/energy/saudi-energy-reserves.html.

Twilight only mentions the presentation, ignoring much of its contents and chooses instead to use the presentation to claim that it is in contradiction to Dr. Saleri's SPE Distinguished Author publication. *Twilight* cites the paper delivered by Dr. Saleri in December 2003 (SPE 84923) and claims that the CSIS presentation "differed sharply from the Distinguished Authors paper he helped write a few months earlier." The offending passage quoted by *Twilight* was that a more complete evaluation of MRC drilling would require "three to five years of continuous production history." According to *Twilight*, Dr. Saleri's February 2004 presentation rejected these uncertainties. Again, we feel this is where a little context would have been helpful. In what respect is there uncertainty? Cost? Performance? Drilling time? Operations? We believe there is not enough information here to dismiss the Saudi forecast let alone an entire comprehensive presentation.

During a Q&A after his presentation Dr. Saleri warned against focusing on the SPE papers as they tend to focus on technical challenges and the engineering applied to address them. Accordingly they paint a somewhat negative picture on balance. The SPE mission is "to collect, disseminate, and exchange technical knowledge concerning the exploration, development and production of oil and gas resources, and related technologies." Accordingly, reporting on the implementation of new technologies and transferring that information among members is critical.

It appears that *Twilight* chooses to believe that the bits and pieces of operational history these papers represent, can offer an accurate view of the Saudis' oil production future. We struggle with how *Twilight* could dismiss the guts of a presentation made by the Saudis in a forum like CSIS - in front of hundreds of very savvy energy lawmakers and investors. We make no such distinction within the continuum of Saudi insight spanning about 50 years, up to and including Dr. Saleri's CSIS presentation.

Who is Dr. Saleri? According to his biodata on the Saudi Arabian Section of the SPE website, he holds M.Sc. and Ph.D. degrees in chemical engineering from the University of Virginia. He worked for Chevron for 18 years, up to 1992, most recently as Manager of Reservoir Engineering Services. He is a member of the Advisory Board of Petroleum Engineering at the University of Houston. He is an SPE Distinguished Lecturer. Without having met him, these credentials would suggest a very solid, industry tested petroleum engineer who has earned credibility from peers.

Why would Saudi Aramco lie about what's going on? As we have seen elsewhere, reservoirs are merciless in getting the truth out, as seen by the recent experiences of Pioneer, Marathon, El Paso or Shell. Furthermore, there is no substitute for doing homework on a field, gathering the data and managing the assets like they are precious.

Overall, we think, Saudi Aramco has given us no reason to doubt statements about its reserves or future production capacity.