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RESEARCH PAPER

The Shale Technology Revolution and the Implications for the GCC

Paul Stevens | Jan 2015

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Abstract

The "shale technology revolution", which began in the United States, will and already is having significant consequences for the GCC countries[1] in terms of energy and geo-political issues. This paper attempts to consider what those consequences are and might be in the future. It begins by discussing the nature of this "shale technology revolution" and then considers how the impact on the United States has already begun to influence directly global energy markets and geo-politics. It also considers how the revolution may indirectly influence global energy markets and geo-politics in the future, and how these influences may have relevance for the GCC countries.

[1] These are Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates.

What is the "Shale Technology Revolution"?

The "shale technology revolution" has undoubtedly been a major game changer in global energy. Although it has only attracted attention relatively recently, in reality it has been over 30 years in the making (Stevens, 2010, 2012). The two main technical components of the revolution are extended reach horizontal drilling and multi-stage hydraulic fracturing. Neither are "new" technologies. Horizontal drilling was developed in the United States in the 1930s and the first well was hydraulically fracked[2] in the United States in 1947 (Zuckerman, 2013). Two other technologies are also contributing to the revolution. The first is three-dimensional and four-dimensional seismic, and the second is coil tube drilling. The seismic allow operators to identify deposits of shale gas or shale oil more precisely and to target the "sweet spots"[3]. Coiled tube drilling is where the drill bit is attached to a flexible cable and liquid nitrogen, rather than conventional drilling muds, lubricates the drilling. The drill bit is directed by an operator observing a 3-D map on the computer and can be manipulated to within a few feet several miles away.

Several points need to be emphasized about this technology revolution. First, as already indicated, it is not "new". While attention has focused on shale technology in the last few years, due to the rise of domestic shale production in the United States, the revolution has been in the making for years. Cynics describe this as an "over-night sensation that has taken 30 years". Second, the government has played a significant role in its development. In the early 1980s, the United States' Government, aware of predictions of anticipated serious declines in domestic gas production, began to pour millions of dollars into basic scientific research covering low permeability operations for shale plays. The results were then made available to the industry, owners and operators, who then took them and used them in the development of their operations (Zuckerman, 2013). This was a crucial kick-start to the process of producing shale gas

[2] The industry, in an attempt to distance itself from the negative connotations of "fracking", either spell it "fraccing" or refer to "well stimulation" which is supposed to sound much more attractive.

[3] The shale technology revolution is spawning its own jargon. For example, what in conventional oil and gas are called "fields" have become in shale jargon "plays".

and oil since private companies would not invest in such fundamental scientific research[4].

Another point to emphasize is that, although something of a cliché, the whole revolution has been a real triumph of technology. However, for this to work, it has required a huge amount of effort in drilling and fracking. A key characteristic of shale operations is that they are highly differentiated[5]. Different plays differ in their geological characteristics and their responsiveness to fracking operations. Even wells on the same play differ. Therefore, to gain a critical mass of information to create a "learning by doing" curve, requires a great many wells to be drilled and fracked and that information needs to be shared amongst operators[6]. As will be seen in the course of this paper, this presents a considerable barrier to the development of shale operations outside the United States.

The Indirect Impact of its Effects in the United States on Global Energy Markets and Geo-Politics

The shale technology revolution has already had a significant impact on energy in the United States, and, as a result, on global energy more generally. Figure 1 shows the source of domestic gas production since 2008 and demonstrates how shale's contribution increased from less than 10 percent in 2008 to over 35 percent by 2012[7].

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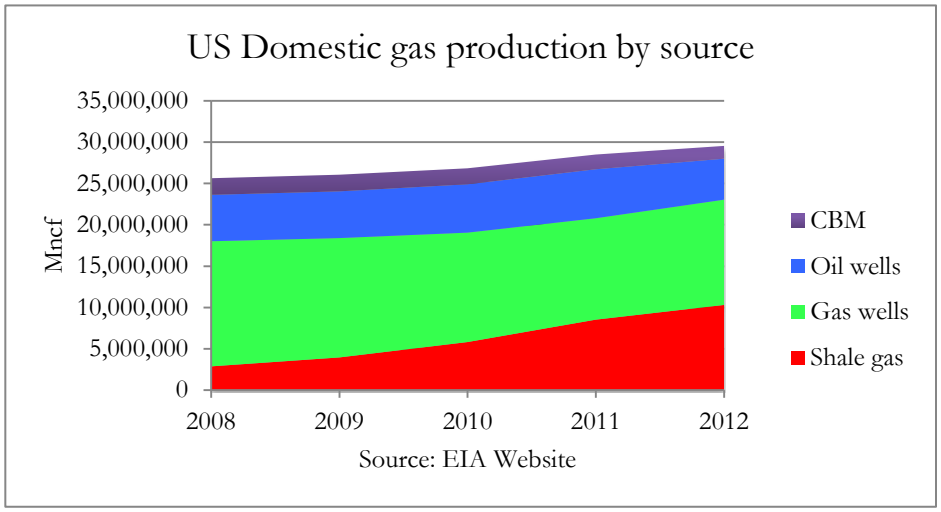
[4] No private company would fund Isaac Newton to sit under his apple tree and discover gravity. While his concepts of gravity underlie Western science they have no commercial value. The Laws of Gravity cannot be patented.

[5] Shale operations can produce either shale oil or shale gas. Shale oil should not be confused with oil shale. The latter is effectively a manufacturing process whereby rocks are crushed and then "cooked" in order to extract the liquids.

[6] A good example of this in the United States is the Marcellus Shale Coalition formed in 2008, which has over 300 members and meets regularly to exchange experiences.

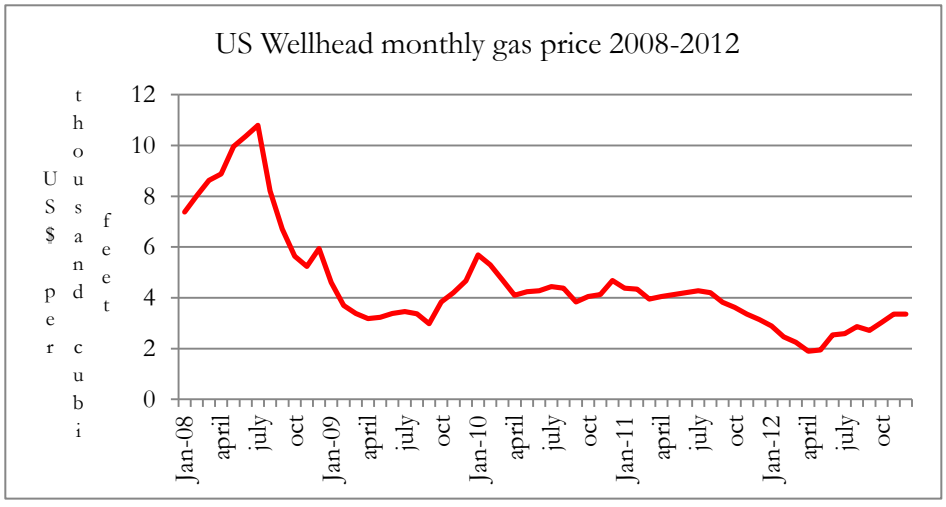
[7] As of mid-October 2014, 2012 was the latest year for which Energy Information Administration data is available. To some extent this delay in data reflects the fact that shale gas is produced by a very large number of small to medium sized companies and therefore it takes some considerable time to collect the data. Estimates for 2013-14 put shale's contribution at over 40 percent of domestic gas production.

Figure 1



A key consequence of this increase in shale gas production has been a collapse in the United States' domestic gas price as can be seen in Figure 2.

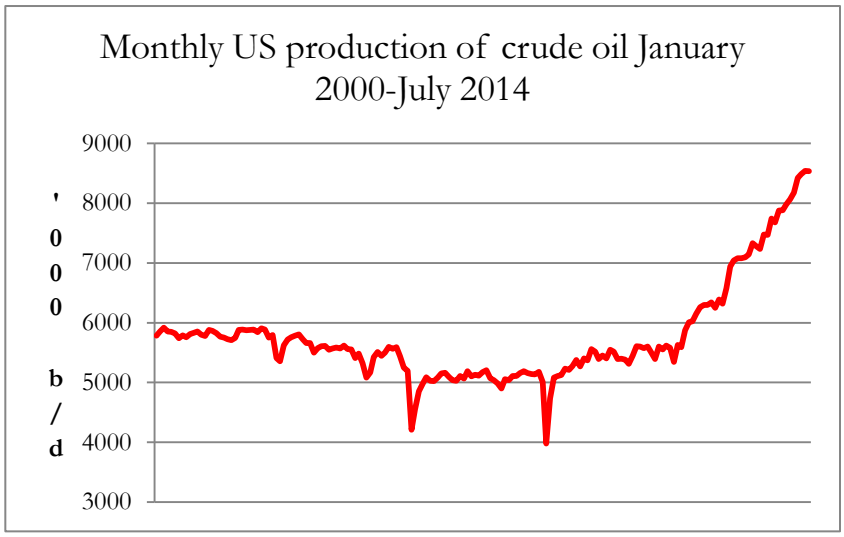
Figure 2



Source: EIA Website

Another key consequence of the shale technology revolution with global implications has been an increase in domestic oil production in the United States shown in Figure 3. What is really fascinating about this outcome is that had someone predicted this only five or so years ago they would have been regarded as insane. Yet in the last two years, United States oil production has increased annually on average at 1.065 million b/d. This is a record for an individual country during the whole history of the oil industry since 1859[8].

Figure 3



Source: EIA Website

As illustrated above, since the start of 2009, domestic production has increased by around 3.5 million b/d. Both the fall in gas prices and the increased oil production have had important indirect implications for global energy markets in general and the GCC in particular.

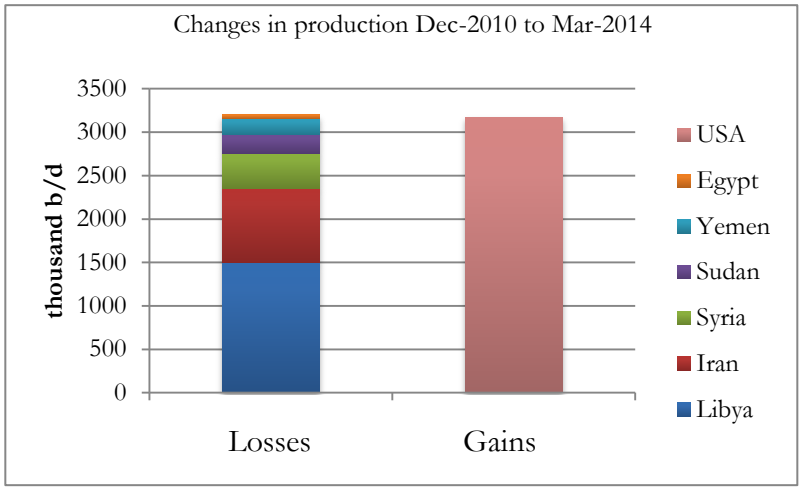
Indirect Oil Market Impact and the GCC

The first impact has been to save oil markets from a serious price spike. The Arab Uprisings that began in Tunisia in January 2011, together with tightening sanctions on

[8] Traditionally the history of the international oil industry is dated from 1858 when Colonel Edwin Drake drilled the first oil well at Titusville, Pennsylvania. In fact, this was done over ten years earlier at Baku, Azerbaijan.

Iran, triggered a large number of geo-political outages of oil supply from the Middle East and North Africa Region (MENA). These, listed in Figure 4, amounted to 3.2 million b/d between December 2010 and March 2014. That represents a serious political outage, which would be expected to have produced a very significant price response in the market.

Figure 4



Source: IEA Monthly oil Market Report, various issues

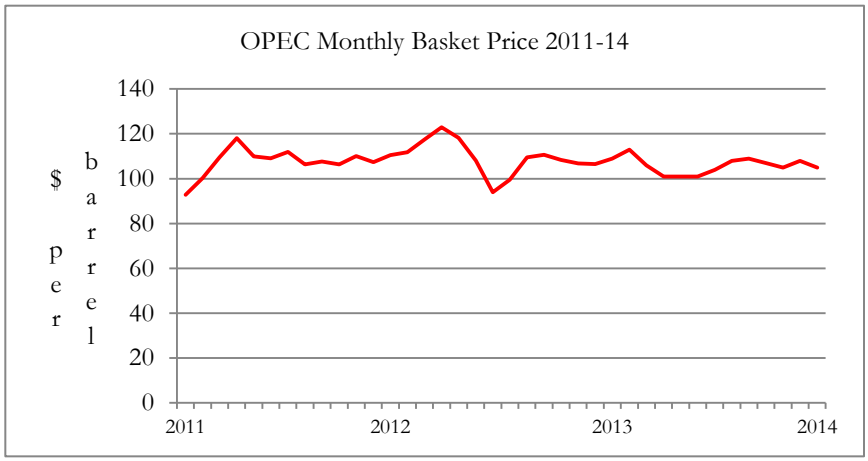
However, purely coincidentally as Figure 4 also shows, in the same period, the shale technology revolution increased domestic oil production in the United States by 3.2 million b/d exactly matching the geo-political losses during the same period. The result was, as can be seen from Figure 5, that up to July 2014 price remained remarkably stable[9].

Yet, this can only be part of the story. The geo-political outages in MENA and the offsetting rise in production as a result of the shale technology revolution have not been entirely smooth. The other necessary ingredient to smooth prices has been that Saudi Arabia has quietly resumed the swing role, which it began in the 1970s following the first oil shock of 1973-4. During the 1970s, before the second oil shock of 19789-80, Saudi Arabia used its production levels to balance the market, increasing production when prices were showing signs of rising and reducing if the signs were for weakening

[9] Since July 2014 to the time of writing (end October) oil prices have fallen by some 25 percent. The reasons for this and the implications will be discussed below.

prices. After the second oil shock, it tried to resume this role to defend the high prices generated by the Iranian Revolution and the Iran-Iraq War. However, faced with weakening demand and increasing supply as a result of the much higher oil prices in the 1970's, Saudi production simply fell. In 1980 Saudi Arabia produced 10.27 million b/d. By the summer of 1985 this had fallen to 2.6 million b/d. The result was a change in policy to move away from defending price and instead, producing to quota at the same time as adopting netback pricing. This presaged the 1986 price collapse. Inevitably, this generated very unhappy memories, and so Saudi Arabia was reluctant to repeat the exercise. However, despite these painful memories they resumed the role in order to stabilize the market and achieve an oil price of $100-$110 per barrel[10]. As can be seen from Figure 5 this proved to be successful until around June 2014.

Figure 5



Source: OPEC website

Arguably, from the point of view of the GCC oil producers, these developments had important implications. Absent the increase in United States' oil production, assuming the GCC wished to avoid a price spike, its production would have needed to be higher and, during the transition period of higher production coming to market, they would have received higher prices. In effect the shale technology revolution has denied an

[10] At the start of 2014, during a meeting with a senior Saudi official, as the author described these views, the official said "please do not call it the swing role. Too many of us still bear the scars from that period. Call it the balancing role instead."

important revenue windfall to those in the GCC with spare capacity – predominantly Saudi Arabia but also Abu Dhabi and to a lesser extent Kuwait.

Another indirect impact relates to an oil market issue that has been labeled "OPEC's dilemma" (Stevens & Hulbert, 2012). The idea is a simple one. Since the Arab Uprisings began in Tunisia[11] at the start of 2011, the Arab oil producers have needed higher oil revenues to assuage their populations through the provision of jobs and subsidies. This requires higher oil prices. Figure 6 provides estimates of the higher prices needed based upon work done by Apicorp (Aissaoui, 2014). To put this in perspective, in 2008 it was estimated that the break-even price for Saudi Arabia was some $40 - $50 per barrel.

Figure 6

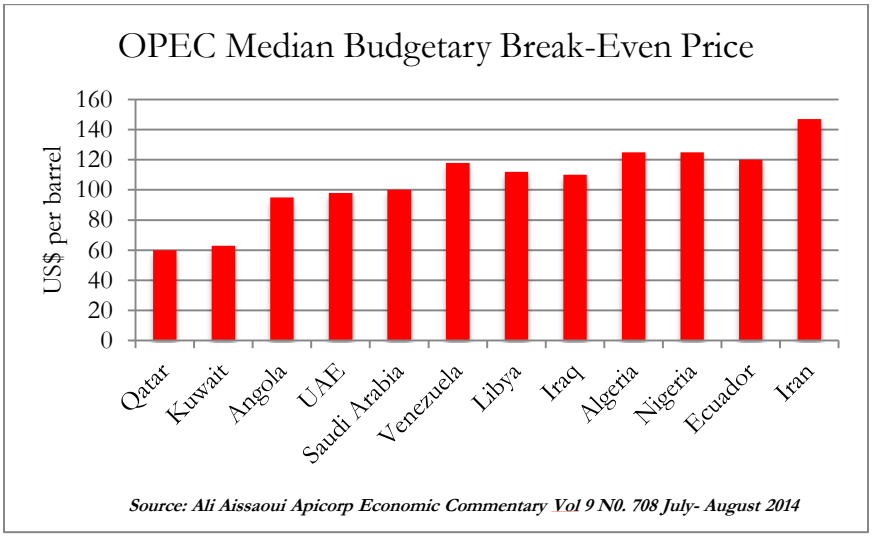
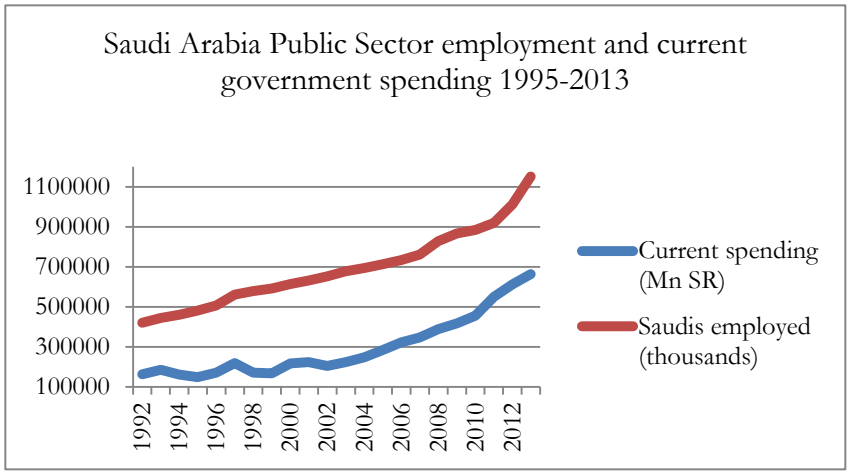


Figure 7 illustrates the issue for Saudi Arabia. In the 1990s, the Saudi Government slowed the growth in jobs for Saudi nationals in the public sector in the hope that, with a programme of Saudiization, the private sector would generate more employment. This failed to happen and unemployment among nationals began to rise. As the first decade of the 21st Century progressed, the government policy changed and more public sector

[11] These are popularly referred to as "The Arab Spring". However, those actively involved protesting on the streets and in the squares hate this term. They regard it as a Western media construct that also hints at the failure associated with the Prague Spring when Russian tanks crushed the Czechoslovak uprisings in 1968. They prefer the term either Arab Revolution or Arab Uprisings. This author, regarding it as too early to tell if it is a revolution, prefers the term Arab Uprising. This term also carries resonance of George Antonius's famous work The Arab Awakening, published in 1939.

jobs were offered to try to alleviate the growing problem of unemployment amongst Saudi nationals, a process that significantly accelerated after 2010. The implications of this for current spending can be seen in Figure 7[12].

Figure 7



Source: Sama Annual Reports, various issues

However, higher oil prices driven by the imperative of higher levels of spending by MENA/GCC oil producing governments lead inevitably to market feedback loops. Thus it will lead to demand destruction. Already, as 2014 progresses, forecasts of oil demand are being trimmed. For example, since August 2013 the IEA has reduced its oil demand forecast for 2014 from 92.7million b/d to 92.4 million b/d. Other forecasters have produced similar reductions in expected demand growth.

Higher prices will also increase non-OPEC supply, and it is here where the shale technology revolution is having its most spectacular impact with the dramatic increase in oil production in the United States as illustrated by Figure 3.

This global oil market situation described by "OPEC's Dilemma" is clearly unsustainable. It is impossible to have a high price market needed for political survival with weakening demand and increasing supply for any length of time. The only way this can be sustained is if Saudi Arabia continues to play a "balancing role" in the market. While the

[12] This growth in state current spending was reinforced as existing employees were offered large increases in salaries in 2011.

Call on OPEC fluctuates this is not difficult. However, if the Call shows a determined downward trend, the question then arises on how long Saudi Arabia can afford to watch its financial reserves fall as its falling production, required to balance the market, brings down oil revenues. It effectively seems like a re-run of the period 1980-85 when Saudi Arabia was eventually forced to drop the "swing role" which in turn triggered the 1986 price collapse.

There are of course differences. To start with, there were no significant paper markets in the early 1980s, implying prices were less volatile. Also, the pain involved for Saudi Arabia in the early 1980s means lessons will have been learnt. However, the current Saudi response to the fall in prices seen since the start of August 2014[13] appears to be somewhat confused. On the one hand, there has been a cut in production of 300,000 b/d in August, followed by a further cut in sales of another 300,000 b/d (but not in production) in September[14], followed by the shutting in of the Khafji field in the Neutral Zone which had been producing 300,000 b/d[15]. On the other hand, the recent fall in prices has also elicited a response that Saudi Arabia is content to see lower prices for some time to come[16]. All this led to speculation regarding Saudi Arabia's motives and the idea that falling prices have been deliberately engineered by Saudi Arabia. It is here where conspiracy theorists are having a field day. In this regard, there are two main schools. Both agree Saudi Arabia would welcome lower prices that will damage Iraq and Iran. Although it also hurts Saudi revenue, they have a considerable financial cushion. Neither Iraq nor Iran has any financial cushion. The schools then diverge. One school argues that the US has encouraged the Saudis, given that lower prices hurt Russia in the context of Ukraine. The other school argues lower prices damage the US since it inhibits the shale revolution that (allegedly) depends on high prices to keep it going. This school argues this suits the Al Saud. Relations with Washington have been

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[13] At the start of August the OPEC basket stood at $105 per barrel. By mid-October this had fallen to $82.

[14] There is some confusion over this announced cut. Bloomberg on the 24th October announced the cut in "supply" to international markets of 382,000 b/d/ in response to increased domestic demand from new refinery capacity

[15] The official reason given by Saudi Arabia was that there were environmental concerns about the field that need to be addressed. However, it appears that Kuwait, at least initially, was less than happy with this decision although they have subsequently denied a rift.

[16] It is not clear just how "official" this view of the market situation is.

distinctly cool since the fall of Mubarak, events in Syria, and the Iranian nuclear deal. It also (possibly) undermines a significant competing source of oil.

The truth of the situation was hard to fathom. Since prices began to fall in summer, the Saudi response as indicated above has been to cut sales to the market. However, at the same time, they have been cutting prices leading to speculation about a "price war". All this uncertainty has not helped because mixed messages, many of them "anonymous", are emerging from the Saudi oil sector that normally speaks with a clear unambiguous voice. This is reinforced by the suggestion that the oil sector, as with other sectors, is trying to position itself for a change of leadership when the Al Saud are forced to jump a generation in the succession.

At the end of November, OPEC kept its formal production level of 30 million b/d in what was a clearly oversupplied market. This controversial decision was taken because to have cut production would cede market share to the growing production flooding out of the USA. The immediate result was a significant fall in oil prices.

The "official" logic behind the decision was twofold. First, weak demand was temporary because of slow economic growth and would recover next year. Second, lower prices would shut in the high cost production from the shale technology revolution. In other words, current prices were too low and the market, allowed to operate, would rectify this. Many (rightly) saw this decision as a significant landmark in global oil markets. In effect, OPEC had ceded any semblance of control over the market and prices, instead launching the oil price onto a sea governed by market forces.

Those with knowledge of oil market history will see this as a very dangerous gamble based on two serious misconceptions. After the oil shocks of the 1970's, the market was in a similar position as now. Demand was falling and non-OPEC supply was rising. In response, to defend prices, OPEC (but effectively Saudi Arabia) cut production because the fall in demand was seen as temporary as a result of global recession and would shortly recover. When the oil price eventually collapsed in 1986, the OPEC view was that lower prices would quickly reverse as they would shut-in high cost production, specifically in the North Sea. These views in the 1980s were conceptual mistakes still relevant today and likely to undermine OPEC's current strategy. The mistakes are a failure to understand the difference between an income effect and a price effect on demand and the failure to understand the difference between a break-even price and a shut-in price.

While some of the fall in demand in the 1980s was because of the recession (an income effect), some was due also to genuine demand destruction as the result of much higher prices (a price effect). The significance was (and is) recession induced lower demand reverses itself when the global economy recovers but demand destruction was (and is) permanent. Today, part of the fall in oil demand is because oil prices have inexorably risen (from $32.40 in 2002 to $108.66 in constant 2013$). Furthermore, many sources of recent oil demand growth, notably China and India, have been moving from subsidized domestic oil prices to higher border based prices. OPEC's expectations of quickly recovering demand may be optimistic as they were in the early 1980s.

OPEC is hoping lower break-even prices will reduce shale production. The break-even price is what investors consider when deciding whether to invest in new producing capacity. Various estimates for the US shale break-even price have being bandied around ($60-$80 per barrel). Most are far too high because they ignore the fact that the recent boom in shale operations has grossly inflated project costs. If investment in new capacity slows then project costs, and hence the break-even price, will fall. However, in terms of OPEC's current strategy, the break-even price is the wrong metric. What matters in the next few years is the shut-in price. This is the price where the operator cannot cover variable costs and therefore stops producing from existing wells. Post the 1986 price collapse, a number of stripper wells in USA (with high variable costs) did close but the loss of production was minimal. North Sea production, which had been OPEC's prime target, was hardly affected and actually increased in 1987. The current level of shut-in price for shale oil is again debatable but almost certainly is well below $40 per barrel. Thus it will be some time before existing shale oil production falls even if prices stay low. Should the oil price fall towards variable costs threatening shale supply it will be the OPEC producers who must blink first from the pain and try to take back control of the market, if they can.

Indirect Gas Market Impact and the GCC

The main indirect way the shale technology revolution has impacted global gas markets is through its impact on LNG markets. In the EIA's 2006 Energy Outlook, the projection was that because of declining domestic gas production, the United States' import of LNG would rise from virtually nil to 4 trillion cubic feet by 2030. This amounts to the equivalent output of six Trinidad & Tobago's or four Indonesia's. It is a lot of LNG. In anticipation of this new market, a great many gas producers began to build new LNG capacity. However, as the domestic production of shale gas rose, this new capacity

aimed at the American market effectively became surplus to requirements leading to something of a glut in potential LNG supplies. This was reinforced as the global financial crisis and subsequent recession generally led to a decline in gas demand, with OECD gas demand falling by 2.75 percent in 2009 over 2008. The impact of this on the GCC is fairly limited because, as will be discussed below, only Qatar among the GCC States might have serious ambitions for more LNG projects and this would seem unlikely given the current moratorium on further gas projects. However, the resulting weakening of the LNG market may encourage those GCC countries who may be interested in importing LNG, most obviously Kuwait, to take advantage of what has become a buyers' market.

Possible Direct Impacts of the Shale Revolution on Energy and Geo-Politics Relevant to the GCC Countries

The direct effects of the shale technology revolution on global energy markets, and hence the GCC, will depend in large part upon the ability of the United States' experience with shale to be replicated elsewhere. To consider this, it is useful to ask why the United States experienced a shale revolution in the first place. There were in place a number of characteristics that collectively explain the development of shale (Stevens, 2010; 2013). These are listed in Table 1

Table 1 Necessary Conditions for the shale revolution in the USA
1. Favorable geology
2. Lots of drill core data to help identify "sweet spots"
3. Weak environmental regulation for fracking
4. Tax credits + Intangible drilling cost expensing
5.Property rights to the landowner

6.Pipeline access easy –large network + common carriage
7 Selling gas into a "commodity supply" market very easy
8. Driven by small entrepreneurial companies
9. Dynamic and competitive service industry
10. Population familiar with oil and gas operations
11. Licensing large areas with vague work programs
12. Significant government investment in basic R & D
13. High liquids content in the gas
14. Started by rising gas prices
15.Access to risk capital on a large scale
16. Easy access to water
17. Easy access to futures markets to hedge price risk
Source: Stevens, 2013

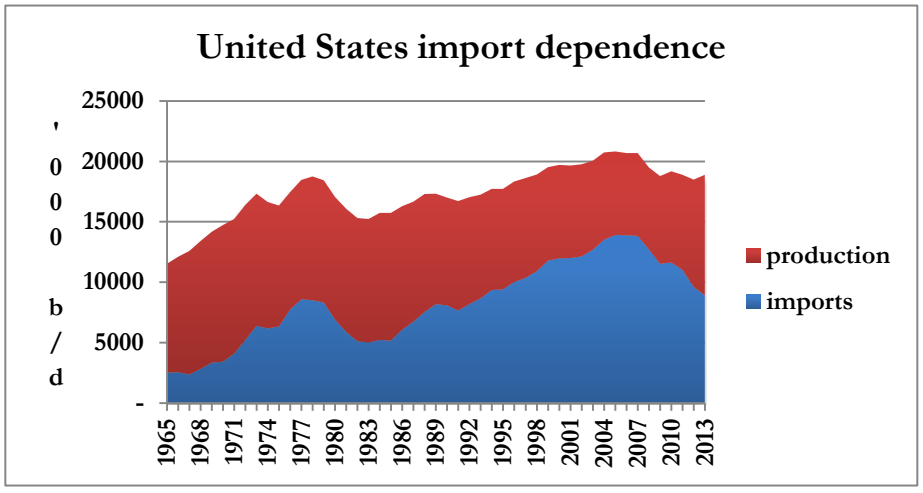
The key underlying the impact of these characteristics was the fact that the sector in the United States was dynamic and competitive in a private sector environment. Trying to replicate these conditions elsewhere will prove to be extremely difficult and it is unlikely that other areas of the world will be able to replicate such conditions in the near term. Over time however, it is likely that the shale technology revolution will boost

global oil supplies even if it is a more gradual process than experienced in the United States.

The area this will initially influence will be how long OPEC's Dilemma will continue since this will be influenced by the response of Non-OPEC supply to higher prices. The greater the supply response, the sooner high prices will be undermined. At the time of writing, this begins to look to be sooner rather than later. Thus the recent path of oil prices show a dramatic fall. In September 2013, the OPEC basket averaged $108.73. In July 2014 the average was $105.61 but by mid-October 2014 the price averaged $88.06.

In the past the oil price has been rescued because Saudi Arabia and Iran have been able to broker a deal for the whole of OPEC that lasted long enough for oil prices to recover. Whether in the current circumstances, with Saudi Arabia and Iran at loggerheads over the nuclear issue and the situation in Syria and Iraq, such collaboration could be repeated must be regarded as uncertain. Faced with a collapse in oil prices, the main GCC players have in the last few years been able to accumulate large financial surpluses and could therefore "survive" for longer than any of the other OPEC members. Estimates suggest Saudi Arabia has reserves amounting to $745 billion.

Figure 8



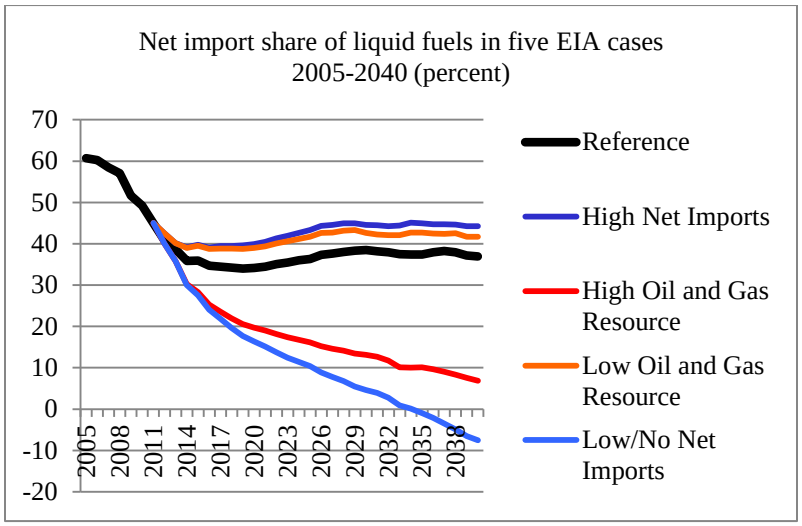
Source: BP Statistical Review of World Energy 2014

A second relevant area concerns the prospects for the United States to achieve its long held goal of "Energy Independence". President Nixon first mooted this in 1974 in

response to the Arab Oil embargo and the first oil shock at a time when the country faced rising oil imports as can be seen in Figure 8.

Figure 9 illustrates how two of the five scenarios from the Energy Information Administration suggest that Energy Independence could be a reality.

Figure 9



Source: EIA Energy Outlook May 2014

There are many who question the viability of the United States reducing its oil imports to zero. Specifically, this revolves round the sustainability of the shale/tight oil revolution. Several factors throw doubt on continued increases in domestic oil production[17]. First, there are concerns over the apparently rapid depletion rates on shale wells, the implication being that more frequent fracking will inevitably increase production costs. Second there are concerns over the economics of shale oil production in a world of falling oil prices. It is clearly difficult to arrive at how low oil prices must fall before production is shut in. Various estimates are being suggested as to what the "break even" prices might be. However, such numbers miss a key point. Costs are as they are because there has been a boom in shale operations over the last few years. The classic often quoted example is that truck drivers in North Dakota can command

[17] It is important to note that in the two scenarios indicating zero imports, around half the reduction in imports is accounted for by improved energy efficiency reducing demand growth. It is not just a response to the shale technology revolution.

over $200,000 per year. However, if the boom falters, they would clearly be willing to work for significantly less. This is true of other services that have been pushing up the cost of shale oil production. A third reason why the prospects for a continuation of the shale revolution might be in doubt is that much of the operations have been built upon a mountain of debt. The result is that many of the small to medium sized operators are very highly leveraged. When interest rates rise, as they inevitably will, many operators will go bankrupt. At the very least this will lead to a large number of orphaned wells[18]. This leads to the final grounds for concern over the sustainability of shale operations in the United States. To date there have been relatively limited protests over the potential environmental damage associated with shale operations. Such damage relates to pollution of water tables, the creation of "earthquakes" and fugitive methane emissions in a world concerned about levels of greenhouse gas emissions and climate change. It is perfectly reasonable to anticipate this environmental "holiday" coming to an end, resulting in a dramatic rise in local community opposition of the sort that has been seriously inhibiting shale operations in Europe[19]. Such an environmental backlash would be greatly aggravated in a world where orphaned wells become an issue.

However, for the sake of argument, this paper assumes there will be a move towards much lower oil imports. Such a trend could have serious geo-political and economic implications for the GCC countries.

First, there is the fact that around half of the United States' current account deficit is accounted for by oil imports. Thus as oil imports fall, so too does the trade deficit. This will be reinforced because as coal is being pushed out from under the boiler by low domestic gas prices, it is being exported from the United States. These increased coal exports will further reduce the trade deficit. This will clearly have implications for the value of the dollar although what these may be is far from clear. However, given the fact that much of the overseas assets held by the GCC countries are in US dollars and indeed a number of GCC currencies, notably the Saudi Riyal, which are directly linked to the value of the dollar, clearly this will carry important albeit uncertain implications.

Second, there is the expectation that lower domestic energy costs will lead to a revival in the petrochemical industry. All the signs are that this is already happening. This

[18] These are wells for which no one will take responsibility in terms of decommissioning.

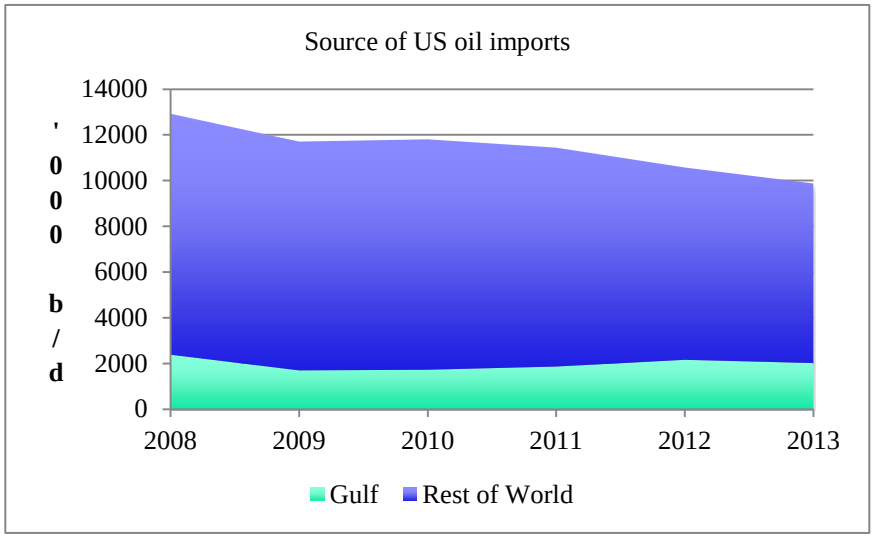
[19] The "holiday" was kicked off in 2005 when the Energy Act explicitly excluded hydraulic fracturing from the EPA's Clean Water Act, the so-called "Cheney/Haliburton loophole".

would directly compete with the GCC's industrialization strategy that is largely based upon moving down the petrochemical value chain and has been a central tenet of the GCC's industrialization strategy for many decades. This could create tensions with the United States, not least in the context of the WTO where there are likely to be claims and counter claims regarding the "subsidization" of petrochemical feedstock and energy. There is also the fact that the GCC will now have to compete with the United States for inward foreign investment into petrochemicals.

Third, there is the concern that as oil imports decline, the country will lose interest in policing sea-lanes. In terms of the GCC, given that many, if not all, of its members are under the protection of the military umbrella of the United States, this could lead to them being vulnerable to any countries with hostile intent. However, in reality such an eventuality seems extremely unlikely. Super-powers police sea-lanes. It is what Super-powers do and this is unlikely to depend upon the source of one single commodity even if that commodity is as strategic as oil. There are many other "strategic commodities" whose access will need to be protected, if necessary by military force.

Finally, there is a view that as import dependence falls the United States will lose interest in trying to influence or control the MENA region. This, as with other assumptions discussed, is debatable.

Figure 10



Source: BP Statistical Review of World Energy 2014

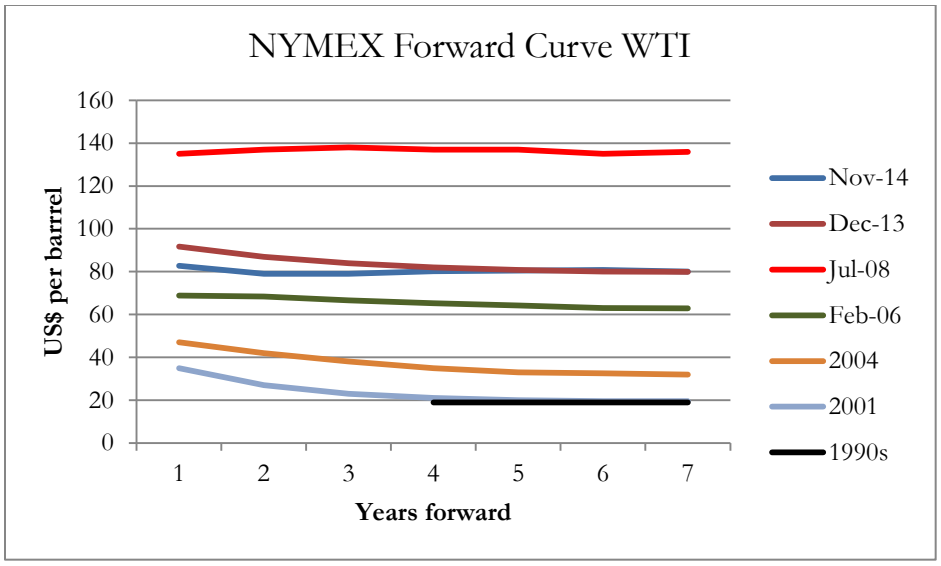
First, it assumes that the foreign policy of the United States has been driven largely by oil. It is true that since the end of World War II there have been occasions when oil has played a role in driving policy, most recently following Iraq's invasion of Kuwait in 1990 when there was a real fear in Washington that the Iraqi forces would continue further south into the Eastern Province of Saudi Arabia. Generally, however, other drivers determine policy in the MENA region, most obviously the support of successive Administrations for Israel. Also in recent years, relatively little crude oil has come from the Middle East into the United States as can be seen from Figure 10[20]. However, the most convincing argument for continued American interest in the region, in terms of oil, concerns the nature of international oil markets. The oil market is "one big pool". Thus if geo-political events in (say) Saudi Arabia cause the oil price at Ras Tanura to be $200 per barrel, the price will also be $200 per barrel (give or take) in Houston. Thus the United States will retain an interest in ensuring stability in the Middle East if only to mitigate the impact of high and volatile oil prices on the United States' and global economies.

All this analysis of course assumes that China believes that the United States will continue to police sea-lanes and seek to influence geo-politics in the region. If the Chinese were to doubt this then they would seek to some degree to police sea-lanes[21] and also to seek political influence in the Middle East. This could of course lead to the sort of client-patron relations between the super-powers and the states of the region of the sort that characterized the Cold War between the United States and the Soviet Union, potentially leading to all sorts of geo-political implications for the GCC and its position in the region.

Figure 11

[20] Much of the oil imported has come from Saudi Arabia at the insistence of the Kingdom despite opposition from Saudi Aramco's American joint venture partners who argue they can get their crude slates far cheaper from the Western Hemisphere. The result has been that Saudi Aramco has had to offer discounts on the crude price.

[21] China is already in the process of developing a blue water naval capability.



Source: NYMEX website, various dates

There is a final implication of the possible direct future effects of the shale technology revolution on global oil markets. That concerns perceptions of impending shortages. During the first decade of this century, the concept of "peak oil" began to gain increasing attention. This idea, largely derived from the idea of King Hubbert, an American geologist, suggested that it was possible to determine the year in which global oil production would peak. Increasingly, proponents of "peak oil" were arguing that the world faced imminent shortages of oil. While there were very good reasons for dismissing these claims[22] they did generate a growing belief among many that shortages were inevitable. Arguably, it was this view of impending shortages that caused the forward price curve on NYMEX to change dramatically. During the 1990s the back end of the curve remained stubbornly between $18 to $20 per barrel. However, in 2002, the back-end began to increase reaching a peak around July 2008 as can be seen from Figure 11. Since then, and especially since the growth in shale oil production, the curve has fallen and the forward price is around $80 per barrel.

This suggests that the perception is now one of future oil abundance. Obviously, the impacts of such views are very difficult to predict but the most obvious impact is likely to be on future investments plans in the upstream. This directly relates to the depletion policy adopted by the GCC members, which in turn will have a crucial impact on future

[22] Any prediction of future oil supply that ignores issues of cost and price cannot be taken seriously

oil supplies. During the 1970s, a commonly held view among the GCC oil producers was that "oil in the ground is worth more than money in the bank". In recent years, as the policy makers have become more sophisticated, this is modified by a codicil which adds"…especially if the bank has sub-prime mortgage assets". This view assumes that future oil prices are likely to be higher. However, if views of impending shortages are now challenged as a result of the shale technology revolution this could persuade producer governments to produce sooner rather than later.

Such views might also be influenced as the debate over "unburnable carbon" begins to gather momentum. This debate — one that began to gain public attention in the last 18 months – revolves around the argument that if the world actually burns all of the proven hydrocarbon reserves available then the consequences for climate change would be catastrophic. This is beginning to generate a backlash reminiscent of the campus campaigns of the 1960s against apartheid South Africa. For example, the Norwegian Parliament is discussing whether to force the Norwegian Pension Fund (Norway's' sovereign wealth fund) to divest itself of shares in BHP Billiton because it is a coal producer. In a similar vein, the Australian National University has announced it is divesting itself of a number of shares in companies associated with the production and consumption of hydrocarbons. Even the Rockefeller Foundation has announced it will remove oil and coal companies from its portfolio. If such movements gained more traction, this could well force more governments to take climate change seriously and impose policy measure to reduce carbon emission. Although obviously coal would take the greatest hit, oil and gas would not be immune. Given the location of conventional proven oil and gas reserves in the GCC this would have serious consequences.

This analysis on producers' reactions is further complicated as the major international oil companies (IOCs) struggle to satisfy their shareholders. There are a number of reasons why this is the case (Stevens, forthcoming) but a key consequence is that in the last 12 months the buzz words amongst the IOCs have been "capital discipline". This simply translates into a loss of appetite for large, high risk, long term oil and gas projects. Thus, it appears the upstream investment pot of the IOCs is shrinking which will threaten future oil supplies. This threatens less supplies while a change in GCC depletion policy would create more supplies hence the complexity of the analysis.

The direct impacts of the shale technology revolution are also relevant for the GCC in terms of global gas markets.

First, there is the issue of future competition in the LNG market. The indirect impact arising from lower than expected LNG demand from the United States has already been discussed. The result has been the creation of what amounts to a buyers' market for LNG up to the end of the decade as LNG capacity intended for the American market comes on-stream and seeks alternative buyers. There is also uncertainty over the extent to which United States' own LNG exports will actually materialize. To date, only two projects have received full regulatory authority to operate. Another 12 are going through the approval process and despite talk of streamlining this, it remains a daunting prospect. At the same time there are growing lobby pressures in Washington to restrict LNG exports from two sources. From those still wedded to the ideas of Energy Independence who see gas exports undermining that as a goal; and from those who see lower domestic gas prices as a major incentive to the continued revival of petrochemical activities specifically and manufacturing more generally.

It is not entirely clear how such LNG developments would affect the GCC. Of the GCC countries, only Qatar has the capacity to expand its LNG operations and this is currently extremely debatable given the now long-standing moratorium on further gas projects.[23] There appear to be few, if any, new LNG projects from the region that would be affected. Indeed the only consequence might be cheaper LNG imports for those GCC members considering such an option.

A second indirect impact is the possibility that the GCC countries could develop their own shale gas resources.

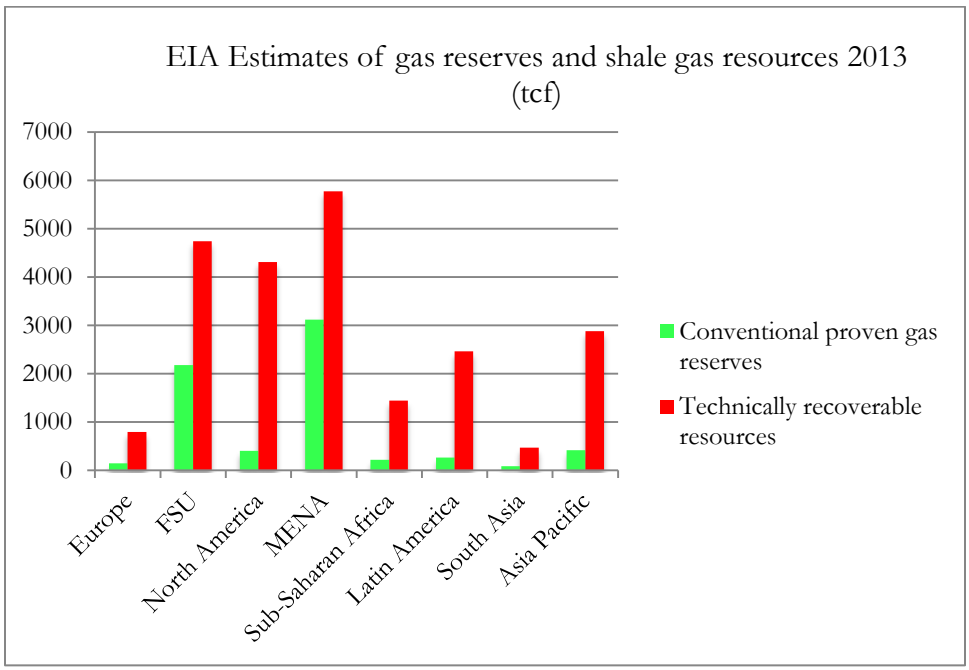
As can be seen from Figure 11, the region already has significant reserves of gas and even more potential for technically recoverable reserves of shale gas[24]. Despite this, the region already suffers from severe gas shortages. This largely reflects serious institutional weakness within the sector, largely associated with gas prices being set at levels that are far too low, encouraging wasteful consumption and limited production.

[23] Qatar introduced a moratorium on new gas projects in 2005 to last until 2009. In 2009 this was extended to 2015. The reasons for the moratorium have been the subject of much speculation. They include the view that it was Iranian pressure to prevent Qatar from draining gas currently located in Iran's South Pars field, to the possibility that the North Field is facing serious problems due to over production.

[24] Estimates of technically recoverable resources for shale gas need to be treated with great care. In the United States the general rule of thumb is that only 10 percent are likely to convert to reserves. Even then such numbers face constant revision since they are, for the most part, based upon very limited geological data.

Clearly shale gas would be a welcome source of energy in the region. However, when the barriers listed in Table 1 are considered, the prospects for a shale gas revolution do not look promising. In particular the conditions require "…the sector (to be) dynamic and competitive in a private sector environment" and this does not fit well in the GCC. The argument, put rather unkindly, is that if the GCC cannot get its gas act together when sitting on 22.5 percent of global proven conventional gas reserves there is little hope of rapidly promoting the production of unconventional shale gas.

Figure 11



Source: Technically Recoverable Shale Oil and Shale Gas Resources: An Assessment of 137 Shale Formations in 41 Countries Outside the United States. Release date: June 10, 2013 Updated: June 13, 2013

A third indirect consequence relevant to global energy markets might be that if gas becomes more generally available, this could threaten the dominance of oil in the transport sector thereby undermining the last bastion of protection for oil markets. The oil shocks of the 1970s pushed out oil from the static sector but oil in transport remained secure. However, today, gas could threaten the transport market for oil in one of two ways. First, by the use of compressed natural gas CNG. This is increasingly being used, especially in urban areas where air quality is an issue. Second, the use of

LNG for long haul heavy road freight is being considered both in North America and in Australia.

Finally, as already referred to, there is the prospect of greater competitive threats to GCC petrochemical exports as lower domestic feedstock prices in the United States attract increasing amounts of investment in petrochemicals. At the very least this threatens the whole basis of the development strategy adopted by the GCC countries.

Conclusions

In the now famous words of Zhou Enlai in response to a question about the importance of the French Revolution, "it is too early to tell"[25]; a similar reply is justified when asking about the impact of the shale technology revolution on the GCC countries. Two reasons explain this. First, the shale revolution is only just beginning and there are uncertainties regarding how far it can be replicated outside of the United States and indeed its sustainability within the United States. There has been much hype regarding the revolution (Stevens, 2010) but fortunately now more measured views are emerging as to what may or may not be possible. That said, the impacts for the GCC countries are likely to be important and far-reaching and they could be positive or negative. Second, the impact will ultimately be determined by a multitude of policy decisions taken by companies and governments. These are far from known or predictable. However, one thing can be said with certainty and that is that the shale technology revolution will have major impacts on global energy markets and indeed has already done so. Any impact on global energy markets will inevitably impact the GCC countries given their total dependence upon the production and export of oil and gas. Despite much rhetoric and some effort, the GCC today is more dependent on oil and gas than it was in 1990. In the GCC, the IMF claims in 1990 non-Hydrocarbon GDP was 61 percent of GDP but by 2010 had fallen to 51 percent. It is therefore of crucial importance for these countries that they monitor closely shale technology developments and consider how these may impact upon their current and future strategies regarding their hydrocarbon sectors.

[25] This is disputed and some believe he was talking about the French student unrest of 1968

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